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Fishery Agribusiness-based Development Model for the Coastal Villages in Donggala, Indonesia – Integrating Ethical Aspect into the Conceptual Development Framework

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Abstract. Donggala Regency has coastal areas with great potential to be managed as fishery agribusiness management areas affecting coastal village development efforts. Many residents of the coastal village areas in Donggala Regency run fisheries and industrial businesses that need to be managed optimally. This idea reaches from the need for a sound commodity management system and a sustainable fisheries agribusiness system. This study aims to examine and develop the concept of developing a coastal village model based on sustainable fisheries agribusiness in Donggala Regency. The analysis method of the system dynamic model was used. The study results show that the conceptual model in coastal village development can be carried out with a robust management approach. Embedded ethical values integrated into the fisheries agribusiness system are expected to have implications for community protection, increasing income, and sustainable fisheries management.

Keywords: dynamic model, coastal management, sustainable fishery, agribusiness, ethics

1. Introduction

Economic development activities in the coastal area should positively impact community welfare. However, development has not yet been felt evenly by some communities, especially those in coastal villages, as strengthened by Wan Tan et al [1]. That is partly due to the non-optimal policies governing the direction of the development of coastal villages. The development model should accommodate the optimal use of marine resources and socio-cultural aspects [2]. Thus, to anticipate and overcome, policies that direct coastal villages as one of the bases for integrated development are required [3].

According to Riyadi [4], agricultural development must be implemented with an agribusiness approach and developed in a more integrated way with rural development so that development will be more focused. By then, limited resources can be utilized optimally. Developing the fishery agribusiness chain (upstream-downstream) in coastal villages will improve the community's economy [5]. Considering the complexity mentioned earlier, the concept of development through integrating an agribusiness-based development plan in coastal areas is needed. As such, the development process can be undertaken to minimize ecosystem damage, reduce conflicts and optimize the use of coastal area resources based on fisheries agribusiness.

Meanwhile, a model represents a system (both concrete and conceptual) using another system. This other system, called a model, is undoubtedly more straightforward than the actual system, so its behaviour is easier to understand. The model is a representation or formulation in a particular language of a real system [6]. The system referred to here is a dynamic system paradigm. Systematic thinking means studying the relationship between objects from observations and investigations in the real world. This way of thinking has existed in the human process of solving life's problems by discovering the reality it faces, similar to what Lehuta et al [7] have studied. In investigating and observing reality, humans always see the relationship between the factors they observe by sorting (analysis) and assembling them (synthesis). In this way, a comprehensive solution will be achieved.

Hence, two questions arise to formulate a coastal village development model based on fisheries agribusiness. Firstly, what obstacles are faced in the economic development of communities in coastal villages? [8]And secondly, how is the coastal village model based on fisheries agribusiness formulated?

Concerning the questions above, several studies have been conducted. Glaeser [9] studied the coastal and marine typology to develop the basis for understanding and comparing the ecological, sociocultural, and economic aspects of coastal and marine systems. Martuti et al.[10] studied the integration of human, natural, social, and financial capital in coastal management. Safitri et al.[11] observed the role of the main stakeholder involved and their influence on the coastal areamanagement policies. Rudianto et al.[12] modelled the integration of biological and ecological aspects in the coastal zone in Malang, Indonesia.

A study modelling managementis critically important to endeavor how coastal village development in Indonesia should be appropriately managed.

In addition, one of the human aspects critically observed later in this study is ethical attributes that reflect human behaviour, i.e., considered good or bad or appropriate or inappropriate. It is realized that ethics concerns interactions or relationships between human beings and are also very important in managing natural resources. Ethics determines what behaviour is considered good and what behaviour is considered bad in a particular community or society. Ethics is a system of values and norms that control human behaviour. However, with the environmental or ecological crisis outbreak, ethical issues have become an essential topic in environmental management discourse. According to Keraf [13], the ecological crisis is a technical issue and a matter of morality and ethics. Ethics is viewed from two aspects, namely, social ethics and environmental ethics.

One of the regions in Indonesia known for its richness in marine and coastal resource is Donggala Regency Central Sulawesi. The coastal area of the Regency spreads along a coastline of 414 km with 79 coastal villages. However, despite the richness of resources, Donggala Regency is one of the highest levels of poverty among other regencies in Central Sulawesi Province. The selected villages located at the west coast of Central Sulawesi Province. Administratively, Donggala Regency has 16 sub-districts and 167 villages/urban villages with a total area of 5,275.69 Km2. Of the 16 sub-districts in Donggala Regency, 14 are located in coastal areas, and 2 (two) are other sub-districts located inland[14]. Figure 1 shows the study location.

Based on the situation mentioned earlier, this research is expected to formulate a coastal village development model based on fisheries agribusiness that can be used to develop rural economies in Donggala Regency.It is to note here that the governmental hierarchy in Indonesia is from central government down to provincial, regency/district, subdistrict, and villages.

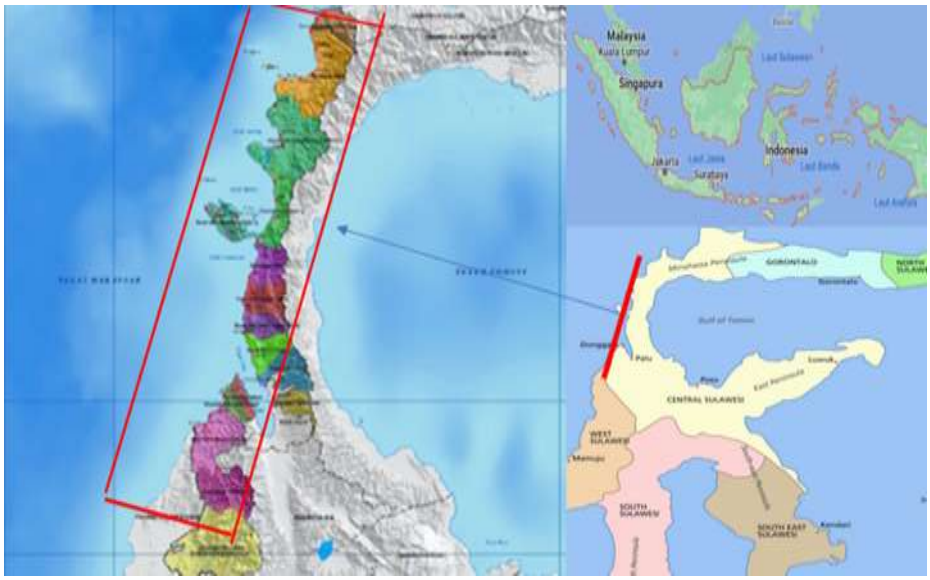

Figure 1. Donggala Regency - Research Location

2. Research Methods

The research method applied was a survey focusing on collecting geographical, regional, social, and institutional data. The research location was in the villages along the west coast of Donggala Regency, covering 14 sub-districts. The village selection criteria were that the community activities are dominated by fishery business. The sub-district where the selected villages are located are those villages under the stipulation of the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, i.e., the Program of Minapolitan, both capture fisheries and aquaculture. Kepmen [15] stated that *Minapolitan* was an integrated economic development concept involving technical efficiency, result quality and acceleration of the production process.

