Strategy to strengthen longline tuna fishery business as a result of catch fishery business license moratorium and transshipment ban

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Abstract. The Ministry of Marine Affairs and Fisheries (Indonesia) Regulations No. 56 and No 57 of 2014 concerning the moratorium on fishing permits and the prohibition of transshipment was issued to ameliorate illegal fishing, unreported fishing, and unregulated fishing. Tuna longline is the fishing gear affected by the regulation. Thus, many fleets are not operating, reducing tuna production in Indonesia. Business strengthening strategies need to be applied to address these problems. The approach to solve these issues regards a soft system methodology. The results showed that the dominant catches of longline tuna at Nizam Zachman Oceanic Fishing Port were bigeye (*Thunnuns obesus*) (27%), yellowfin (*Thunnus albacares*) (26%), skipjack (*Katsuwonus pelamis*) (12%), and albacore (*Thunnus alalunga*) (7%), with catchment areas in Fisheries Management Area (FMA) 572 and 573. After the policy took effect, longline tuna production decreased from 11768.267 tons in 2014 to 4636.657 tons in 2019. The frequency of vessels that land fish has also dropped, from 514 units in 2014 to 156 units in 2019. Strategies have been made based on three conceptual models. First, the Ministerial Regulation No. 58 of 2020 needs to be implemented properly. The second necessary strategy is to supervise and foster a longline tuna fishery business license through an integrated data collection system. Third, the government needs to develop sustainable longline tuna fisheries business by determining the amount of optimal effort allocation.

Key Words: conceptual model, policy, problem, regulation.

Introduction. The Ministry of Marine Affairs and Fisheries has issued Regulation No. 56 of 2014 concerning the temporary suspension (moratorium) of capture fisheries business licenses in the Indonesian fisheries management areas. The temporary suspension (moratorium) of fishing permits is applied to realize responsible fisheries management in the Indonesian waters. In the same year, the ministry also issued a regulation on the termination of transshipment activities at sea, namely Ministerial Regulation Fisheries No. 57 of 2014.

The government made a moratorium policy due to heavy losses from the marine and fishery sectors caused by foreign vessels operations (Saptanto et al 2015). In 2013, non-tax state revenues from 5329 fishing vessels amounted to 17.54 million USD (Saptanto et al 2015). This amount is very different compared to the loss of 20 billion USD due to illegal, unreported, and unregulated fishing in Indonesian waters (Nurhayat 2014).

One of the dominant catches of foreign vessels of more than 30 GT is tuna (*Thunnus* spp.) (Saptanto et al 2015). Tuna is an export commodity with the second-highest export value after shrimp, amounting to 747.54 million USD in 2019 (Hariono 2019; Directorate General of PDS 2019). Meanwhile, in 2018, tuna, skipjack (*Katsuwonus pelamis*), and cob (*Euthynnus affinis*) (TCT) contributed to exports, amounting to 14.69% of the fishery products total export value, 713.9 million USD. Indonesia's TCT exports volume amounted to 168400 tons or 14.69% of the total export volume of fishery product (Directorate General of PDS 2019). Despite using foreign vessels, tuna fishermen also conduct transshipment because of the dramatic increase of fuel price, becoming the largest component of the operational cost of fishing at sea (Pangemanan et al 2015). For tuna fishermen, transshipment can save fuel, and the freshness of the fish is better (Nurani et al 2013).

Although government policies related to the banning of transshipment and moratorium on fishing boat permits provide benefits to the sustainability and availability of fish resources, they might bring several drawbacks to Indonesia's longline tuna fishing industry (Nurani et al 2019). In some areas, longline tuna fishermen stop going to sea or change their business when the regulations are enforced (Arthatiani & Apriliani 2015). The decrease in total operating vessels led to a decrease in tuna production (Nurlaili et al 2016). The drop in production occurred at Palabuhanratu Fishing Port, Nizam Zachman Oceanic Fishing Port, Benoa Bali Fishing Port and Bitung Oceanic Fishing Port (Saptanto et al 2015; Nurlaili et al 2016; PPS Nizam Zachman 2019).

According to the data from the Western and Central Pacific Fisheries Commision (WCPFC) and Indian Ocean Tuna Commission (IOTC) catchment reports, Indonesia has been ranked as the world's largest tuna catcher from 2011 to 2017 (Sugandhi 2019). Indonesia is the ninth world producer in 2018 with 167695 tons and 710.11 million USD. Indonesia's export volume in 2018 decreased by 15% compared to 2017, reaching 198.185 tons (Rifaldi et al 2020). This led to a decrease of Indonesia's ranking as an exporter. In the event of a continuous decline in export volume, the tuna fishing industry will weaken and impact its exports (Saptanto et al 2015). Consequently, a strategy is needed for businesses to develop the tuna industry.

