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Research Article

# Exploring the Resources Governance Connectivity of Cultural Ecosystem Services: Evidence in Tanjung Lesung SEZ Tourism, Banten Province, Indonesia

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## Abstract

The existence of the utilization of the Tanjung Lesung Special Economic Zone (SEZ) as connectivity, interaction relationships, and the balance of resource governance influence cultural ecosystem service. This research aimed to map out the social-ecological system components of coastal and marine cultural ecosystem services. The focus is on examining the connectivity network between resource governance (RG) components such as resource actors (RA), resource units (RU), and resource systems (RS). The data obtained were analyzed using the stages of social-ecological network analysis. The results show a significant influence and strong interaction between resource governance (RG) components and other components. The presence of institutional structures and typologies is a crucial component that serves as a guideline for SEZ management influenced by actor centrality through links. Several performance indicators are still lacking based on the interaction conditions, indicating the need for strategies to strengthen governance. However, a particular challenge that needs attention is the implementation of every governance strategy formulation. Cohesion among stakeholders in enhancing resource governance performance with the surrounding community is paramount. Improvement can be achieved through strong collaboration to ensure the sustainability of coastal and marine cultural ecosystem services.

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## 1. Introduction

Coastal and marine areas offer numerous benefits with abundant ecosystem resources and dynamic, complex characteristics that occupy space and involve many interaction processes (Dahuri *et al*., 1996). This ecosystem is known for protecting the coast against waves and storm attacks, as well as supporting the life of various marine organisms (Hidayah, 2015). The interaction process in the development of coastal and marine areas is interconnected between the management system and the system being managed, with various interests involved in obtaining certain benefits (Kooiman, 2008). Generally, the dynamics of utilizing coastal and marine ecosystems benefit humans through ecosystem services obtained to enhance well-being (Costanza *et al*., 1997). Ecosystem services have gained more attention since the Millennium Ecosystem Assessment (MEA) in 2005, which has increased exploration studies of the ecosystem services produced (Burkhard *et al*., 2012; Costanza *et al*., 2014; De La Cruz, 2021). Cultural ecosystem services, which offer nonmaterial benefits such as aesthetic experiences and recreation, are often extensively utilized by humans in coastal and marine environments (MEA, 2005; Gajardo *et al*., 2023).

Failure to establish a proper coastal and marine area governance system can lead to increased ecosystem degradation in the surrounding areas (Kurniawan *et al*., 2016a). Changes in land use and ecosystems due to imbalanced development, economy, population growth, and distribution can also result in various issues such as conflicts in land use (De Leon and Kim, 2017). If not well-anticipated, such conditions can be predicted to occur in the case of special economic zones (SEZs) (Lipták *et al*., 2015; Wu *et al*., 2021), especially in Indonesia. Special economic zones (SEZs) stand out as exceptional components of the global economy with regard to their legal structure, institutional arrangements, and economic functions (Chaisse and Dimitropoulos, 2021). Therefore, the use of coastal and marine ecosystems requires integrated and sustainable governance concepts (Cicin-Sain and Knecht, 1998; Banarsyadhimi *et al*., 2022) to reduce ecosystem degradation that can also trigger social collapse (Espeso-Molinero and Pastor-Alfonso, 2020). The Indonesian government established the SEZ by enacting Law Number 39 of 2009 to accelerate economic growth and regional development. One of the SEZs that utilize coastal and marine areas is the Tanjung Lesung SEZ, which is allocated for cultural services. The current condition of Tanjung Lesung SEZ continues to undergo performance effectiveness improvements due to suboptimal implementation conditions (Dewan Nasional KEK, 2022). The Tanjung Lesung SEZ as a cultural service has the potential for continuous development due to the beauty of its coastal and marine ecosystem. The cultural ecosystem services of coastal and marine areas include attractions such as enjoying the natural beauty with the background of the sea on a sandy beach, water sports, jogging tracks, snorkelling, diving, and fishing (Mulyawati *et al*., 2020). The management and development of Tanjung Lesung SEZ are delegated to the private sector, while the government continues to promote the development of public facilities and accessibility (Kemenko Perekonomian, 2023). The success of developing cultural ecosystem services in coastal and marine areas depends on the planning and effectiveness of stakeholders involved in the governance system (Munawar *et al*., 2021). The concept of sustainable cultural service management involving various parties, especially the local community proportionally, can maintain program consistency (Abidin *et al*., 2022).

The social-ecological system (SES) approach is necessary to facilitate an understanding of the dynamics and complex interactions between systems, with a simple presentation (Berkes *et al*., 2003). Identifying the elements of SES and their relationships can help clarify assumptions or perspectives on the system from various viewpoints (Anderies *et al*., 2004; Biggs *et al*., 2021). The SES approach can reflect an integrated understanding of ecological aspects and socioeconomic values (Cumming, 2011; Hafsaridewi *et al*., 2018). The components of SES have interrelated interactions among the subsystems (Ostrom, 2009; Reyers *et al*., 2018; Biggs *et al*., 2021). Interactions can arise from anthropogenic actions in managing ecosystems and the goods and services produced by ecosystems for human life (Kittinger *et al*., 2012; Levin *et al*., 2013). Interconnectedness between systems can help to identify changes, influences, and interactions of social-ecological components based on situational action conditions (Schlüter *et al*., 2019). In practice, SESs comprise three subsystems: the natural system, the human system, and the management system (Charles, 2001).