Two types of data were collected, i.e., primary and secondary data. Primary data was obtained from the main actors, including actors in agribusiness activity who were mainly used as respondents. Such actors are known to undertake the procurement and distribution of fishery business production facilities (catching, aquaculture, processing, marine tourism and environmental services), primary production, processing, and marketing activities. Secondary data was obtained through literature and document studies from several related agencies and the results of previous research studies.

Referring to Napitupulu [16], the obtained data were used to model the agribusiness-based development of the coastal villages using a dynamic system approach with the assistance of I-Think tools.

A comparison with the real system was carried out to validate the established model using the MAPE (Mean Absolute Percentage Error) test. MAPE is the average absolute difference between forecasted

and actual values, expressed as a percentage of actual values. This test can be used to determine the suitability of the predicted data with the actual data with the equation as explained by Chang et al.[17]

$$\text{MAPE} = \sum_{t=1}^{n} \left| \frac{y_i - \hat{y}_i}{\hat{y}_i} \right| \times 100\%$$

where:

n = period/number of data
y = score of actual result
ŷ = score of estimation result

The use of MAPE in evaluating the prediction results can avoid measuring the accuracy of the actual and predicted scores. Chang et al [17] also categorized the results of The MAPE score criteria as seen are in Table 1 below.

Table 1. MAPE Score Criteria

MAPE Score	Criteria
< 10 %	Accurate / Very good
10 – 20 %	Good
20 – 50 %	Fair
> 50	Bad/inaccurate

3. Results and Discussion

Economic and Fisheries Business Condition

Gross Regional Domestic Product (GRDP) is one of the critical indicators to determine a region's economic condition in measuring development's success over a certain period of time. Donggala Regency is an agricultural area. Hence agriculture is dominant in the economic structure. The agricultural sector's contribution to the Gross Regional Domestic Product (GRDP) was above 35.11 percent or 4,114,846.1 million rupiahs in 2020. Overall, Donggala Regency's GRDP continues to increase from year to year. It also shows that Donggala Regency has experienced a phase of regional development, i.e., the shift in the role of the primary sector, which is replaced by the secondary and tertiary sectors.

Fishing ground for fishers living in the study area is the marine water of the Donggala Regency, located partly in the Makassar Strait. The Makassar Strait is a national fishing ground classified as Fisheries Management Area (FMA) 713, covering the strait and the Flores Sea. The FMA is a fishing ground targeting large pelagic fish, small pelagic fish, demersal fish, consumption reef fish, peneid shrimp, lobster, squid and ornamental fish. The Makassar Strait is famous as a rich fishing ground, particularly for large pelagic fish such as tuna [18].

The fishery business carried out by fishermen is an individual business. Various capture fisheries businesses, from modern to traditional, operate along the waters of Donggala Regency. The diversity of this type of business depends on the fishermen's capital capabilities and the business opportunities that can benefit them. Owners of significant capital will choose to develop their fishing business by procuring 20 GT purse seine vessels, bagan (light fishing) fishing gear, 1-5 GT long-line tuna vessels, and floating net cages. Meanwhile, fishermen with small capital will pursue a small-scale fishery business using fishing rods, gillnets, sero and traps.

Following is the summary of fishery production of Donggala Regency.

Table 2. Fishery Production by sub-district and sub-sector in Donggala Regency (tonnes) in 2020

No	Sub-dictrict	Capture Fishery	Public Waters	Aquaculture	Total number
1	Rio Pakava	0	0	0	0
2	Pinembani	0	386	0	386
3	Banawa	5 216,1	0	6,4	5 222,5
4	Banawa Selatan	1 862,3	0	0	1 862,3
5	Banawa Tengah	1 500,7	0	0	1 500,7
6	Labuan	568,3	174	0	742,3
7	Tanantovea	452,3	0	0	452,3
8	Sindue	856,5	0	0	856,5
9	Sindue Tambosabora	641,3	0	0	641,3
10	Sindue Tobata	608,3	0	0	608,3
11	Sirenja	897,2	227	0	1 124,2
12	Balaesang	1 908,5	0	1,1	1 909,6
13	Balaesang	1 302	245	295,3	1 842,3
14	Dampelas	1 718,4	358	227,7	2 304,1
15	Sojol	1 294,6	0	5,4	1 300
16	Sojol Utara	2 509,8	0	437,3	2 947,1
	Donggala	**21.336,3**	**1. 390**	**973,2**	**23 699,5**

Fishery Agribusiness-Based Coastal Village Model

The coastal village development model based on fisheries agribusiness in Donggala Regency used a dynamic system approach through the logic of the relationship between related components and their interactions. Simonovic [19] stated that the systems approach is a method that can be used to solve complex, dynamic and uncertain situations. To obtain a comprehensive model of coastal village development based on fishery agribusiness, a dynamic system methodology was used based on consideration of its ability to present the relationship between the variables studied and simulate the behaviour of the system when an intervention is made to the system.

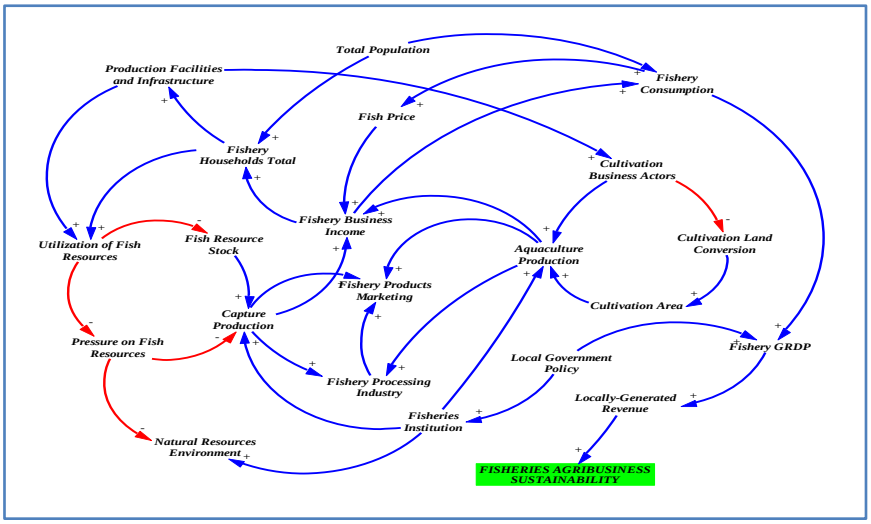

Figure 2. Causal loop diagram for the management of fisheries resources in the development of coastal villages based on fishery agribusiness.