The preparation of strategies to strengthen the tuna fishery business will be carried out using a soft system methodology (SSM) approach. SSM builds a system model through a deep understanding of problems related to existing conditions (Nurani et al 2018). This study aims to evaluate and create conceptual models based on the biological and technological aspects of the longline tuna fishery business after the moratorium and banning of transshipment.

Material and Method

Study site and period. This study was conducted at Nizam Zachman Oceanic Fishing Port, Jakarta, Indonesia (Figure 1). The collection of data and field observations was conducted from August 2020 to November 2020. Interviews with stakeholders of the longline tuna fishery business were conducted. The determination of locations was based on areas affected by the moratorium and banning transshipment since the Regulation of the Minister of Marine Affairs and Fisheries has been enacted.

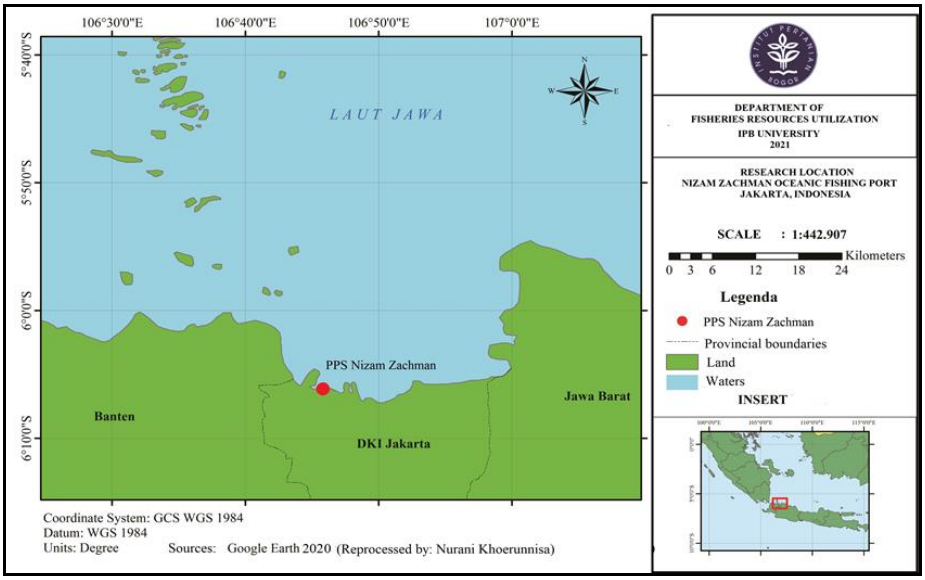

Figure 1. Research location.

Research methods. The SSM method is used in this study because the problems studied are related to human activities, namely stakeholder actions (Gigentika et al 2017) in the longline tuna fishery business at Nizam Zachman Oceanic Fishing Port. The objective is to determine and solve the root of the problem in every aspect. The SSM can identify problems more profoundly and structured. Interrelationships between parties and issues involved in the system are more visible with depicting situations from rich pictures (Rahmah et al 2013). A SSM approach has 7 process stages: (1) understanding the situation of unstructured problems; (2) present the problem in a structured manner; (3) create the problem definition; (4) create conceptual models; (5) compare conceptual models with the real world; (6) determine the desired change; (7) determine the action steps for improvement. In this study, the first four stages were carried out to achieve research objectives (Checkland & Poulter 2007).

The first step needs to be undertaken by understanding the unstructured, complicated situation with many perspectives. Understanding the problems proposes statistical data analyses, literature studies, and interviews with relevant stakeholders. Comprehension of the system’s condition was carried out through analysis of fishing port statistics to measure the trend of longline tuna catches landed at Nizam Zachman Oceanic Fishing Port Jakarta from 2014 to 2019, and through in-depth interviews with stakeholders from August to November 2020. This stage also carried out productivity calculations for longline tuna fisheries based in PPS Nizam Zachman Jakarta. The purpose of calculating the productivity of the fishing gear is to consider making policies and taking informed decisions for the sustainability of longline tuna fishing businesses. Productivity is calculated by Catch per Unit Effort (CPUE) analysis. CPUE is a unit of fish population per type of fishing equipment divided by capture efforts (Hutagalung et al 2015). CPUE can be calculated by the following formula (Gulland 1982):

CPUE =Catch/Effort (measured in ton trip^{-1})

