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POLICY DESIGN FOR COASTAL AND MARINE TOURISM DEVELOPMENT IN KOMODO NATIONAL PARK USING INTERPRETATIVE STRUCTURAL MODELING: A CASE STUDY OF PADAR AND KOMODO ISLANDS

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ABSTRACT
Komodo National Park in East Nusa Tenggara Province is one of 21 model national parks in Indonesia and is one of the first five national parks established in Indonesia. The potential of natural resources in East Nusa Tenggara Province is the existence of a coastline of 5,700 kilometers, this makes the prospect of beaches and waters around Komodo National Park increasingly valuable. Apart from being a natural habitat for rare animals, namely *Varanus komodoensis*, in Komodo National Park, there are also other endemic animals and vegetation in both land and sea territories. Beach tourism developed at this time is pink beach recreation, while marine tourism is snorkeling and diving activities. These three tourism activities are a supporting attraction for tourists in addition to tourism activities to see endangered animals. The purpose of this study is to make recommendations for the management or policymakers through the design of policies for the development of coastal tourism and marine tourism on Padar Island and Komodo Island in Komodo National Park. The research method uses a survey method using questionnaires to fill out questionnaires by conducting direct interviews with key stakeholders. The research stage is through mapping the development needs of coastal tourism and marine tourism and analyzing key elements, tabulating and analyzing data using the Interpretative Structural Modeling (ISM) method with EXSIMPRO software. The results of the study show that there are 7 stages with 18 key sub-elements that play an important role in policy recommendations for developing coastal tourism and marine tourism on Padar Island and Komodo Island.

KEY WORDS
Interpretative structural modeling, Komodo National Park, beach tourism, marine tourism.

East Nusa Tenggara is one of the provinces in Indonesia which is located in the Nusa Tenggara Islands group with a population of 5,456,200 people, the population growth rate from 2018 to 2020 is 1.59%, 1.58%, and 1.56% respectively (BTNK, 2020). Komodo National Park (KNP) in East Nusa Tenggara is one of the 21 model national parks in Indonesia and is one of the first five national parks established in Indonesia. KNP was founded in 1980 and is located in the Komodo sub-district, Manggarai Regency, East Nusa Tenggara Province. In 1986 KNP was designated by UNESCO (United Nations Educational, Scientific, and Cultural Organization) as a World Heritage Site and a Man and Biosphere Reserve. Scientifically, KNP was researched by JKH Van Steyn in 1911 and since then the conservation goals have been broadened to protect all biodiversity both at sea and on land. KNP includes 3 main islands namely Komodo Island, Rinca Island, and Padar Island. The current area of KNP is 1,817 KM^2 (BTNK, 2020). In the KNP area, several animals such as horses, wild bulls, deer, male wild boars, snakes, monkeys, and various types of birds were also found. In addition,

KNP has amazing underwater biota. The potential of natural resources in East Nusa Tenggara Province is the 5,700 KM coastline (BTNK 2020). This makes the potential of the beaches and waters around Komodo National Park (hereinafter referred to as KNP) even more valuable. Apart from being a natural habitat for rare animals, namely *Varanus komodoensis*, in KNP, there are also other endemic animals and vegetation in both land and sea territories. Beach tourism activities that are currently in demand are recreational activities at Pink Beach, while marine tourism activities of interest are snorkeling and diving activities. These three tourism activities are a supporting attraction for KNP tourists in addition to tourism activities to see rare animals. The problems that exist in the coastal and water areas of Padar Island and Komodo Island in KNP are related to policy design in the development of coastal and marine tourism as island tourism destinations. The condition of natural resources on Padar Island and Komodo Island is expected to support the development of integrated tourism in KNP. The urgency of this research being conducted in KNP is one of Indonesia's three main priority destinations in the province of East Nusa Tenggara. The study area includes a conservation area that has the function of protecting the biodiversity of Komodo dragons, marine biota, and commercial fish spawning grounds for the supply of fishing waters in the surrounding waters. The main challenge in KNP management is reducing pressure on resources and conflicts between incompatible activities. Concerning the implementation of research, several aspects that can be obtained for the development of science and technology are: (1) the availability of data/information on the need for developing coastal tourism and marine tourism on Padar Island and Komodo Island in KNP, and (2) the availability of a tourism development policy design. beach and marine tourism.