System Identification

The system components involved in the utilization and management of fishery resources to support fishery agribusiness activities in the coastal area of Donggala Regency are:

1. The population (number of Fishery Households)
2. Per capita fishery consumption and market
3. Fishery production processes (availability of fish resource stocks, area of cultivated land, fishing activities, and aquaculture)
4. The fishing industry (processing)
5. Fishery institutions (improvement of human resources and environmental management, and sustainability of fishery business),
6. and government policies (increasing Locally-Generated Revenue/LGR)

The causal loop diagram above illustrates the interrelationships between components in the agri-fishery sustainability system, similar to what has been explained by Orgill et al. [20]. The identification of the causal loop diagram system is then interpreted to build the black box concept of the input-output diagram. According to Lili[21, 22], there are three kinds of information found to compose a black box, namely: (1) input variables, (2) output variables, and (3) parameters that limit the structure of the system. There are two kinds of input variables: those from outside the system (exogenous inputs) or environmental inputs and overt inputs originating from within the system (endogenous inputs). Overt input consists of controlled and uncontrolled inputs, while the output variable consists of desired and unwanted outputs. The results of the analysis of the input-output diagram of the coastal village development model based on fisheries agribusiness in Donggala Regency can be seen in Figure 3.

In the input-output diagram, there are four crucial factors: uncontrollable, controlled, desired, and unwanted inputs. The following table depicts the input-output diagram of a coastal village development model based on fisheries agribusiness in Donggala Regency.

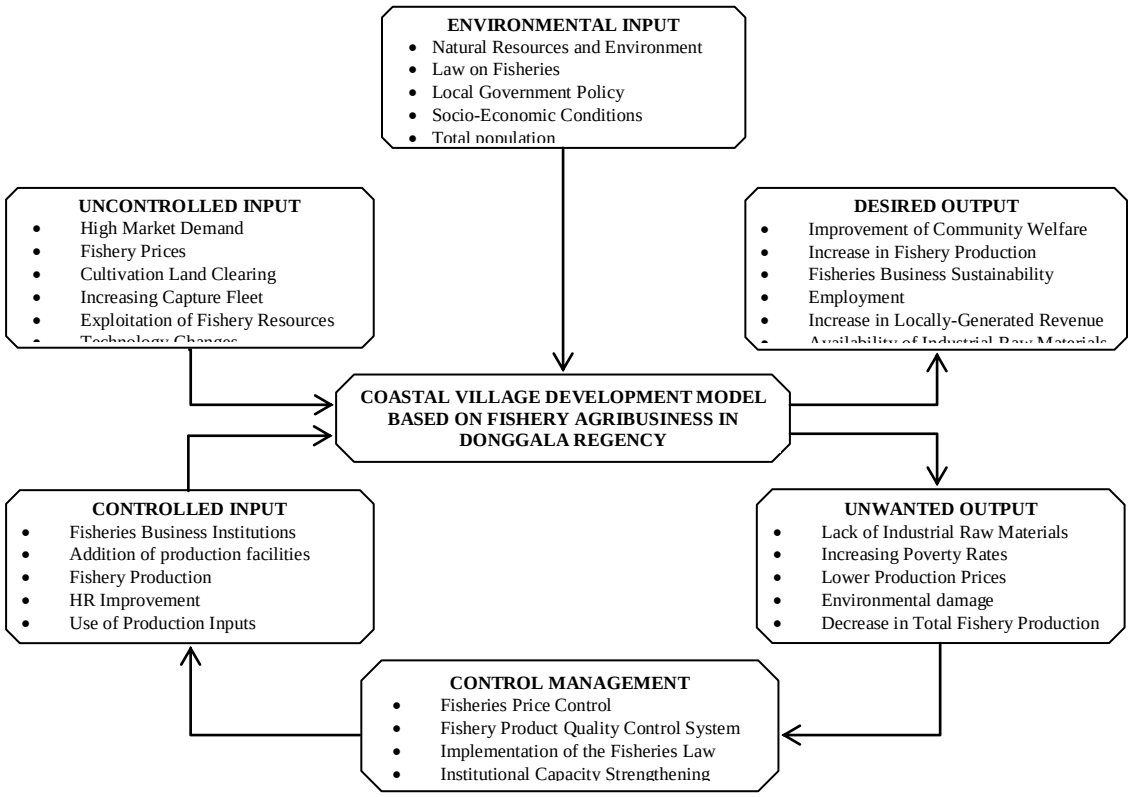

Figure 3. Input-output diagram of a coastal village development model based on fisheries agribusiness in Donggala Regency.

The inputs needed to increase fishery production but cannot be controlled are high market demand, fishery prices, cultivation land clearing, increasing capture fleets, exploitation of fisheries resources, and technological changes which are part of uncontrolled inputs.

Environmental inputs are factors that indirectly influence the development of the fisheries agribusiness sector in achieving the objectives, namely natural and environmental resources, laws on fisheries, local government policies, socio-economic conditions, population, and geographical conditions of the region.

The three inputs listed in the diagram above will produce the desired and unwanted output. The desired output is increased community welfare, increased fishery production, realized sustainability of fishery business, increased employment, increased Localy-Generated Revenue, enhanced availability of industrial raw materials, and financial institutions. Meanwhile, the unwanted outputs are the lack of industrial raw materials, increasing poverty rates, decreasing production prices, environmental damage, and decreasing the amount of fishery production.

Model Structure and Simulation

System modelling is a group of activities describing the system under study.The model built is a deterministic symbolic model (mathematical model) [23]. The modelling of the coastal village development system based on fisheries agribusiness was carried out using I-think 6.0.1 software (Figure 4). The development of the dynamic system model aimed to determine the behavior of the fisheries agribusiness system during the coastal village development which is useful in improving community welfare.

In this study, the structural characteristics of the coastal village development model based on fisheries agribusiness in Donggala Regency are described at a macro level and formed in 4 sub-models, namely: (1) a sub-model of increasing fishery production, (2) a socio-economic sub-model, (3) processing industry development sub-model, and (4) fishery product marketing sub-model.