The second stage is the situation of the problem expressed holistically. The results of this step are the ideas about the situation of the problem. Hence, it is expressed as a rich picture. The third stage, namely the formulation of root definitions, will formulate the root definition of the problem, including a particular view of the problem from relevant perspectives (root definitions for suitable purposeful activity systems). Root definitions (RDs) are used to enrich statements about problem situations. The suitable system will be controlled by CATWOE (customer, actor, transformation, worldview, owners, and environmental constraints). Customers are parties who receive the impact of the transformation process, actors are the parties who carry out activities on the process of transformation, transformation is the process carried out. The worldview represents the point of view that makes the transformation process meaningful, owners are the people who have the highest interest in the system, and environmental constraints are elements outside the system that can affect the system, but cannot control the system (Rahmah et al 2013). CATWOE analysis is a tool to ensure that root definitions truly describe the relevant system of human activity (Ikhsan et al 2017). The 3E criteria used to reference how this transformation process should be implemented are efficacy, efficiency, and effectiveness.

The fourth stage is the formulation of conceptual models. The model was formulated based on the explanation of the system's workings following the problems studied (conceptual models of the system named in the root definitions). The model was built from ideas based on the theory used (Prasetya & Prasetyaningtyas 2020), and further investigations (not presented in this study) will include a practical aspect to this model.

Results and Discussion

Understanding of problem situations. The disclosure of the problem situation is the outcome of the first and second stages of SSM. Disclosure of problems is focused mainly on the biological aspects and technological aspects of tuna longline fishery business from the example of the case at the Nizam Zachman Oceanic Fishing Port. The conditions that describe the biological aspects consist of the composition of catches and production of longline tuna fisheries, while the technology aspect is illustrated by the number of vessels based in Nizam Zachman Oceanic Fishing Port and the frequency of vessels landing fish in the port.

The dominant catch of longline tuna is tuna. There are five species of tuna caught by longline and landed in Nizam Zachman Oceanic Fishing Port, namely albacore (*Thunnus alalunga*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obessus*), skipjack, and southern bluefin tuna (*Thunnus maccoyii*). Four tuna species form the dominant catch at the Nizam Zachman oceanic fishing port, all excepting southern bluefin tuna. The percentage of catch composition at Nizam Zachman Oceanic Fishing Port in 2014-2019 is presented in Figure 2.

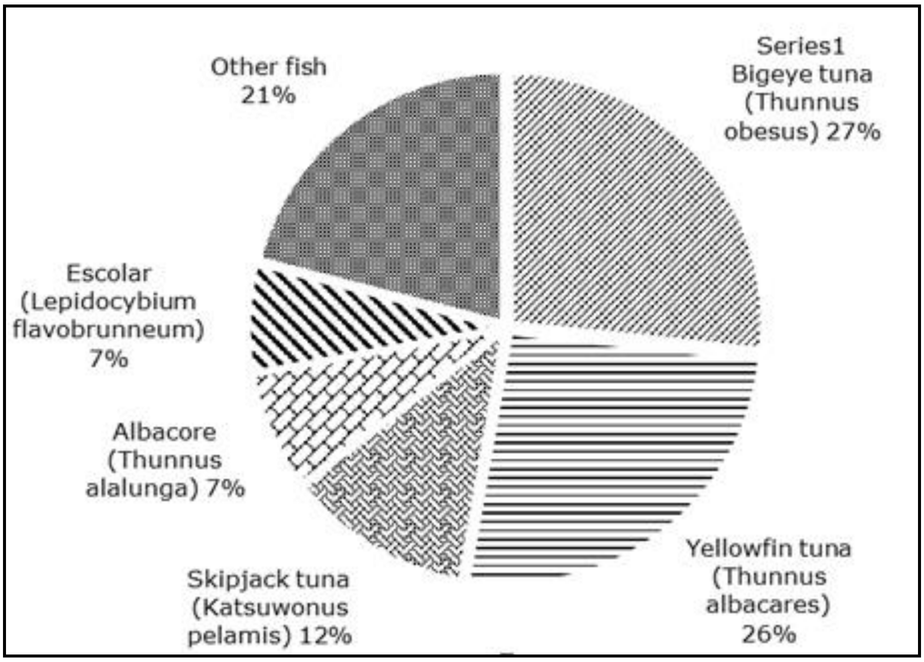

Figure 2. Percentage of fish catch composition at Nizam Zachman Oceanic Fishing Port in 2014-2019.