The components of SES are essentially linked by various activities based on the typology of a network system (Hu *et al*., 2017). A network perspective involves the connectivity of a system entity that is interlinked, bound together, and forms a structure (Mahon and McConney, 2013). Network knowledge is highly multidisciplinary and can be found in social and natural systems (Barabasi, 2002; Cross and Parker, 2004) in node and ties characteristics (Mullon, 2014;

Luke, 2015). From a different perspective, Mahon *et al*., (2005) state that essential questions arise. First, "who are the nodes?" identifying stakeholders from each interaction relationship is necessary. Second, "how do these interactions relate to actors' characteristics?"understanding how interactions connect with actors needs to be identified first. A network perspective can provide an overview of the interactions between stakeholders or specific groups, roles, opportunities, and risks in implementing a system (Raab and Kenis, 2007).

However, applying the SES approach in research is still quite complex, and its concepts will continue to evolve according to specific case studies. To broaden our understanding, we have improvised by focusing on the interaction and connectivity of resource governance. Resource governance refers to the dynamic changes in the structure, mechanisms, and processes of human-environment interactions (Nayak and Armitage, 2018). Governance interactions encompass policy frameworks, laws, regulations, institutions, and decision-making mechanisms that shape how natural resources, and the environment are managed and utilized by society (Glaser *et al*., 2022). Resource governance also recognizes the importance of coordination and cooperation among various stakeholders, considering human influences and behavior to better balance social and ecological aspects (Badry and Hickey, 2022). This exploration follows the basic procedures in scientific studies using the SES approach.

Therefore, this research aims to understand the complexity of a system by mapping the social-ecological system of the coastal and marine cultural ecosystem services in the Tanjung Lesung Special Economic Zone, Banten Province. The results of the basic SES mapping are then focused on examining the connectivity network of the resource governance (RG) component with the resource actor (RA), resource unit (RU), and resource system (RS) components. Focusing on the RG network aims to understand various interaction phenomena and evaluate the performance of the resource governance system. Furthermore, assessing the connectivity of the RG system can help formulate strategies to strengthen the sustainability of Tanjung Lesung SEZ implementation. The findings of this research are expected to contribute as guidelines for policymakers in making informed and appropriate decisions.

## 2. Materials and Methods

### *2.1 The Research Site and Material*

This research was located in the Tanjung Lesung Special Economic Zone (SEZ), Pandeglang Regency, Banten Province (Figure 1). Located on the west coast of Java Island, this area offers a stunning natural panorama with beautiful coastlines, white sandy beaches, and pristine seawater. Visitors can enjoy various beach activities, such as diving, snorkeling, and other recreational activities. The SEZ is designed as a leading tourist destination with comprehensive facilities, including hotels, villas, restaurants, and water sports. Its accessibility to major cities like Jakarta holds great potential to attract local and international tourists (Dewan Nasional KEK, 2022). Data collection encompasses the entire coastal and marine area with its utilization limited to cultural ecosystem services. The data collection process was carried out from August to December 2022. The research data required were primary and secondary data. The selection of research locations during primary data collection was determined by field observations and interviews with respondents purposively selected based on criteria to understand the development and implementation of Tanjung Lesung SEZ so that the data obtained are more informative according to the research objectives (Puspitawati *et al*., 2022). The interviews with respondents were conducted using the rapid rural appraisal (RRA) method (Chambers, 1994; Sofield and Marafa, 2019). The secondary data were obtained through literature studies and the availability of documents from various supporting sources.

The interviews were conducted with 47 respondents, including representatives from government institutions, the private sector, and the community. Government sector representatives comprised three respondents, including the Administrator SEZ as a National and Regional Council representative in evaluating Tanjung Lesung SEZ's development. The Provincial Tourism and Marine and Fisheries Offices were also interviewed to provide supporting information regarding the use of SEZs as a cultural service. Private sector representatives comprised two respondents, including PT Banten West Java (BWJ) Tourism Development, who have the authority to manage the area. Community sector representatives comprised ten respondents who are employees of Tanjung Lesung SEZ, ten respondents who provide independent tourism services, ten respondents from MSME (Micro, Small, and Medium Enterprises), ten respondents who are fishermen, and two respondents from the Tanjung Jaya Village Pokdarwis (Tourism awareness group). The selection of community respondents was done using a snowball method with referrals from the head of Pokdarwis, who is more knowledgeable about the desired conditions for the study.