METHODS OF RESEARCH

Research sites. This research was conducted in April - August 2022, which are located in Padar Island and Komodo Island, Komodo National Park, West Manggarai Regency.

Data source. Methods of data collection using survey methods through interview and observation techniques. The data collected consists of primary data and secondary data. Primary data obtained from questionnaires, field observations, and interviews with experts. The type of data used in this study is secondary data obtained through library research and reports from various related agencies at the Komodo National Park Center and the West Manggarai Regency Government, while primary data was obtained from filling out questionnaires by conducting direct interviews with key stakeholders, including leaders of agencies, community leaders, local fishermen, tourism investors, and others.

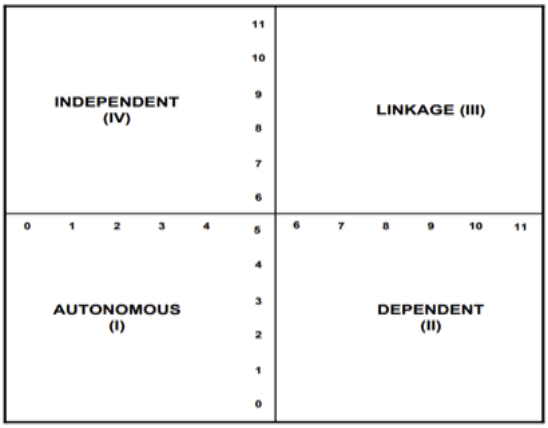

Figure 1 – DP-D Matrix for the key elements of tourism development

Data analysis. The modeling technique developed for strategic planning used in this research is Interpretative Structural Modeling (ISM). The ISM analysis in this study using EXSIMPRO software. According to Eriyatno (1998), ISM is a group learning process in which structural models are generated to capture complex matters of a system, through carefully

designed patterns using graphics and sentences. The ISM technique is one of the systems modeling techniques to deal with the hard-to-change habits of long-term planners who often directly apply operational research techniques and/or descriptive statistical applications. The data obtained are based on interviews with stakeholders in the field, then an analysis is carried out using the ISM which is basically to compile a hierarchy of each sub-element in the element being studied and then make a classification into 4 sectors to determine which sub-elements are included in the variables according to Kholil (2005) and Eriyatno (1998): autonomous (sector 1), dependent (sector 2), linkage (sector 3), and independent (sector 4). Broadly speaking, these four variables can be seen in Figure 1.

RESULTS AND DISCUSSION

To develop coastal tourism and marine tourism on Padar Island and Komodo Island in KNP based on the results of FGDs and in-depth interviews, 20 (twenty) key elements of the need for developing coastal tourism and marine tourism are presented in Table 1. Respondents who attended the FGD on the development of coastal tourism and marine tourism were 27 representatives from related SKPDs, namely the provincial and district governments, heads of related offices/institutions, the Implementing Agency for the Labuan Bajo Flores Authority (BPOLBF), PT. Flobamor, academic/researcher; while in-depth interviews were conducted through direct interviews with 20 tourism actors and local communities at the research location.