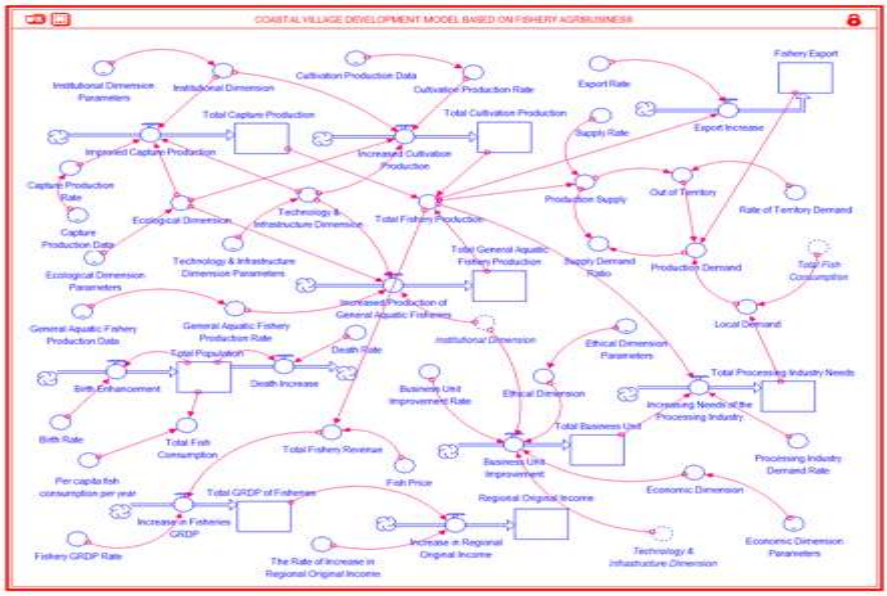

Figure 4. Dynamic model structure of coastal village development based on fisheries agribusiness in Donggala Regency.

Coastal Village Development Model Scenario Simulation

The performance of the model described in the system structure describes the current condition. Over time, there will be changes in system performance according to the dynamics of time in the future. Based on this, various scenarios have been prepared for the model that has been built as a strategy for developing coastal villages in the future. The built scenarios are divided into three: (1) pessimistic scenario (2) moderate scenario, and (3) optimistic scenario.

The pessimistic scenario means that the system's performance variables experience a setback, a change in the existing state that leads to the achievement of progress but is small enough to affect the performance of the system, or there is a very rapid change in the situation that needs to be inhibited. The moderate scenario is defined as a change in several variables that affect system performance, and this change is better than the pessimistic scenario. Meanwhile, the optimistic scenario means a change is more significant than the variables that affect system performance, and this change is better than the first

and third scenarios. The key variables that significantly affect the system's performance include population growth, input and output increase in production, and community income. These variables will affect the increase in production, socioeconomic contribution to Locally-Generated Revenue (LGR) and Gross Regional Domestic Product (GRDP). This study estimates an increase in production of 4%, 8% and 12% in fisheries: capture fisheries production assuming an increase in the number of fishing fleets and an increase in the amount of effort, public water production assuming an increase in the amount of effort, and aquaculture production assuming an increase in land area.

The scenario for increasing fishery production in the coastal village area of Donggala Regency is shown in Figure 5.

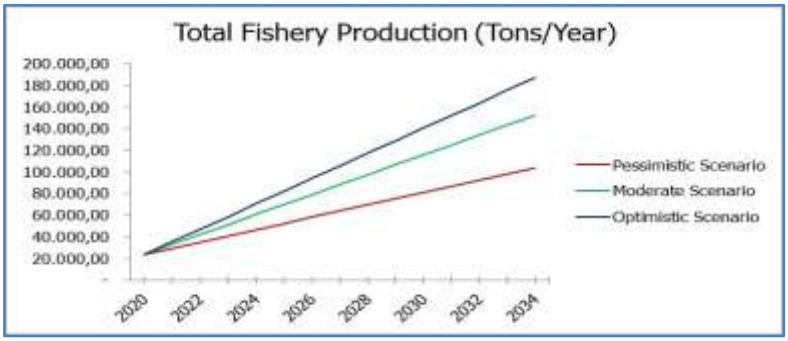

Figure 5. Scenario Simulation of Changes in Fishery Production Increase in the Coastal Village Area of Donggala Regency

The difference in the increase in fishery production shows a sharper curve in the optimistic scenario than in the moderate and pessimistic scenarios. The higher fishery production in the third scenario (optimistic) than the other scenarios is caused by the increase in production inputs in primary activities of the main actors, in addition to other factors affecting the increase in production.

This increase in production will affect the income of the main actors in the coastal villages. The higher the fishery production generated by their business activities, the greater their chances of obtaining profits and income. However, this income is influenced by the amount of production and the price of fishery commodities. By making efforts to increase production through the addition of inputs to production facilities, a scenario model of income from fishery businesses (including capture, cultivation and processing) can be made, as shown in Figure 6.

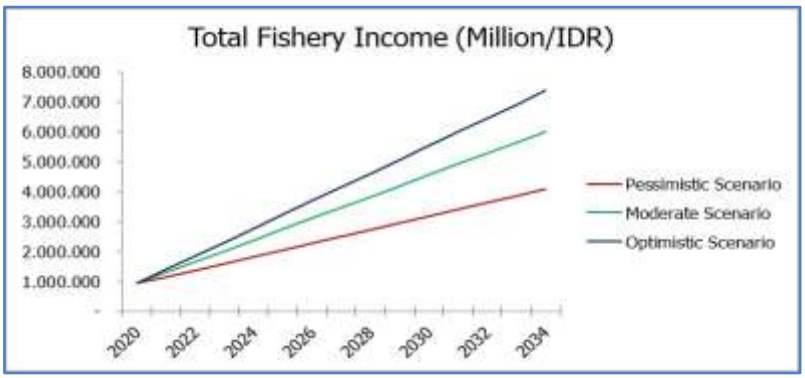

Figure 6. Scenario Simulation of Fishery Business Income in the coastal village area of Donggala Regency

The difference in the growth of the revenue/income curve in the pessimistic, moderate and optimistic scenarios, with the curve in the optimistic scenario being higher than the curve in the moderate and pessimistic scenario, is shown in Figure 05. The difference is partly due to differences in the prices of fishery commodities being traded.

The increase in fishery production will also affect the increase in Gross Domestic Product (GDP). The increase in GRDP originating from the fisheries sector's contribution in this model is made into a scenario model. Commodities for which scenarios are made to see their contribution to GRDP include leading fishery commodities (fish, shrimp, lobster, and others) (Figure 7).