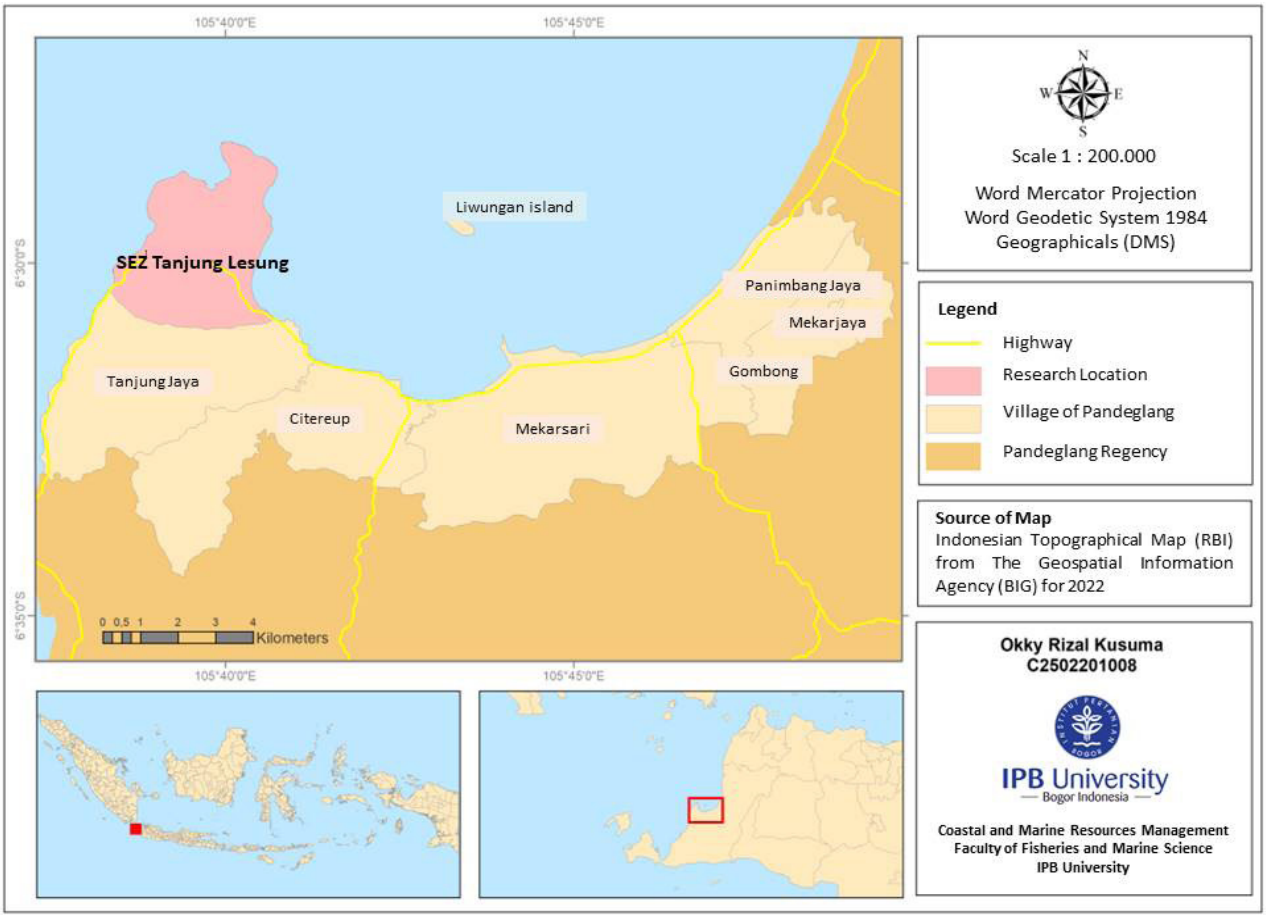


**Figure 1.** Research location

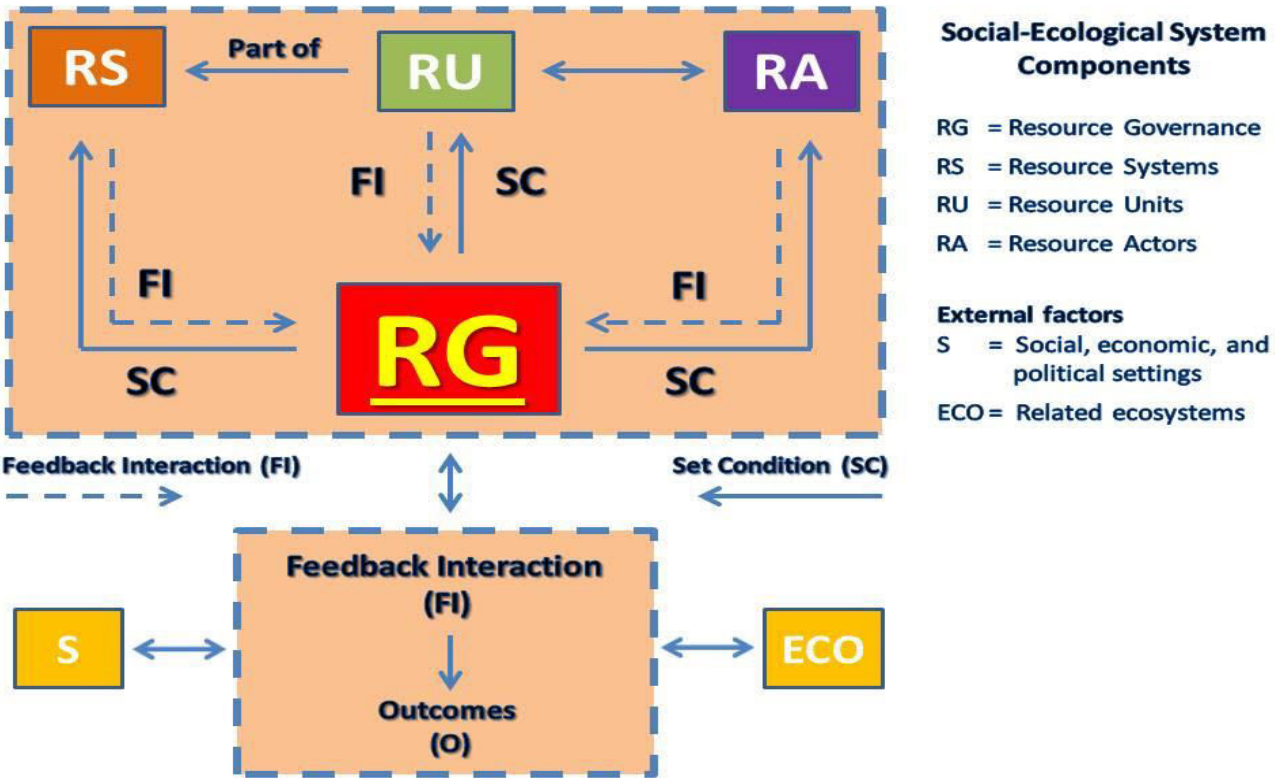


**Figure 2**. Connectivity of resource governance (RG) with other components (Modification of Ostrom, 2009 and Biggs *et al.*, 2021)

### 2.2 Method and Data Analysis

The data analysis components of this research use indicators from the social-ecological system (Ostrom, 2009; Biggs *et al*., 2021). The SES components have interconnected interactions. Successfully mapping the interconnectedness of the resource governance in Tanjung Lesung SEZ can help to represent an ideal model of governance based on the interactions that occur within the system network. The research data is analyzed in five consecutive stages to answer the research objectives. The first stage aims to identify all components of the social-ecological system. The mapping results of these components become the basis for consideration in the second stage, which aims to verify the basic conceptual network formed by the SES components. The verification of the network is presented in two forms, descriptive undirected connections between SES components and directed relationships between resource governance. The undirected network form is only displayed as general information. The conceptual network of connections between resource governance will be used as input for the connectivity analysis in the third stage and governance interaction analysis in the fourth stage. These considerations are based on the perspective that governance networks are dynamic systems of regulation (Sandström *et al*., 2015). The fifth stage involves evaluating the interaction conditions by formulating tactical strategies and strengthening governance.

#### 2.2.1 Identification of social-ecological system components

The identification of the social-ecological system involved mapping all the components of the resource governance (RG), resource actors (RA), resource units (RU), and resource systems (RS) subsystems. This identification process was carried out through interviews and observations, where the subsystem components were grouped or scoped to describe and depict the condition of the social-ecological system in Tanjung Lesung SEZ.

#### 2.2.2 Develop a basic conceptual network model

The basic network concept was developed in two stages using the interview data inventory process (Baird *et al*., 2014). Interviews were conducted to determine whether there is a relationship between component interconnections and respondents, with participants responding "yes", "uncertain", or "no". The first stage was based on observations and interviews to identify the interconnections among components of the social-ecological system. The initial observations and interviews are conducted simultaneously with 47 respondents representing various stakeholders from the government, private sector, and local communities. Observations are conducted as a screening process to select suitable interview respondents. The interviews aim to gain a general perspective in mapping the basic network model. The second stage involved a confirmatory approach where the basic network was presented to key respondents to improve consistency and reduce errors. Key respondents are selected based