Table 1 – Key elements of the need for developing coastal tourism and marine tourism

No	The Key Elements of the Need for Development of Coastal Tourism and Marine Tourism on Padar Island and Komodo Island	Abbreviation
1	Management and control of coastal and marine debris	E1
2	Digitizing coastal tourism visits and marine tourism	E2
3	Policy to suppress immigrants to Komodo Village	E3
4	Excellent service from all elements of tourism actors and individual tourism actors	E4
5	Strengthening governance for coordination forums/stakeholder associations	E5
6	Integrated supervision with relevant stakeholders	E6
7	Improvement of infrastructure for coastal tourism and marine tourism (including waste)	E7
8	The existence of a marine waste processing unit in the KNP area	E8
9	Coral reef and mangrove rehabilitation program to support coastal and marine conservation efforts	E9
10	Creation of task forces and SOPs with stakeholders related to supervision	E10
11	Studies that address issues of integrated and sustainable coastal tourism and marine tourism management	E11
12	Increased socialization and education for tourists	E12
13	Public education related to the conservation of protected waters and marine biota	E13
14	Optimization of space and resources based on carrying capacity and ecosystem services	E14
15	Enforcement of rules/sanctions under applicable legal regulations	E15
16	Business diversification for local communities, especially in Komodo Village	E16
17	Harmonization and synchronization of regulations on the management of coastal tourism and marine tourism	E17
18	The existence of standard operating procedure (SOPs) in the management of KNP by stakeholders under the authority	E18

At this stage, each element of the program being studied is translated into several sub-elements based on the opinion of the respondents. After that, a contextual relationship is established between the sub-elements that contain a direction in subordinate terminology that leads to pairwise comparisons, such as "Is goal A more important than goal B?" respondent's opinion. Based on the consideration of contextual relationships, a Structural Self-Interaction Matrix (SSIM) was compiled.

The understanding of the value of 1 is that there is a contextual relationship between the sub-elements, while the value of 0 is that there is no contextual relationship between the sub-elements. The results of the assessment are arranged in a Structural Self-Interaction Matrix (SSIM). The SSIM is made in the form of a Reachability Matrix (RM) table by replacing

V, A, X, and O into numbers 1 and 0. The SSIM preparation uses the symbols V, A, X, and O, namely:

- V if ea = 1 and eb = 0; means that element A is more influential than element B;
- A if ea = 0 and eb = 1; means that element A is more influential than element B;
- X if ea = 1 and eb = 1; it means that element A is equally influential with element B;
- if ea = 0 and eb = 0; means that element A and element B have no influence.

The key elements of the needs generated in Table 2 are then analyzed for the interrelationships between the sub-elements of the needs for the development of coastal tourism and marine tourism using the ISM-VAXO matrix technique in the Structural Self-Interaction Matrix (SSIM) which can be seen in Figure 2.

SSIM | Reachibility Matrix | Revision Matrix | Final Matrix | Graph | Structure

NO	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
A1		A	X	V	A	A	V	V	X	V	V	A	A	A	V	V	A	A
A2			V	V	A	X	V	V	V	V	V	V	V	V	V	V	X	A
A3				V	A	A	V	V	X	V	V	A	A	A	V	V	A	A
A4					A	A	A	A	A	A	X	A	A	A	A	X	A	A
A5						V	V	V	V	V	V	V	V	V	V	V	V	X
A6							V	V	V	V	V	V	V	V	V	V	X	A
A7								X	A	V	V	A	A	A	V	V	A	A
A8									A	V	V	A	A	A	V	V	A	A
A9										V	V	A	A	A	V	V	A	A
A10											V	A	A	A	X	V	A	A
A11												A	A	A	A	X	A	A
A12													X	X	V	V	A	A
A13														X	V	V	A	A
A14															V	V	A	A
A15																V	A	A
A16																	A	A
A17																		A
A18																		

Figure 2 – Results of the Structural Self-Interaction Matrix (SSIM)

SSIM | Reachibility Matrix | Revision Matrix | Final Matrix | Graph | Structure

NO	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
A1	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	0
A2	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0
A3	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	0
A4	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0
A5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A6	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0
A7	0	0	0	1	0	0	1	1	0	1	1	0	0	0	1	1	0	0
A8	0	0	0	1	0	0	1	1	0	1	1	0	0	0	1	1	0	0
A9	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	0
A10	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0
A11	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0
A12	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0
A13	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0
A14	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0
A15	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0
A16	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0
A17	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0
A18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Figure 3 – Results of Reachability Matrix