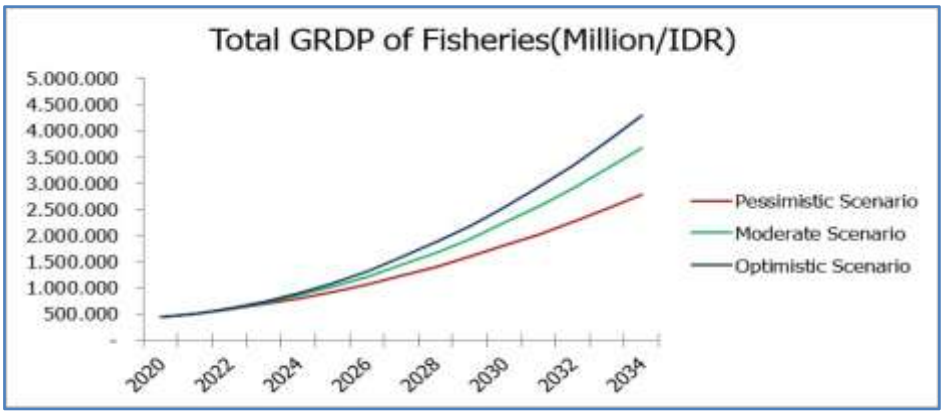

Figure 7 Scenario Simulation of GRDP Contribution in the coastal village of Donggala Regency

The simulation results of each component making up the sub-model show a tendency to form a positive growth curve that follows the exponential curve until 2034. However, several components of the sub-model, such as increased fishery production and marketing of fishery products, are always balanced by the availability of technology and support for facilities and infrastructure of fisheries agribusiness so that in this model, there is a positive feedback relationship through the reinforcing process. The form of the model being built follows the basic pattern of "Limit to Growth" in a dynamic system. To improve the model's performance, the scenario that needs to be carried out is the optimistic scenario, namely by conducting a more significant intervention on one or more variables that affect the model.

Model Validation Test

The model validation test was carried out using MAPE on 4 (four) main sub-models. They were

1. the fishery production sub-model,
2. the socioeconomic sub-model (population, Fisheries GRDP and LGR),
3. the sub-model of development of the fishery product processing industry, and
4. The marketing sub-models (fishery exports and demand for fishery production outside the region assuming 50% of total production).

The validation test results for each sub-model are shown in the following table.

Table 3. Validation test results

No	Description	MAPE Test Results	Range
1.	Increase in Fishery Production	12 %	10-20 %
2.	Socio-Economic (Total population, GRDP & LGR)	2 %, 10 % 24 %	0-10 % 10-20 % 20-50 %
3.	Processing Industry Development	40 %	20-50 %
4.	Fishery Product Marketing	16 %	10-20 %

Analysis of the model validation test was also carried out on the sub-model of the needs of the fisheries processing industry. The MAPE test value of the sub-model is 40%, so the sub-model can be categorized as "fair" because it meets the criteria that the MAPE test is in the range of 20 - 50%. Meanwhile, the MAPE test value of the marketing sub-model is 16%, categorized as "good" because the MAPE test results are 10-20%.

A Conceptual Model of Coastal Village Management Based on Agribusiness Sustainable Fisheries

The study results show that the coastal area of Donggala Regency is very potential for developing the fisheries sector, especially capture fisheries and aquaculture. However, its development is limited by technological factors and the availability of facilities and infrastructure to support fishing and aquaculture, including the level of awareness (ethics), in managing fishery resources.

Considering the potential of the coastal area of Donggala Regency, development policies in this region are directed at development in the fisheries sector through agribusiness development. However, in doing so, adequate facilities and infrastructure is a necessity. One of the concepts of balanced area development that can be applied in this area is the development of coastal village areas or fishing village areas (Minapolitan). This concept aligns with the national, provincial, and district developmental concepts. Since its launch in 2011, the Minapolitan main objective has been to develop coastal villages through the development of fishing towns. However, based on the analysis results, the existing condition of the coastal village areas is largely undeveloped, so it is necessary to improve the coastal village area by completing the necessary facilities and infrastructure.

The main obstacle faced in developing coastal villages in Donggala district is the limited infrastructure/facilities and the quality of human resources in utilizing technology. The infrastructure in question includes the availability of an ice factory, Fish Auction Place (TPI), workshops, provision of refuelling stations for ships, and provision of fishery tools and materials (catching/cultivating). Besides that, the relevant agencies' coaching and training activities still need to be improved because there are not enough skilled workers in the village area. Key variables include capital, financing systems, technology, human resources, facilities and infrastructure, and market access [24]. Therefore, it is necessary to provide adequate infrastructure and increase skilled human resources to overcome this. In

this case, the role of the government, both the Central Government and the Donggala Regency Government, as direct implementers in the field is vital, especially in making policies for the development of coastal village areas.

On the other hand, the potential for social conflict between communities is also a severe threat that can occur anytime. Issues of marginality and a sense of injustice and inequality in economic and socio-cultural aspects generally cause social conflicts. The integration of fisheries into coastal area management is carried out because the coastal area is fragile due to various overlapping interests that tend to trigger conflict [25]. The development of village areas with the concept of agribusiness is a Bottom-Up Planning approach. Therefore, the active participation and involvement of all stakeholders in the coastal village area (main actors/fishery businesses, investors and local governments) are crucial.

The waters along the coastal villages as places for fishery business activities and suppliers of fishery commodities will undoubtedly be seen from several components of the problem and improvement efforts as follows:

a) The main actors (fishermen and fish cultivators), as the beneficiaries of the existing fishery resources in the waters, will undoubtedly try to get as many fish commodities as possible with the equipment they have to increase their income. With the availability of equipment and good water conditions, their enthusiasm and work ethic will positively impact them. On the other hand, if the equipment is damaged/unavailable, technological capabilities are low, and the waters are not good, they will be reluctant to do activities to get fish commodities (becoming lazy).
b) Efforts to conserve aquatic ecosystems (coral reefs, seagrass beds, mangroves) and fish resources will ensure fish commodities' current and future needs. On the other hand, if irresponsible people damage the environmental quality of the aquatic ecosystem and efforts to obtain commodities are carried out destructively, such as bombing or destroying wood, this will harm the growth and sustainability of fish resources. As a result, the main actors will not get the expected results.
c) The availability of supporting facilities and infrastructure is essential for every village, considering that facilities and infrastructure such as Fish Auction Place (TPI), markets, financial institutions, raw material shops, ice factories and others are needed. The availability of these facilities will affect the activities of the main actors in efforts to repair equipment, market products, and meet fishing needs.
d) Management of fishery resources. The management referred to here is concerned with the behaviour of the main business actors in utilizing fishery resources. Awareness of ethics among the main actors in utilizing fishery resources is essential, considering that if fish resources are not managed properly, it will impact future generations. Therefore, it is necessary to maintain the quality of the waters by carrying out conservation efforts and making collective agreements in formulating rules for managing fishery resources.