on their positions and roles in understanding the actual conditions, representing stakeholders from various sectors (Aprian *et al*., 2023). The confirmation stage was carried out with five respondents, including a private sector director, an administrator, a village official, a community leader, and a head of POKDARWIS. The interview questions include, "do these two components have a relationship?", "if yes, what kind of relationship is formed?", "How does each respondent perceive this relationship?", and "what is the condition of this relationship?". The basic network conceptual model was visualized using the DIA tool as input (available from http://live.gnome.org/Dia).

#### 2.2.3 System connectivity analysis

The connectivity of the components in the social-ecological system is assessed to examine the patterns of interdependence within the analyzed governance system using social-ecological network analysis with the help of R-studio (R Core Team, 2021). The analysis was conducted using the script of igraph package (Csárdi and Nepusz, 2006), and it was organized into a folder within the working directory, following the framework of Melbourne-Thomas *et al*., (2012) for community matrix and function matrix in reading the basic network input from the DIA file (available from https://bit.ly/GitHub-SENA). The substance of this analysis is to examine the relationships formed within a relation between subsystem components. The process of identifying components in mapping the social-ecological system has varying levels of importance and complexity, requiring precision to be more suitable (Kluger *et al*., 2015). The attributes of the system's connectivity evaluated include network size in the form of nodes, density in the form of edges, centrality in the form of degree centrality and eigenvector centrality values in the form of hubs and authorities, as well as community detection or clustering (Luke, 2015).

Density refers to the proportion of connections that have either a directed or undirected form and can be calculated using the following formula. Directed, relationship refers to a one-way connection with a

weight or value assigned to it, calculated using the following formula (Luke,2015):

$$DG = \frac{L}{k(k-1)} \quad \text{(Eq 1)}$$

Undirected relationships are connections that lack a definite direction or influence flow. Such relationships are typically binary and do not involve any degree of intensity or weight. This network calculated using the following formula (Luke,2015):

$$UG = \frac{2L}{k(k-1)} \quad \text{(Eq 2)}$$

where, DG represents the matrix of directed graph, UG represents the matrix of undirected graph, L represents the number of observed relationships in the network, and k(k-1) represents the maximum number of possible connections between actors in the network.

Centrality refers to the value of the central connection in a network that can be both structural and functional in nature. Degree centrality, a measure of the number of connections that a node has in a network, was calculated using the following formula (Luke,2015):

$$CD(ni) = d(ni) \quad \text{(Eq 3)}$$

where, CD(n*i*) represents the value of degree centrality, and d(n*i*) represents the distance of the node connection.