Longline tuna catches consist of 78 species of fish, with 4 species being the dominant catch. Big eye tuna was the largest catch in Nizam Zachman Oceanic Fishing Port in 2014-2019, approximately 11697.6 tons or 27% of the total catch. Longline tuna vessels based at PPS Nizam Zachman conduct fishing operations in the Indonesian Fisheries Management Area (FMA) 572 and 573 and the Indian Ocean. These areas host large quantities of bigeye tuna, yellowfin tuna, skipjack, albacore, and south bluefin tuna (KKP 2015). The minister's decree of tuna, skipjack and cob fisheries management plan No. 107 explains that FMA 572 and FMA 573 are part of the Indian Ocean Tuna Commission (IOTC) management area, and the southern bluefin tuna catch is under the observation of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) (KKP 2015). Longline tuna production has diminished yearly since the moratorium regulations on fishing permits and transshipment bans were imposed (Figure 3).

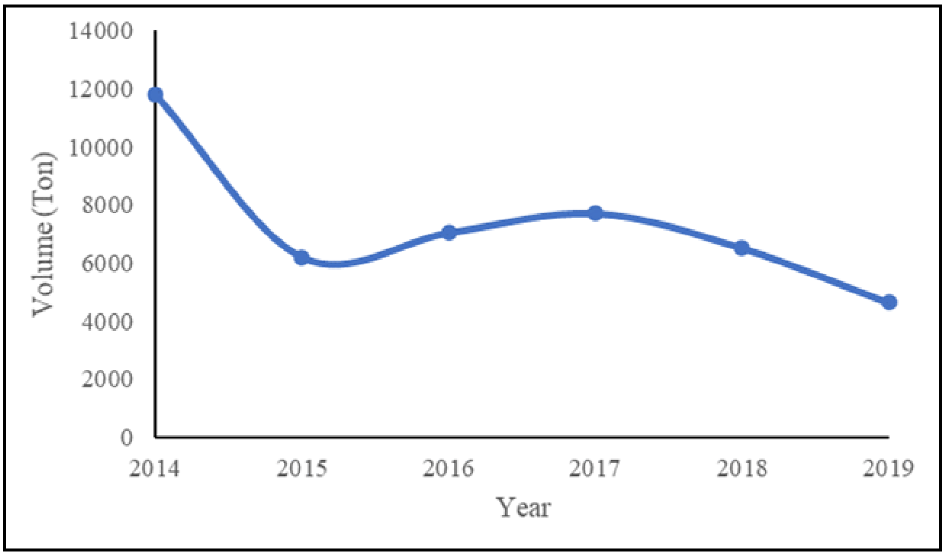

Figure 3. Longline tuna production at Nizam Zachman Oceanic Fishing Port in 2014-2019.

Longline tuna production at Nizam Zachman Oceanic Fishing Port revealed a decrease from 11768.267 tons in 2014 to 4636.657 tons in 2019. Based on a statistics report of Nizam Zachman Oceanic Fishing Port (2017), the production trend declined as a result of the Presidential Regulation No. 191 of 2014 about the restriction of fuel subsidies, regulation on transshipment ban, and moratorium. Weather that does not support fishing operations also reduces production, and, subsequently, the number of fishing vessels (Saptanto & Wijaya 2014; PPS Nizam Zachman 2017). The declining number of longline tuna vessels based at Nizam Zachman Oceanic Fishing Port from 2014 to 2019 is illustrated in Figure 4.

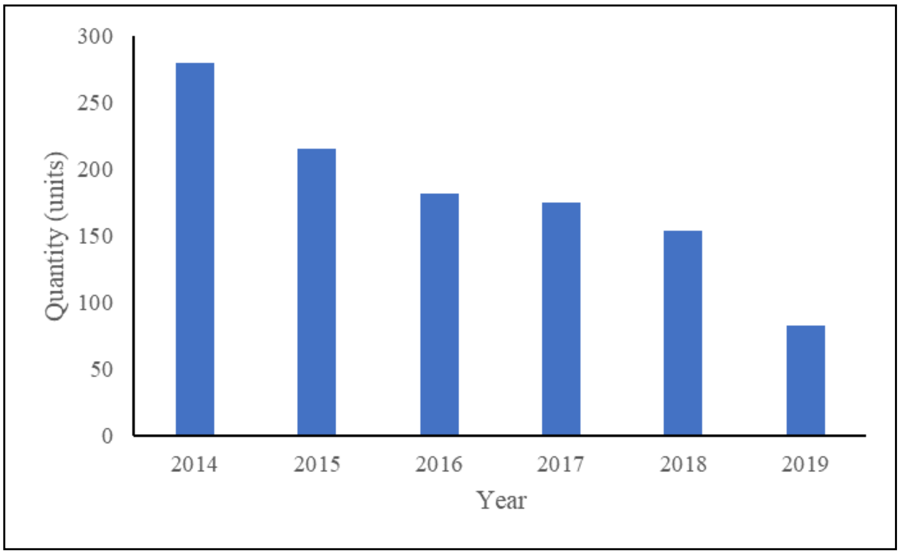

Figure 4. Number of vessels based in Nizam Zachman Oceanic Fishing Port from 2014 to 2019.