Based on the preceding, to create effective fisheries management, it is necessary to have management ethics and the integration of systems and policies. This integration is built based on connectivity and system synergy formed from fishery activities which include fishery resources, fishery actors, fishery infrastructure, and fishery infrastructure providers in coastal village areas. This connectivity and

synergy are in line with the opinion of Kurniawan et al. [26], who has stated that to increase the development of rural areas for the community, economy, and regional development, intensive efforts to develop local potential are needed.

Government control and guidance emphasize using environmentally friendly fishing gear and the types and sizes of fishing gear so that fishery resources and their habitats can be sustainable. The integration of fisheries management and agribusiness systems approach is regulated in a policy mutually agreed upon. The needed agreement is, for instance, the use of environmentally friendly fishing gear and technology, government intervention on uniformity of market prices in coastal village areas, and justice for all main actors, both members and non-members, in the utilization of BUMDes/Cooperative. Another integration that must be implemented is the integration between the government, the private sector, cooperatives and the main actors/business actors in the management of fishery activities. The government carries out its role as a supervisor for fisheries actors in order to realize sustainable fisheries, and universities provide guidance and introduce technology from research results to increase productivity and production.

The conceptual model framework for the management of capture fisheries agribusiness in coastal village areas in a sustainable manner must be applied. Moving towards this manner means that fishery actors make the best use of fishery resources, supported by management ethics in good agribusiness and infrastructure systems under the supervision of the government as the infrastructure provider. The conceptual model framework for fisheries agribusiness management in the coastal village area is shown in Figure 8.

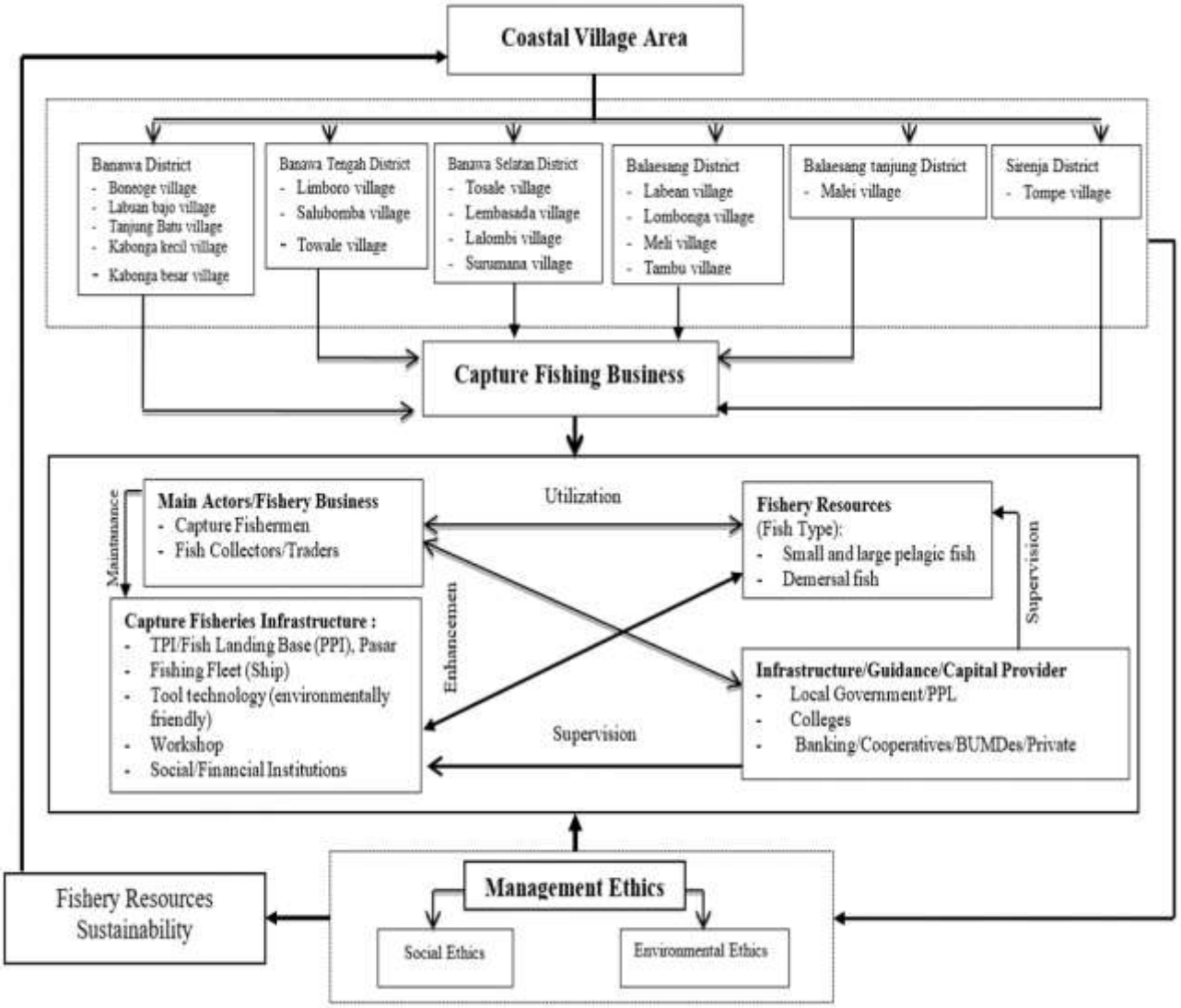

Figure 8. Conceptual Model of Management of Coastal Village Areas Based on Fishery Agribusiness (Sustainable Capture Fisheries) in Donggala Regency

The concept of integration is based on connectivity with aquaculture systems (Figure 9). The aquaculture components consisted of aquaculture actors, i.e., fish farmers/cultivators, managed fishery resources such as cultivated land (in the sea and brackish water including inland waters), and cultivated commodities such as milkfish, shrimp, seaweed and others. Besides that, the availability of cultivation infrastructure such as aquaculture storage warehouses, production markets including ice factories, suppliers or infrastructure providers from the government and the private sector (shops/providers of tools and materials) are vital. Technical guidance from appropriate agencies in providing information such as aquaculture technology (traditional, semi-intensive and intensive) that cultivators need to know and master will positively impact land productivity, which can increase production.