Hub value is a measure that quantifies the number of links from a node to other nodes in the network. Nodes with high hub centrality are considered to be significant sources of information (Newman, 2010). This centrality metric emphasizes outgoing links from a node, calculated using the following formula (Luke,2015):

$$AA^T y = \lambda y \quad \text{(Eq 4)}$$

Authorities value is a measure that quantifies the number of links from other nodes to a specific node in the network. Nodes with high authority centrality are considered beneficiaries, indicating their importance in receiving information or influence from other nodes (Newman, 2010). This centrality metric focuses on incoming links to a node, calculated using the following formula (Luke,2015):

$$A^T A x = \lambda x \quad \text{(Eq 5)}$$

where, A refers to the adjacency matrix, $A^T$ represents the transpose matrix, $\lambda$ represents the largest eigenvalue, Y represents the eigenvector of hubs, and X represents the eigenvector of authorities.

Community detection or clustering is the process of grouping nodes based on their proximity, structural similarity, patterns, and characteristics, using the following formula (Luke,2015):

$$CC(ni) = \frac{N-1}{\Sigma\, d(ni,nj)} \quad \text{(Eq 6)}$$

where, CC(n*i*) refers to the closeness centrality value (cluster), N refers to the number of nodes in the network, and d(n*i*, n*j*) represents the distance between node n*i* and n*j* in the network.

*2.2.4 Governance interaction analysis*

The governance interaction is analyzed descriptively and qualitatively by examining the patterns of interaction and conditions of the resource governance (RG) component towards the resource actors (RA), resource units (RU), and resource systems (RS) components (Figure 2). The evaluation of the conditions of the RG component's interactions is interpreted in the form of performance, which can be categorized as good, general, or poor.

*2.2.5 Tactical strategy and strengthening of governance*

The formulation of tactical strategies is carried out descriptively with the aim of strengthening the governance of the Tanjung Lesung SEZ. These strategies are formulated based on the results of social-ecological system mapping and the conditions of the interaction process that occur within resource governance.

## 3. Results and Discussion

### *3.1 Social-Ecological System Components*

The research findings on identifying the components of the social-ecological systems (SES) (Ostrom, 2009; Biggs *et al*., 2021) of cultural coastal and marine ecosystem services in the Tanjung Lesung Special Economic Zone (SEZ) are presented in this study (Table 1). The results are supplemented with components from external factors, such as socioeconomic and political settings (S) and related ecosystems (ECO). In addition, the overall outcome (O) is obtained based on the conditions of feedback interactions (FI) (Table 2).

Coastal and marine areas are sources of the community's economy through various direct utilization. (Yudhistira *et al*., 2021). This direct utilization considers

**Table 1.** Components of the social-ecological system for the governance of cultural ecosystem services in Tanjung Lesung SEZ, Banten Province, Indonesia

| Social-Ecological System Components | Result Indicators | |
|---|---|---|
| | Symbol | Description |
| Resource systems (RS) | RS1 | Utilization of resources as cultural services |
| | RS2 | Ecosystem area |
| | RS3 | Resource threats |
| | RS3.1 | Destructive activity |
| | RS3.2 | Various waste |
| | RS3.3 | Natural disasters |
| Resource units (RU) | RU1 | Ecosystem type (e.g., beach, coral, seagrass) |
| | RU2 | Diversity of fish resources |
| | RU3 | Economic valuation value of resources |
| | RU3.1 | Resource investment |
| | RA3.2 | Value of tourist number |
| Resource actors (RA) | RA1 | Private sector |
| | RA2 | Investors |
| | RA3 | Government agencies |
| | RA4 | Tourism awareness group (Pokdarwis) |
| | RA5 | SEZ employees |
| | RA6 | Community independent of cultural services |
| | RA7 | Micro small and medium enterprises (MSME) |
| | RA8 | Fisherman |
| Resource governance (RG) | RG1 | Institutional structure and typology (e.g., SEZ management) |
| | RG2 | Policy Document |
| | RG3 | Cultural service activities |
| | RG4 | Facility construction |
| | RG5 | Support program |
| External factors comprise socio-economic and political settings (S) and related ecosystem (ECO) | S1 | Population growth |
| | S2 | Local government revenue |
| | S3 | Political stability and regional policies |
| | ECO1 | Climate change and seasons |
| Action-Situation comprise feedback interaction and outcomes (O) | O1 | Community income |
| | O2 | Public welfare |
| | O3 | Labor absorption and productivity |
| | O4 | Ecosystem quality |

Source: Research data analysis results

the potential of available resources in the form of cultural services. There is a relationship between community utilization of cultural services as an economic sector for the community, utilizing and enjoying natural resources (Pueyo-Ros, 2018). In the context of resource utilization in Tanjung Lesung SEZ, it holds great promise for the community's economy through cultural services. The utilization of cultural services in the Tanjung Lesung SEZ is a great hope for the local economy. This is seen from the various job statuses of the resource actors (RA) in the surrounding community who depend on the existence of SEZ (RS1) with various potential resources available (RU1, RU2). PT Banten West Java (BWJ) Tourism Development Corporation, as the area manager (RA1), is authorized by government agencies (RA3) through decision-making regulations (RG2) to carry out and operationalize the Tanjung Lesung SEZ. The optimization of each community role (RA6, RA7, RA8) in various sectors of SEZ management (RA1, RA3) in their daily lives is bridged or facilitated by Pokdarwis management (RA4) with the aim of being more collaborative (Pujiyono *et al*., 2019). In addition, the presence of investors (RA2) also greatly supports area development by managers, which will have an impact on the number of job opportunities as employees (RA5) that can be taken from the local community.