The number of longline tuna vessels based in Nizam Zachman Oceanic Fishing Port has decreased gradually during the studied period. In 2014, there were 280 units of longline tuna vessels based at the port, the number being reduced to 215 units in 2015. This continued to decrease in 2016, 2017, 2018, and 2019, with 182, 175, 154, and 83 units, respectively. The decrease of vessels based in the fishing port is directly proportional to their fish landing frequency in the fishing port (Table 1).

Table 1
Frequency of longline vessels landing fish in Nizam Zachman Oceanic Fishing Port by size

Vessel size (GT)	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
11-20				1		
21-30	103	29	18	15		
31-50	55	46	76	32	23	16
51-100	243	182	216	269	216	103
100-200	113	51	54	63	63	37
Frequency	514	308	364	380	302	156

When the moratorium policy and the ban on transshipment were implemented, some fishermen shifted to purse seine or stick-held deep net fishing gear. Fishermen chose to switch fishing gears to keep earning, as many longline tuna fishing units stopped operating. However, longline is still the primary fishing tool for tuna, because the catch has a better quality and can be exported immediately. Longline fishing equipment was reduced after the moratorium policy and transshipment ban; although the fleets were decreasing in size, longline still contributed as one of the most production gears in Nizam Zachman Oceanic Fishing Port.

Fishing using tuna longline can be said to be productive based on catch per unit effort (CPUE) values. CPUE results from 2014 to 2019 are presented in Table 2.

Table 2
Production of longline tuna fishing gear, number of capture trips and catch per unit effort (CPUE) value from 2014 to 2019 in Nizam Zachman Oceanic Fishing Port

Year	*Production (tons)*	*Trips per year*	*Catch per Unit Effort*
2014	11768.27	514	22.90
2015	6196.36	308	20.12
2016	7042.09	364	19.35
2017	7706.66	380	20.28
2018	6510.57	302	21.56
2019	4636.66	156	29.72

Table 2 shows that the highest value of CPUE was in 2019, 29.72 tons $trip^{-1}$, while the lowest CPUE value was in 2016, 19.35 tons $trip^{-1}$. CPUE decline occurred in 2015 and 2016, then increased again from 2017 to 2019. It can be stated that the development of longline tuna CPUE in Indian Ocean waters tends to fluctuate. It can be seen that the increase or decrease in the number of fishing trips is not in line with the increase or decrease of the CPUE value. This indicates that there are other factors, which have not been identified. Nevertheless, fishery businesses see the positive contribution of longline tuna fishing equipment in Indonesia. They want the government to review previous regulations regarding the moratorium on fishing permits and the banning of transshipment, so that longline fishery businesses can continue to grow. The transshipment ban policy is considered to not accommodate the needs of the longline tuna business in fulfilling practical fishing activities (Hudayana & Utami 2017; Badahi et al 2019). Therefore, a derivative law is needed to regulate the suitable transshipment mechanism for the longline tuna fishing system (Hudayana & Utami 2017).

The Minister of Marine Affairs and Fisheries announced Circular Number B-239/MEN-KP/IV/2020 concerning transshipment on fishing vessels in April 2020. The government has overcome the constraints of national distribution of fish during the covid-19 pandemic by allowing the transshipment of fishing vessels with predetermined requirements and within a predetermined time. Furthermore, at the end of November 2020, the Minister of Marine Affairs and Fisheries issued Regulation No. 58 of 2020 on the fishing business. In Chapter XIII, the regulation mentions that fishing vessels operating in Indonesian fisheries management areas are allowed transshipment to fishing vessels or ships operating on high sea, and can perform transshipment on high sea or in the fishing port of the destination country, if it is a member state of the Regional

Fisheries Management Area (RFMO). In the closing provisions, Article 156 mentions that when the Ministerial Regulation No. 58 of 2020 applies, then Ministerial Regulation No. 57 on fishing business in Indonesian fisheries management area and Ministerial Regulation No. 56 of 2014 concerning the moratorium and licensing of catch fishery business in Indonesian fisheries management area is invalid. Regulation No. 58 of 2020 could be used as an opportunity to develop a longline tuna fishery business in the future. Several problems result from the enactment of regulations (Table 3).

Table 3

Longline tuna fishing businesses problems

Problems
Government policy does not support longline tuna fishery businesses.
Longline tuna production decreases.
Longline tuna catches from transshipment practices not appropriately recorded at the fishing port.
The number of longline tuna vessels based in fishing ports is decreasing.
The frequency of longline tuna vessels landing fish in fishing ports is increasingly rare.