In order to achieve an integrated and sustainable management of the sub-models that have been prepared previously, where there is connectivity and interaction between systems, it is necessary to make efforts to manage the sub-models that are integrated with a systems approach and policy integration. Connectivity that occurs internally and externally in each village or between villages is caused by interdependent factors, especially the availability of infrastructure that supports social and ecological interactions. A village with external connectivity in interactions between the main actors is generally caused by the unavailability of supporting facilities for community activities, such as markets and other supporting infrastructure. Villages with these conditions will generally depend on other villages. Appropriate spatial planning in the study area requires the integration of policies and integration of infrastructure use. Each village that needs infrastructure will look for another village that has it. This implication aligns with the spatial planning theory that humans will look for a better place, both biologically and physically, to carry out the life cycle [27]. The component attributes of each village must be identified first to find out the absence (e.g. infrastructure) in the village. Then the government or related stakeholders conduct a connectivity study to determine how much each village tends to depend on all the existing components.

The concept of a sustainable fishery agribusiness management model in coastal villages with the support of the Regional Regulation of Donggala Regency is expected to increase their ability to adapt and develop in the Donggala Regency area to increase community income and sustainable fisheries management.

In supporting the development of coastal villages in the Donggala Regency area, it is necessary to develop several formulations of operational policy directions, including:

a) Designate the coastal villages in the sub-district capital as a Growth Center Village (DPP) and other surrounding villages as hinterland areas. This hub is related to the level of development of the villages in the sub-district capital, which are more advanced than the other villages.
b) Build agribusiness facilities and infrastructure in DPP and hinterland areas supported by adequate public facilities and infrastructure, especially markets, transportation and telecommunications in all coastal villages. In so doing is intended to increase fishery business productivity and facilitate access between regions in the procurement of fishery production facilities and marketing of fishery products.
c) Develop economic institutions for coastal communities from, by, and for the benefit of the coastal communities and not for institutions formed for the benefit of the supervisory agency. The coastal communities require guidance from the relevant agencies/institutions because the

main actors generally work individually with minimal skills and capital. Steps that can be taken are to provide encouragement and guidance so that they can work together in groups and form a combined group or association.

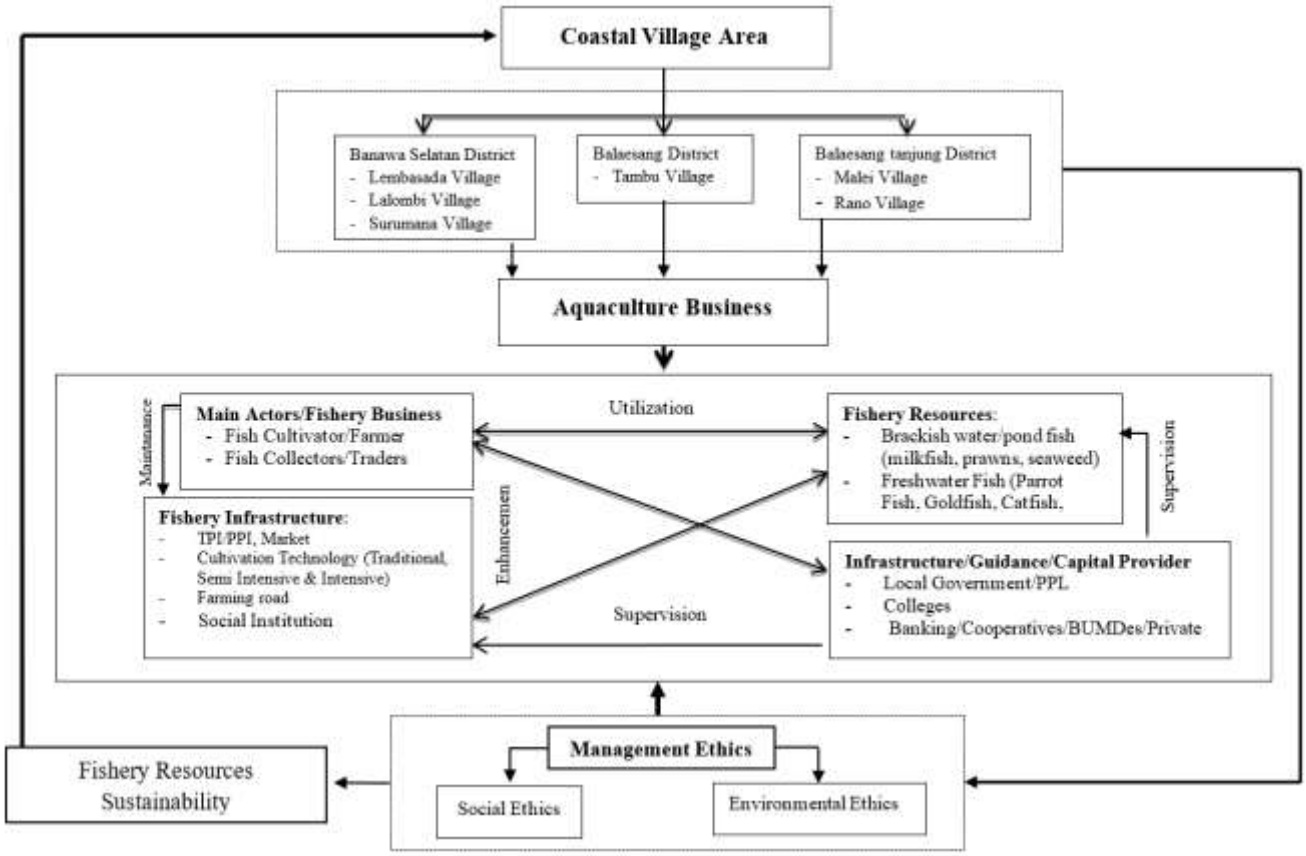

Figure 9. Conceptual Model of Management of Coastal Village Areas Based on Fishery Agribusiness (Sustainale Aquaculture) in Donggala

d) Improve coordination and establish good partnerships with all relevant stakeholders. In this case, coordination and partnership between the government, coastal communities and the business world are critical in developing coastal village areas following their respective authorities. The government is expected to be able to provide strategic public facilities and infrastructure and fishery research activities. The role of the business world is essential in terms of providing fishery inputs and processing fishery products. At the same time, as the main actor, the community contributes to the utilization of facilities and infrastructure prepared by the government and the business world to increase their income.

e) Increase the level of awareness in the environmental management of fishery resources with a behavioural (ethical) approach, both social and environmental ethics, so that resource sustainability is maintained for the future.

f) Increase the capacity of coastal communities by providing formal and informal education such as training, courses, and workshops. This capacity building is essential considering that the community is expected to be able to take the initiative independently and creatively to seek steps that must be taken in their business activities, including the processing and marketing of fishery products.