The presence of various resource actors (RAs) in utilizing coastal and marine ecosystems as cultural services potentially pose various threats (RS3) that arise from human activities as well as natural factors. Human threats arise from exploitative activities that damage the ecosystem (RS3.1) as well as the disposal of waste from cultural service activities and daily waste, and environmentally unfriendly development (RS3.2). Another threat is natural disasters such as the 2018 tsunami, which not only caused damage but also impacted the community's social and psychological conditions (Mulyawati *et al*., 2019). These threats will greatly affect the ecosystem resilience level (RS2) (Kurniawan *et al*., 2016b) for the sustainability of cultural service utilization.

Resource governance (RG) serves as a regulating system that balances the utilization of resources by social systems or actors with the available resource conditions (Adrianto *et al*., 2021). The structure and typology of institutional governance (RG1) within the governance system were important in measuring the system's performance through clear mechanism procedures (Gao *et al*., 2022). The mechanisms for implementing the governance of the Tanjung Lesung SEZ are broadly outlined in regulatory documents (RG2), including Presidential Regulation number 26 of 2012 regarding the initial designation of SEZ, Law number 11 of 2020 concerning Job Creation and the SEZ section, as well as further elaborated in Presidential Regulations number 40 and 42 of 2021 concerning national strategic projects and ease of doing business. Various cultural service activities (RG3) and attractive promotions as a brand will affect the tourist appeal to visit (RU3.2), thus increasing economic value (RU3) and other interests, particularly in investment (RU3.1). Facility development (RG4) is conducted to support the development activities of the Tanjung Lesung SEZ as a cultural service. The achievement of development is also continuously driven by supporting programs (RG5), such as buffer zones around the area, capacity building among stakeholders and the community, and various other programs.

Every element in the resource governance of Tanjung Lesung SEZ, which is included in the SES component, has a system linkage that interacts with each other. The interaction of the resource governance components takes the form of feedback interaction (Table 2), resulting in an outcome (O) that includes increased income and welfare, absorption and productivity of the workforce, and the preservation of ecosystem quality. Moreover, the interaction of the components can also be influenced by external factors' uncertainty, which can alter the conditions of each interaction between elements (Hanifah *et al*., 2022). External factors' uncertainty that can affect the success of the Tanjung Lesung SEZ development governance system includes the growth of the local and migrant population (S1), regional economic development targets (S2), and political stability and regional policies (S3). Climate and seasonal changes (ECO1) can also impact various cultural ecosystem activities carried out in coastal and marine areas in unpredictable ways (de Andrés *et al*., 2018). The dynamics of the overall interaction of the components can influence the SES status (Kurniawan *et al*., 2019) of cultural ecosystem services in the coastal and marine areas of the Tanjung Lesung SEZ. Based on these dynamics, various resource actors (RAs) strive to adapt to the existing conditions and situations to maintain the Tanjung Lesung SEZ's development.

### *3.2 Basic Network Model*

#### *3.2.1 Undirected network model*

Efforts to utilize cultural coastal and marine ecosystem services require a comprehensive understanding that represents the complexity of the interrelationships between social-ecological systems as nodes and links in each component (Felipe-Lucia *et al*., 2022). A mapping network of all social-ecological