Formulation root definitions (RDs). Based on the existing problems, three root definitions are determined (Table 4). First, the Ministry of Marine Affairs and Fisheries should supervise the implementation of PERMEN-KP Number 58 the year 2020, in order for it to work properly. Second, the fishing port should supervise and foster longline tuna fishery business licenses. Third, the government needs to develop business sustainable longline tuna fisheries business by determining the amount of optimal effort allocation.

Table 4

Root definitions of longline tuna fishing business

Root definitions (RDs)
The Ministry of Marine Affairs and Fisheries needs to ensure that PERMEN-KP No. 58 of 2020 is carried out properly through strict law enforcement against fishery businesses that do not comply with regulations to realize increased production of longline tuna fisheries and the sustainability of fish resources.
The fishing ports need to supervise and foster business licenses to longline tuna fishing companies through regular reporting of fishery business operations to realize a good fishery port data collection system.
The government must help develop the tuna fishery business by optimizing the economic benefits while considering the sustainability of tuna fish resources.

The CATWOE analysis of the three root definitions is described in Tables 5, 6, and 7.

Table 5

CATWOE analysis and 3E criteria for root definition 1

CATWOE ANALYSIS	
Customer (C)	Longline tuna fishing company and fisherman
Actors (A)	The government
Transformation (T) or process	Implementing effectively PERMEN-KP Number 58 the year 2020 as the latest regulation
Worldview (W)	Strict enforcement of fisheries businesses that do not comply with regulations to achieve increased production of longline tuna fisheries and the sustainability of fish resources
Owners (O)	The government
Environment (E)	Support of longline tuna catching companies and fishermen to conduct fishing efforts following applicable rules
3E CRITERIA	
Efficacy	Strict enforcement of fishery businesses that do not comply with regulations
Efficiency	Increased production of longline tuna fisheries and lack of violations of applicable rules
Effectiveness	Implementation of PERMEN-KP Number 58 the year 2020

Table 6

CATWOE analysis and 3E criteria for root definition 2

CATWOE ANALYSIS	
Customer (C)	Fishing port, longline tuna fishing company, fisherman
Actors (A)	Fishing port
Transformation (T) or process	Supervision and development of longline tuna fishery business license
Worldview (W)	Reporting longline tuna fishery business operations to realize a good fishery port data collection system
Owners (O)	Fishing port, longline tuna fishing company
Environment (E)	Support longline tuna catching companies and fishermen to report business operations
3E CRITERIA	
Efficacy	Reporting of longline tuna fishery business operations
Efficiency	Minimizing undocumented data at the fishing port
Effectiveness	Achieving of supervision and development of longline tuna fishery business license conducted by the fishery port to longline tuna fishery companies

Table 7

CATWOE analysis and 3E criteria for root definition 3

CATWOE ANALYSIS	
Customer (C)	Longline tuna fishing company and fishermen
Actors (A)	Government, longline tuna fishing company
Transformation (T) or process	Sustainable longline tuna fisheries business Available database of tuna fishing operations activities from tuna fishing companies
Worldview (W)	Determination of the optimal amount of effort allocation to realize profitable and sustainable longline tuna fishery business activities
Owners (O)	Government and longline tuna fishing company
Environment (E)	Availability of fish resources in waters that are difficult to predict precisely
	3E CRITERIA
Efficacy	Identifying the optimal amount of effort allocation for longline tuna catching units
Efficiency	Increased productivity of capture units and minimizing business losses
Effectiveness	Profit increase of longline tuna fishery business

Conceptual modeling. The conceptual model was created based on the preparation of RDs. Problems in the biological aspects of tuna fishery can be solved in four steps. First, socialization of Minister’s Regulation No. 58 of 2020. Second, the preparation of stakeholders for applying regulations. Third, the use of the Ministerial regulations. Fourth, is conducting surveillance and law enforcement (Figure 5).

The problem regarding technical aspects is the low data collection of longline tuna fishery businesses. Hence, it is necessary to supervise and foster a business license for longline tuna fishery companies (Figure 6). The first stage needs to socialize the importance of data collection and fishery business reporting; after that, it is needed for these businesses to make the reports. The third stage is to record the longline tuna businesses operational activities. The data should be entered in an integrated system. Lastly, supervision must be carried out.

Another problem of the technology aspect is that there is no business certitude, since the vessels stopped operating. Therefore, the government needs to develop sustainable longline tuna fisheries businesses by determining the amount of optimal effort allocation (Figure 7). The first stage is to provide a database of tuna longline fishery businesses. The database can be used to map the longline tuna capture area to determine the optimal effort allocation of longline tuna capture units. When the allocation of efforts are obtained, public consultation should be carried out to stakeholders related to the longline tuna fishery businesses to further implement the arrangement of the longline tuna catching unit efforts. Finally, it is necessary to supervise the activities and enforce the law.