The next analysis step is to convert the Reachability Matrix (RM) into a binary number on the sub-element aspect of the requirement. The data comes from the opinion of experts who are competent in their fields, and then they are entered in the SSIM matrix and transformed into binary numbers to form the RM matrix in Figure 3. RM is obtained by converting data from the letters V, A, X, and O to binary numbers (0 and 1). The RM

preparation is done by calculating the respondent's answer mode data. The cell mode is obtained by counting the scoring numbers that appear the most (mode data), which can be seen in Figure 3.

From the results of the RM matrix in Figure 11, it is continued with the step of adjusting the RM elements of the aspect of the needs. Adjust binary numbers to get Rank (R), Driver Power (DP), Level (L), and Dependent (D) values. The DP value is obtained by adding the binary numbers in one line. The R-value is obtained by sorting the DP values. The value of D is obtained by adding the binary numbers in one column. The L value is obtained by sorting the D value. The results of the binary number adjustment process from the expert opinion in RM the relationship between the sub-elements of the economic aspect can be seen in Figure 4.

SSIM | Reachibility Matrix | Revision Matrix | Final Matrix | Graph | Structure

NO	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	DP	R
A1	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	0	10	4
A2	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	16	2
A3	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	0	10	4
A4	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	7
A5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	1
A6	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	16	2
A7	0	0	0	1	0	0	1	1	0	1	1	0	0	0	1	1	0	0	7	5
A8	0	0	0	1	0	0	1	1	0	1	1	0	0	0	1	1	0	0	7	5
A9	1	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	0	10	4
A10	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0	5	6
A11	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	7
A12	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	13	3
A13	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	13	3
A14	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	13	3
A15	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0	5	6
A16	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	7
A17	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	16	2
A18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	1
D	11	5	11	18	2	5	13	13	11	15	18	8	8	8	15	18	5	2		
L	4	6	4	1	7	6	3	3	4	2	1	5	5	5	2	1	6	7		

Figure 4 – Final Result of Driver Power Matrix – Dependence

ISM can provide a clear description of the elements of the problem that have been determined so that it can move the description into more detailed sub-elements. Management strategy classification is divided into 4 (four) quadrants, namely:

1. Quadrant I: The weak driver interaction with the weak dependent variable (autonomic), this quadrant is not related to the system and may have a slight relationship, in the position: Drive Power (DP) value 0.5 X and Dependent (D) value 0.5X, where X is the number of sub-elements.
2. Quadrant II: Weak driver interaction with the strongly dependent variable (dependent), this quadrant is included in the dependent sub-element with the position: DP value 0.5 X and D value > 0.5X.
3. Quadrant III: Strong driver interaction with the strongly dependent variable (linkage), this quadrant belongs to the relationship between unstable sub-elements, entering the position: DP value > 0.5 X and D value > 0.5 X.
4. Quadrant IV: Strong driver interaction with the weak dependent variable (independent), this quadrant is included in the remaining part of the system and the independent variable is in the position: DP value > 0.5 X and D value 0.5 X.

Compile classification diagrams and sub-element structural models by sorting in coordinates from Driver Power and Dependence values into classification drawings. The results shown by the next ISM-VAXO will be classified in the needs aspect sub-element group in Figure 5. The results of the ISM-VAXO show that the position of the sub-elements (E5, E18) as key sub-elements of the need for the development of coastal tourism and marine tourism on Padar Island and Komodo Island is at level 7 (the highest level) based on the largest total DP value. All of the sub-elements of the economic aspect are classified

according to the level of Driver Power (DP) and the level of Dependency (D) entered in 4 quadrants, namely quadrant I (Autonomous), quadrant II (Dependent), quadrant III (Linkage) and quadrant IV (Independent) in Figure 5.