**Table 2.** Results of connectivity Feedback Interaction (FI) between RG and RA, RU, and RS

| From | To | Feedback Interaction (FI) | Type of FI | Performance |
|---|---|---|---|---|
| RG1 | RA1 | 1. Institutional performance and patterns of behavior | ↘ | ☺☺ |
| | RA2 | 2. Patterns of collaboration and investment | ↘ | ☺☺ |
| | RA3 | 3. Stakeholder efficiency dynamics | → | ☹☹ |
| | RA4 | 4. Patterns of engagement and collaboration in activities | ↘ | 😂😂 |
| | RA5 | 5. Job vacancy recruitment | ↘ | ☹☹ |
| | RA6 | 6. Initiatives to involve the community in tourism services | ↘ | ☹☹ |
| | RA7 | 7. Initiatives to involve UMKM communities | ↘ | ☺☺ |
| | RA8 | 8. Initiatives to involve fishing communities | ↘ | ☹☹ |
| RG2 | RA1 | 9. As a guideline for area management | ↘ | 😂😂 |
| | RA2 | 10. Implementation pattern in investment activities | ↘ | 😂😂 |
| | RA3 | 11. Developing policy documents | ↘ | 😂😂 |
| RG3 | RA1 | 12. Promotion of improving flagship products | → | ☹☹ |
| | RA4 | 13. Assisting in promoting products | → | 😂😂 |
| | RA5 | 14. Serving and guiding cultural service activities | → | ☺☺ |
| | RA6 | 15. Open trips in independent cultural service and guiding | → | ☺☺ |
| | RA8 | 16. Accepting sideline activities such as fishing services as guides | → | ☹☹ |
| RG4 | RA1 | 17. Maintenance intensity of infrastructure | → | ☺☺ |
| | RA2 | 18. Level of development of resorts and supporting facilities | → | ☺☺ |
| | RA3 | 19. Level of development of roads, revetments, and other public facilities | → | 😂😂 |
| RG5 | RA1 | 20. Buffer zone development | → | 😂😂 |
| | | 21. General activities or events such as festivals | → | ☺☺ |
| | | 22. Coral transplantation activities | → | ☺☺ |
| | RA3 | 23. General activities or events such as festivals | → | ☺☺ |
| | | 24. Environmental condition monitoring | → | ☹☹ |
| | RA4 | 25. Assistance in buffer zone development | → | 😂😂 |
| | | 26. Capacity building of Pokdarwis management | ↘ | ☺☺ |
| | RA5 | 27. Capacity building of employees | ↘ | ☺☺ |
| | RA6 | 28. Capacity building of community independent of tourism services | ↘ | ☹☹ |
| | RA7 | 29. Capacity building of UMKM community | ↘ | ☺☺ |
| RG1 | RU3 | 30. Efficient utilization of natural resources value | ↘ | ☹☹ |
| | RU3.1 | 31. Patterns and ease of resource investment | ↘ | 😂😂 |
| | RU3.2 | 32. Target value of the number of visitors | ↘ | ☹☹ |
| RG3 | RU1 | 33. Promotion of improved flagship products from the ecosystem as cultural services | → | ☹☹ |
| | RU2 | 34. Promotion of improved flagship products from fishery resources as cultural services | → | ☹☹ |
| | | 35. Alternative livelihoods as fishing services | → | ☹☹ |
| | RU3 | 36. Efficient utilization of natural resources value | ↘ | ☹☹ |
| | RU3.2 | 37. Target value of the total number of visitors | ↘ | ☹☹ |
| RG4 | RU3.2 | 38. The level of service or hospitality | ↘ | ☺☺ |
| RG5 | RU1 | 39. Coral transplantation activities | ↘ | ☺☺ |
| | | 40. Environmental condition observation activities | ↘ | ☹☹ |
| RG1 | RS1 | 41. Level of ecosystem utilization | ↘ | ☺☺ |
| | RS2 | 42. Implementation of ecosystem utilization limits | ↘ | ☺☺ |
| RG3 | RS3.2 | 43. Potentially posing a threat of waste pollution | ↘ | ☺☺ |
| | RS3.3 | 44. Frequency of security level | → | ☺☺ |
| RG4 | RS3 | 45. Potentially causing environmental damage | ↘ | ☺☺ |
| RG5 | RS3.1 | 46. Education on the impact of destructive activities towards natural resources | ↘ | ☺☺ |

Source: Research data analysis results, Note: ↘: Hubs or outgoing links (direction of outgoing interaction), →: Authorities or incoming links (direction of incoming interaction), ☹☹: Condition of interaction performance is poor, ☺☺: Condition of interaction performance is general, 😂😂: Condition of interaction performance is good

system components of cultural coastal and marine ecosystem services is generated in this study (Figure 3). Resource governance components are labeled as InStcTyp (Institutional structure and typology), Policy (Policy document), CulServAct (Cultural service activities), FaConst (Facility construction), SuPro (Support program), and SEZ (Special Economic Zone). Resource systems are labeled as UtiCulServ (Utilization of resources as cultural services), EcoArea (Ecosystem area), ResThreat (Resource threat), DesAct (Destructive activity), Waste (Various waste), and NatDis (Natural disasters). Resource units are labeled as EcoTyp (Ecosystem type), DivFish (Diversity of fish resources), ValEcm (Economic valuation value of resources), InvsRes (Resource investment), and VaTourist (Value of tourist number). Resource actors are labeled as PriSec (Private sector), Invstor (Investors), GovAg (Government agencies), ToAwGr (Tourism awareness group), Employs (Employee), ComIndServ (Community independent of cultural services), MSME (micro, small, and medium enterprises), and Fisher (Fisherman). Furthermore, external factors are labeled as PolStabil (Political stability and regional policies), LocGovRev (Local government revenue), PopGrow (Population growth), and CliChang (Climate change and seasons). The network displayed is an undirected type that signifies a relational network of all nodes. The results indicate that the strongest and most numerous relational networks are found in nodes associated with the private sector and the utilization of ecosystems as cultural services.

### *3.2.2 Directed network model*

The connectivity of resource governance (RG) for cultural ecosystem services in Tanjung Lesung SEZ has a strong directed network, as evidenced by the presence of links in the basic model (Figure 4). The network has undergone a confirmation process for mapping the resource governance connectivity (Table 2). Confirmation ensures that the initial stage identification can be assessed with certainty, without any doubt in accordance with the network's conditions. The basic network model of the overall governance system consists of 24 components (nodes) and 46 interactions (links). The incoming and outgoing links from the RG components to other components are all increasing, except for RG5 to RS3.1, which is decreasing. This means that the presence of supporting programs (RG5) is expected to reduce destructive activity (RS3.1) through the interactions that occur within them (Table 2). Resource actors (RAs) influence the RG components most, making them the control subject (Salgueiro-Otero and Ojea, 2020) in managing cultural ecosystem services in the Tanjung Lesung SEZ. Additionally, resource units and systems (RU, RS) are considered object units managed by RA through the RG components. All components formed in the nodes are centralized through links to RG as a management system.