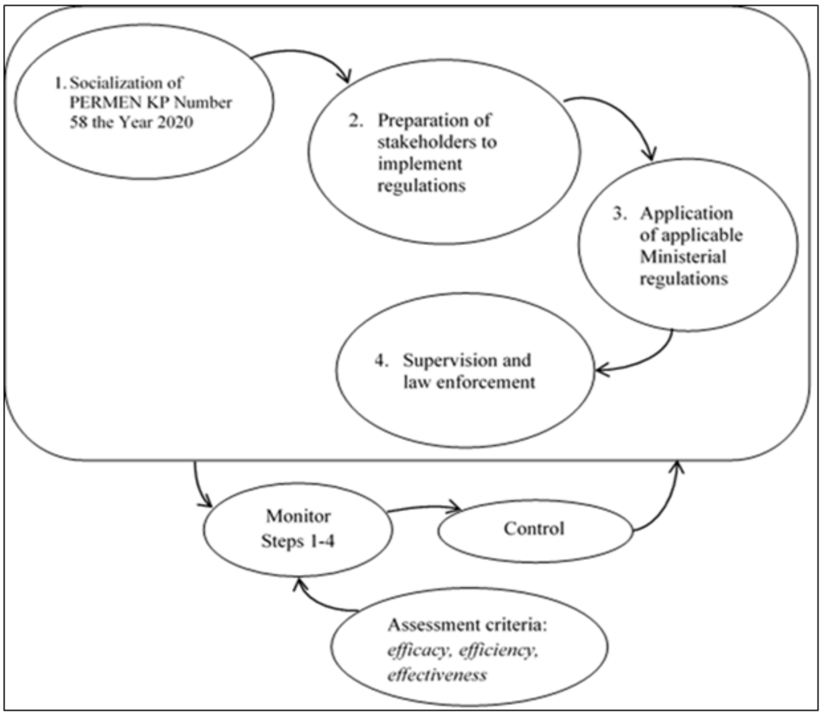

Figure 5. A conceptual model to ensure that the Ministerial Regulation No. 58 of 2020 is correctly functioning.

Figure 6. The conceptual model for supervision and development of longline tuna fishery business license.