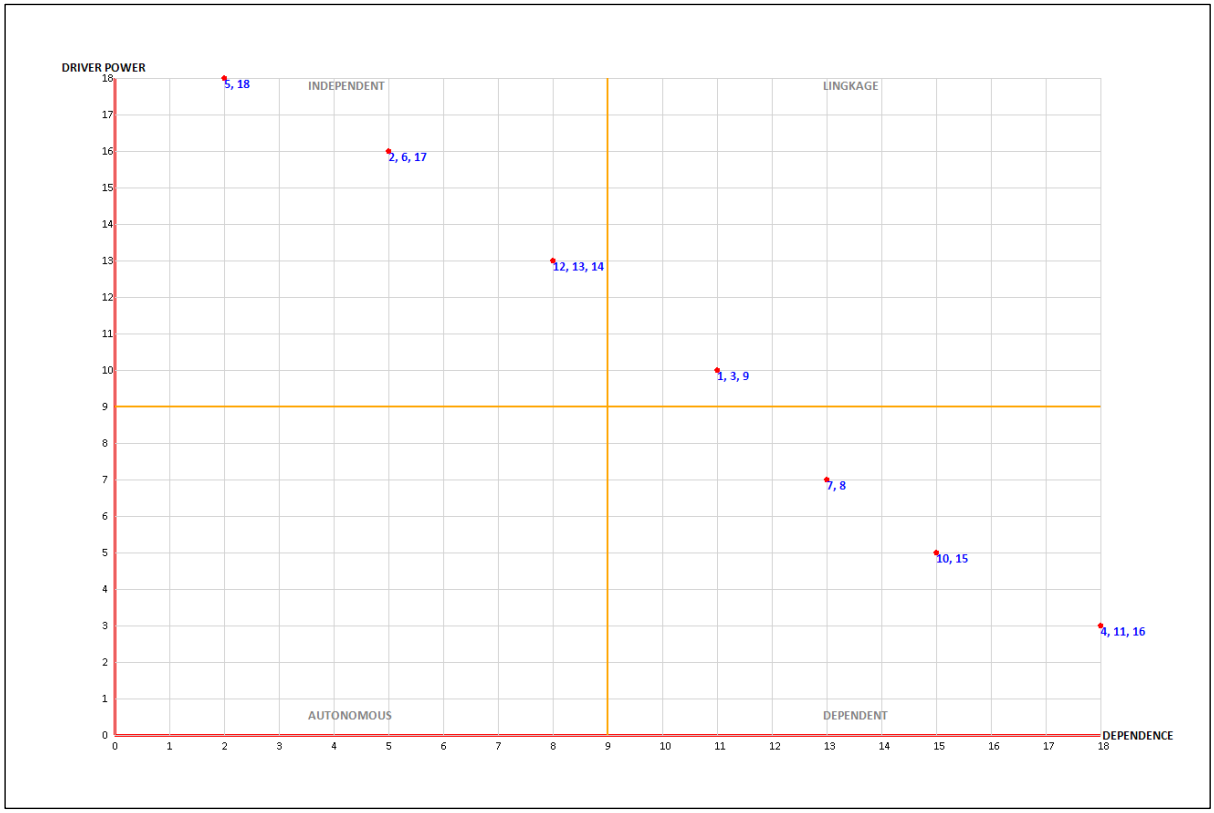

Figure 5 – Quadrant Classification *Driver Power - Dependence*

The classification results in Figure 5 illustrate that there are no sub-elements of economic aspects that are not related to the system (Autonomous quadrant = 0). Sub-elements E1, E3, and E9 are in the Linkage quadrant, so they need to be studied carefully because they have an unstable relationship, but are closely related and have an impact on other variables, especially in the Dependent quadrant variable. The classification also shows that in the Dependent quadrant there are several sub-elements (E7, E8, E10, E15, E4, E11, E16) which are dependent variables that have a dependence on input and corrective actions delivered in the system (Independent quadrant) with independent variables (E5, E18, E2, E6, E17, E12, E13, E14).