4. Conclusions

Based on the results of the research above, it can be concluded that:

1) Constraints and problems in the economic development of communities in coastal villages include:
   - The level of participation of the main actors (fishermen and fish cultivators) as the beneficiaries of the existing fishery resources in the waters is influenced by the need for more equipment availability and the low ability to adopt the technology.
   - Damage to the quality of the aquatic environment results from the large number of main actors carrying out activities that damage the environment, such as bombing, harvesting mangrove wood and others.
   - Supporting facilities and infrastructure/infrastructure is minimal even though every village very much needs their existence, for example, TPI, markets, financial institutions, raw material shops, ice factories and others.
   - The behaviour of the main and business actors in utilizing fishery resources is low. Awareness of ethics is vital among the main actors in utilizing fishery resources, considering that if fish resources are not managed properly, it will impact future generations.
   - Guidance and training activities are still lacking because there are not enough extension workers placed in rural areas
2) The conceptual model in developing coastal villages in Donggala Regency, which is applied with an ethical management approach integrated into the fisheries agribusiness system, will have implications for community protection, increase in income and sustainable fisheries management.

References

1. F W Tan, L Nesti, E Y Yonnedi, E R Ridwan 2021. Strategy to improve economic condition of fishermen living in the coastal area in Kabupaten Pesisir Selatan. *Journal of Business and Socio-economic Development*Vol. 3 No. 1 pp. 69-85.
2. S K Hong and A Grydehøj (2022). Sustainable Island Communities and Fishing Villages in South Korea: Challenges, Opportunities and Limitations. *Sustainability* 2022, 14, 16657.
3. F Nunana, M A Omondib, A Y Nchimbic, M M Mangorad, J G Kairoe,M S Shallif, and Narriman S J 2020 The silos of natural resource governance: implications of sector-led coastal management at the village level in Kenya and Zanzibar-Tanzania. Conservation and Society AOP: 1-13.
4. Riyadi and D M. Masykur., 2003. Pemberdayaan Masyarakat Melalui Pengembangan Kawasan Agribisnis. Pembangunan Pertanian Berbasis Kewilayahan. Perencanaan Pembangunan No. 31 (April-Juni 2003). Bappenas, Jakarta.
5. Fachruddin, M Antara, Arizal, A Laapo 2020. Sustainability Status of Fishery Business in Supporting Development of Coastal Village Based on Agribusiness Fisheries in Donggala District. Indonesia. *Russian Journal of Agricultural and Socio-Economic Sciences* 106(10):94-108
6. S Lehuta,R Girardin , S Mahevas, M Travers-Troletand Youen Vermard 2016 Reconciling complex system models and fisheries advice:Practical examples and leads. *Aquatic Living Resource*. 29, 208
7. Rukin 2018 Pembangunan perekonomian sebagai upaya penanggulangan kemiskinanmasyarakat desa pesisir. *Masyarakat, Kebudayaan dan Politik* Vol. 31, Issue 2, 2018, page 230-24
8. Glaeser 2019 Sustainable Coastal Management for Social-Ecological Systems—A Typology Approach in Indonesia. Global Challenges and Innovations 61-77

9. N K T Martuti, R Pribadi, N K Dewi,W A B N Sidiq3, D Pr Mutiatari 2022 Analysis of Environmental, Socio-economic, and Stakeholder Partnership for Integrated Coastal Management in Semarang City, Indonesia. *Journal of Integrated Coastal Zone Management* 22(1): 9-22
10. D P Safitri, A Hakim, M R K Muluk, F Putra4, R Afriyanti 2022 Stakeholder Analysis of Coastal Management Policy inIndonesia. *SHIMBA*, September 18-22
11. Rudianto, GBintoro, Guntur, D Swatama, A R Paizar, L Klemens, Jeremy, LOktasyah, C APurba 2022 Integrated Model of Coastal Ecosystem Restoration Management on the TambanBeach, Malang Regency, Indonesia. Journal of Hunan University (Natural Sciences）Vol. 49 No. 8August 2022
12. Keraf, S. 2006. Etika Lingkungan. Penerbit Kompas, Jakarta
13. Badan Pusat Statistics 2016 Kabupaten Donggala dalam Angka, BPS Donggala
14. Kepmen 2010. Keputusan Menteri Kelautan dan Perikanan No. KEP. 32/MEN /2010, tentang Penetapan Kawasan Minapolitan. Jakarta
15. T A Napitupulu 2021 System Dynamic Simulation Model of a System with Non-Observable Variables. Lectures Note, unpublished. Master Graduate Program, Binus University, Jakarta
16. P C Chang, Y W Wang and C H Liu2007 The development of a weighted evolving fuzzy neural network for PCB sales forecasting, Expert Systems with Applications, 32(1), pp. 86–96. Available at: https://doi.org/10.1016/j.eswa.2005.11.021.
17. Safruddin 2022 The Characteristics of Fishing Ground Using Purse Seine in Makassar Strait and Flores Sea. Torani: JFMarSci Vol. 5 (2) June 2022: 68-76.
18. S P Simonovic (2020). Systems Approach to Management of Water Resources—Toward Performance Based Water Resources Engineering. Water 2020, 12(4), 1208
19. M K Orgill, S York, and J MacKellar 2019 Introduction to Systems Thinking for the Chemistry Education Community.
20. M S Lili 2002 Dasar-dasar Akuntansi, PT. Bumi Aksara, Jakarta
21. B P Rimal, I E Putro, A Budiyono, D Min and E Choi 2011 System Identification of NN-based Model Reference Control of RUAV during Hover. ResearchGate, DOI: 10.5772/15414
22. S Robonson 2005. Simulation. The Practice of Model Development and Use. John Wiley and Sons, England.
23. N Fajariyah and E B Santoso 2016 Arahan Pengembangan Ekonomi Lokal Berbasis Rumput Laut di Pulau Poteran, Kabupaten Sumenep', Jurnal Teknik ITS, 4(2), pp. C70–C75. Available at: https://doi.org/10.12962/j23373539.v4i2.10836.
24. MBellanger, C Speir, F Blanchard, K Brooks, J R AButler, S Crosson, R Fonner, SGourguet, D SHolland, SKuikka, B Le Gallic, R Lent, G D Libecap, D W Lipton, P Nayak, D Reid, P Scemama, R Stephenson, O Thébaud and J C. Young 2020 Addressing Marine and Coastal Governance Conflicts at the Interface of Multiple Sectors and Jurisdictions. Marine Conservation and SustainabilityVolume 7 - 2020 | https://doi.org/10.3389/fmars.2020.544440
25. A Kurniawan, I Noor, and E Setyowati 2020 Local Economic Development Strategy through Scenario Planning Approach (Study on the Development of Rural Agro-tourism Areas in Banyuwangi). Wacana– Vol. 25, No. 1 (2022)
26. Van der Duim VR. 2005. Tourismscapes: An actor-network perspective onsustainable tourism development. Dissertation, Wageningen University, the Nederland. Belanda (NL)