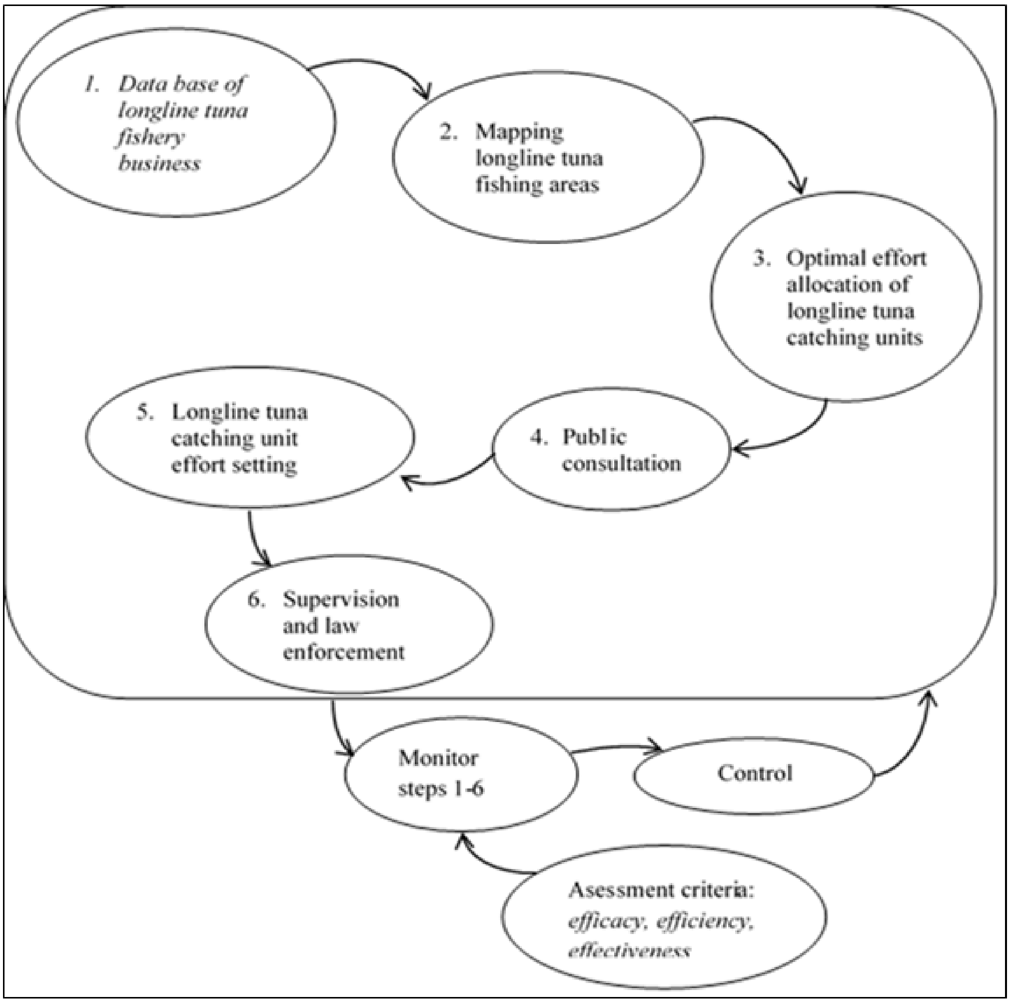

Figure 7. The conceptual model of sustainable longline tuna fisheries business

The policy issued by the government provoked a reaction from longline tuna fishery businesses. Some longline tuna businesses at Nizam Zachman Oceanic Fishing Port ceased operations because operational costs were getting higher and disproportionate to the results obtained (Arthatiani & Apriliani 2015). Businesses complain about the ban on transshipment because it affects the quality of catch. Transshipment can shorten the handling time of catch with up to 12 days to maintain the quality of fish according to export needs (Satria et al 2018).

Government policies that do not support longline tuna business by banning transshipment can be solved by the first conceptual model, where the Ministry of Marine Affairs and Fisheries should ensure that the Ministerial Regulation No. 58 of 2020 on fishery business can run appropriately. Therefore, longline tuna vessels can operate again, and tuna catch production can increase while paying attention to fish resources sustainability. The sustainability of fish resources can be considered through fishing capacity, if it is overcapacity or overexploitation, and if it causes environmental degradation (Nurani et al 2017). When excess fishing capacity occurs, it is difficult for the government to reduce the fleet using a political or social approach (Gigentika et al 2016). The conceptual model was created to guarantee that the Minister of Fisheries and Marine Regulation No. 58 of 2020 can be appropriately implemented (Figure 4). This document regulates the licensing of fishing businesses, procurement of fishing vessels, fishing licenses, fishing vessel licenses, compliance of fishing vessels registered with the Regional Fisheries Management Organization, tagging fishing vessels, fishing boat listing signs for small fishermen, fishing areas, port bases and loading ports, transshipment, conservation and management measures, landing catches, reporting and evaluation of business activities, obligations, development of catch fishery business, supervision, other provisions and transitional provisions (KKP 2020). The regulation detailed in PERMEN-KP No. 58 of 2020 is expected to improve the previous policy, so that the fishery businesses, especially longline tuna businesses, can continue to develop.

Conceptual model 2 for supervision and development of longline tuna fishery business license is based on the RDs technology aspect. The second root definition says the fishing port should supervise and foster longline tuna fishery business licenses through regular reporting of fishery business operations to realize a good fishing port data collection system. In this case, it needs to be integrated data logging for measurable and transparent activities (Miller et al 2018).

For conceptual model 3, the next root definition is that the government needs to build a sustainable tuna fisheries business through determining the optimal amount of effort allocation to realize a profitable and sustainable longline tuna fishery business. The priority activities are providing the database of tuna longline fishery business and the arrangement of fishing areas. Theoretically, all vessels over 30 GT must use a vessel monitoring system (VMS) that can provide information on the movement and position of vessels in fishing areas (Moreno & Herrera 2013; Tawaqal et al 2020). The integrated analysis between VMS data and logbook data will allow fishery data to be analyzed on a spatial scale, which will be more accurate (Gerritsen & Lordan 2011). Moreover, according to Russo et al (2018), a suitable control method for a fishery logbook is to combine two primary sources of data, VMS data and vessel arrival data (whether it is loading or unloading). The data and information results can be used to reference the optimal effort in utilizing longline tuna catching units.

Conclusions. The longline tuna fishery business's conceptual model confirms that the Ministerial Regulation No. 58 of 2020 must function optimally so that the longline tuna fishery businesses can operate again to increase tuna production. Furthermore, it is necessary to supervise and foster a longline tuna fishery business license with an integrated data collection system. Finally, efforts are needed from the government to be able to realize a profitable and sustainable tuna fishery business.

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

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