The results of the analysis of the power-dependence driver matrix on the elements of the need for the development of coastal tourism and marine tourism on Padar Island and Komodo Island obtained 8 key sub-elements (Figure 5) which are in sector IV (Independent quadrant). In the hierarchical structure, these 8 key sub-elements play an important role in the policy of developing coastal tourism and marine tourism so that policy directions can be taken based on the ranking order from the highest level which is at level 7 to the lowest level, namely level 1. The structure of position structure of the relationship between the sub-elements in the elements of the needs for the development of coastal tourism and marine tourism can be seen in Figure 6. In the first policy sequence which is at level 7, 2 interrelated sub-elements need to be prioritized and in this case, this means that the development of coastal tourism and marine tourism on Padar Island and Komodo Island is very much needed to strengthen governance for coordination forums/stakeholder associations (E5) and the need for SOPs in the management of KNP by stakeholders under the authority (E18).

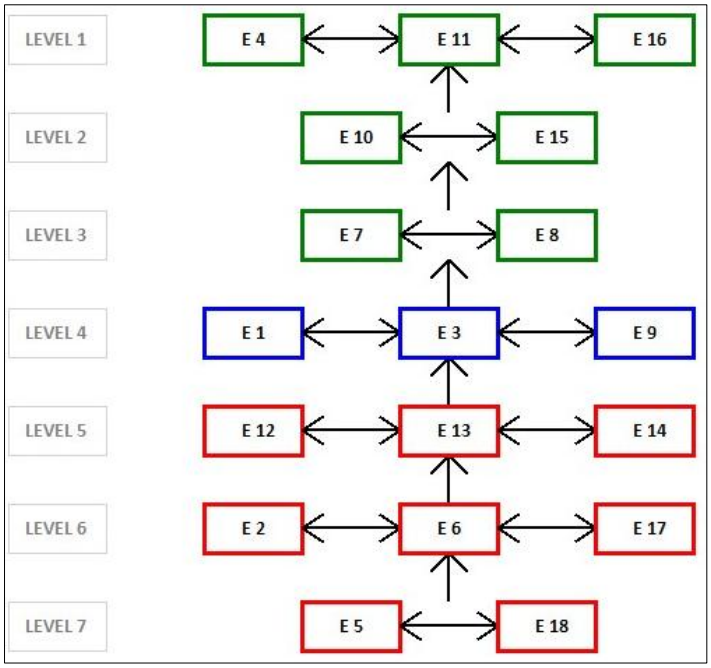

Figure 6 – ISM Hierarchical Structure for Development of Coastal Tourism and Marine Tourism

The success of the 2 (two) key sub-elements at level 7 will encourage the next level, namely level 6 which consists of digitizing coastal tourism visits and marine tourism (E2), integrated supervision with relevant stakeholders (E6), and harmonization and synchronization of tourism management regulations. beach and marine tourism (E17). If the digitization of visits, integrated supervision, and harmonization and synchronization of management regulations has been realized at level 6, it can encourage the fulfillment of tourism development needs at level 5 which has 3 sub-elements consisting of increased socialization and education for tourists (E12), related public education conservation of protected waters and marine biota (E13) and optimization of space and resources based on carrying capacity and ecosystem services (E14).

Behind the fulfillment of the elements of the aspect of the needs at level 5, encouraging the fulfillment of needs at level 4 which consists of 3 sub-elements, namely: management and control of coastal waste and marine debris (E1), policies to suppress migrants to Komodo Village (E3), coral reef rehabilitation programs and mangroves in supporting coastal and marine conservation efforts (E9). Efforts to reduce environmental burdens such as waste and population growth from migrants/immigrants as well as conservation efforts such as rehabilitation and protection of marine species/biota are of particular concern in the development of coastal tourism and marine tourism on Padar Island and Komodo Island.

Level 3 consists of 2 sub-elements namely: improvement of infrastructure for beach tourism and marine tourism (including waste) (E7) and the existence of a marine waste processing unit in KNP (E8). At this level, the target for improving infrastructure and waste management is the focus of the program that will be achieved after the needs at level 4. E10) and enforcement of rules/sanctions under applicable laws (E15).

At level 2, the function of supervising and enforcing rules against violations in coastal and marine tourism areas needs to be improved by following SOPs and/or applicable rules. At level 1, there are 3 sub-elements, namely: excellent service from all elements of tourism actors and individual tourism actors (E4), studies that address issues of integrated and sustainable coastal tourism and marine tourism management (E11), and business diversification for the community, especially in Komodo Village (E16). These three sub-elements are the last requirement to be achieved in the need for the development of integrated and sustainable coastal tourism and marine tourism on Padar Island and Komodo Island, KNP in West Manggarai Regency.

The policy design for developing coastal tourism and marine tourism on Padar Island and Komodo Island in KNP is presented in Figure 6 under the hierarchical structure of policy needs for developing coastal tourism and marine tourism. Some of the resource management efforts of Padar Island and Komodo Island need to be carried out so that the coastal and aquatic ecosystem environments remain balanced as follows:

1. Resource utilization:
   Utilization of resources for the benefit of tourism activities on Padar Island still refers to the rules and main functions of the conservation area. The focus of all activities remains on the preservation and protection of various resources within the area. Padar Island which is in the jungle zone and uses land tourism is given a permit for limited tourism activities adjusted to the carrying capacity of the waters. More than that, it is only intended for conservation and preservation activities. The waters of Padar Island and Komodo Island require special attention to the problem of marine and coastal waste management. It was found that not all waste ends up in the final disposal site in Labuan Bajo, so a community-based waste management policy is needed.
2. Conservation and Preservation:
   Sukana and Gabur (2020) stated that Padar Island is a conservation area, Padar Island certainly has various types of flora and fauna that are conserved and preserved. Since it was opened for tourism activities in the South Padar area or site, some residents from Komodo Village have made their fortune by trading in the South Padar Island area. The interactions that occur are only limited to tourists as buyers and the community as souvenir traders. People from several villages that are included in the National Park area who work as fishermen always carry out illegal activities, such as fishing illegally using various equipment that is prohibited or not allowed. This is certainly very contrary to the implementation of the pillars of conservation, namely the protection and preservation of various types of live fish in the waters of KNP.
3. Empowerment of local communities:
   The involvement of local communities in Komodo Village is a need to support the development of coastal tourism and marine tourism on Padar Island and Komodo Island, for example, involvement through community empowerment in waste management can be a source of creative economic income from waste processing into souvenirs for tourists. In line with the results of the study by Paulus et al (2018, 2019) which states that the sub-elements of actors, especially the community, have a great driving force for the success of development programs in the regions.

The implementation of the policy design for developing coastal tourism and marine tourism on Padar Island and Komodo Island, if carried out in a well-integrated manner, can ensure the sustainability of coastal and marine resources.

CONCLUSION

The policy design for developing coastal tourism and marine tourism on Padar Island and Komodo Island in Komodo National Park consists of 7 policy levels with 18 sub-elements that are hierarchically structured in terms of the needs for developing coastal tourism and marine tourism. The order of policy design follows the pattern of urgency of development needs based on the results of FGDs and in-depth interviews of key respondents both at the level of policy makers to the level of the community as beneficiaries. In the implementation of the policy on developing coastal tourism and marine tourism, it is important to pay attention to the carrying capacity of the area and the carrying capacity of the waters as well as supervision to become the main focus so that the sustainability of the coastal and marine environment remains sustainable by involving local communities.

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