## *3.3 Value of Network System*

### *3.3.1 Degree centrality*

The value of the network produced in the form of centrality is based on the governance system. The centrality of resource governance (RG) produces values in the form of degrees (Figure 5). The analysis of the degree values of the governance system based on the centrality of RG shows that RG1, which is the node of institutional structure and typology, has the highest degree value of 12. The second highest degree value is held by RG3, which is the node of the variety of cultural ecosystem services activities, with 11 degrees. These two nodes are important components in which at least one or two main nodes exist in a network (Munawar *et al*., 2020). The presence of institutional structure and typology is an important component in regulating polarization and governance mechanisms, while the variety of cultural ecosystem services activities is an icon that should be the brand in every attraction and promotion carried out to increase the value of resources. Furthermore, supported by the presence of supporting programs (RG5) (8 degrees) in strengthening the sustainability program of cultural ecosystem services in the Tanjung Lesung SEZ.

### *3.3.2 Value of hubs and authorities*

The results of the relationship between nodes based on the direction of centrality towards resource governance (RG) are presented in the size of the node value formed from each component type (Figure 6). The RG1 node, as a structure and institutional typology, has more outgoing links based on the results of hub centrality. The value of the RG1 hub size indicates that the node is crucial in influencing the other components it connects. On the other hand, the centrality of authorities has a significant number of incoming links towards RG, particularly to RA, RU3, RU3.1, RU3.2, and RS1. Based on their authority level, components play a role as suppliers or providers of resource governance (RG).

### *3.3.3 Community detection*

The analysis of resource governance is further presented in the form of clusters, which indicate the presence of 4 network groups (Figure 7). The resulting cluster shows four groups due to the similarity in field conditions where key stakeholders manage and develop

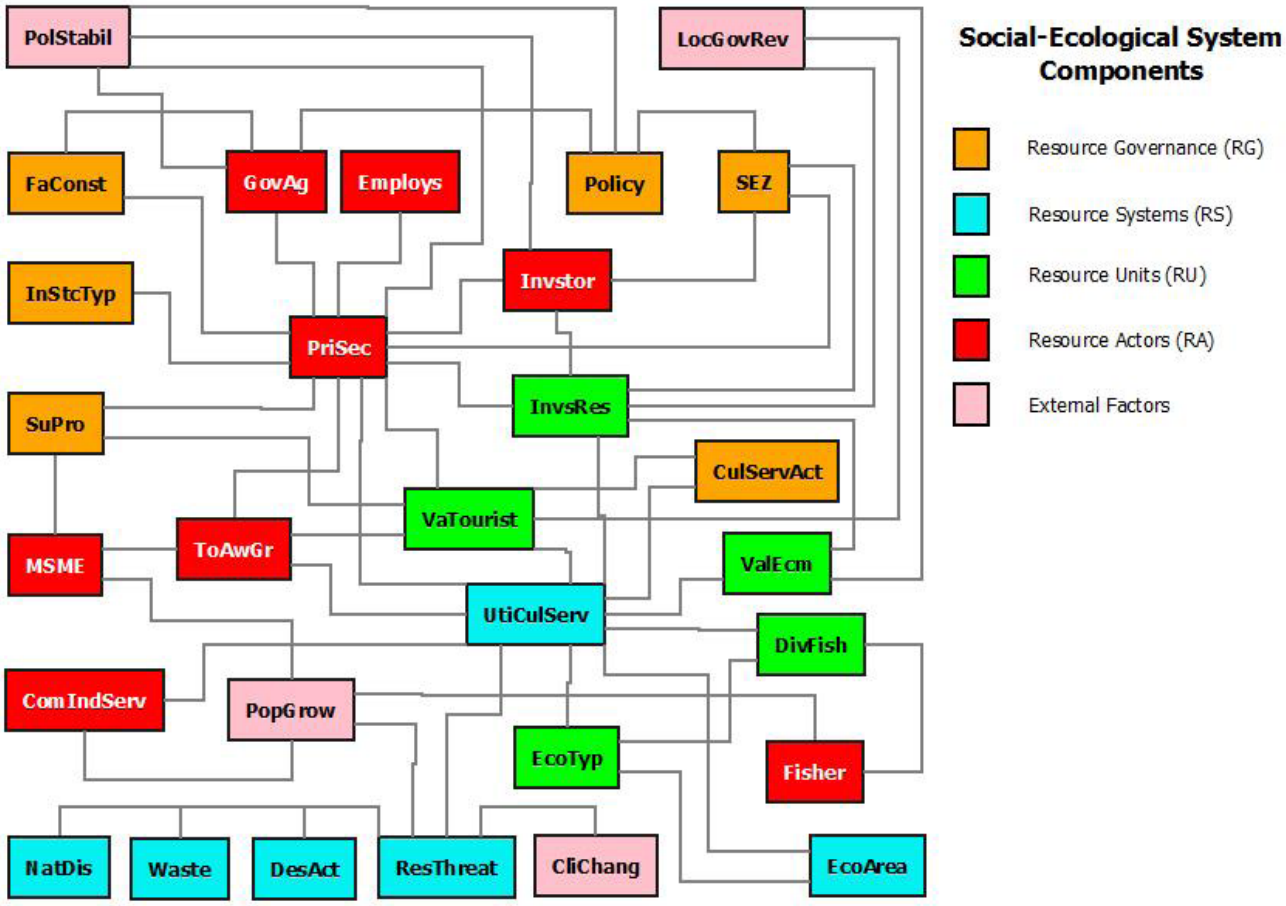


**Figure 3**. Undirected network basic model of social-ecological system component relations

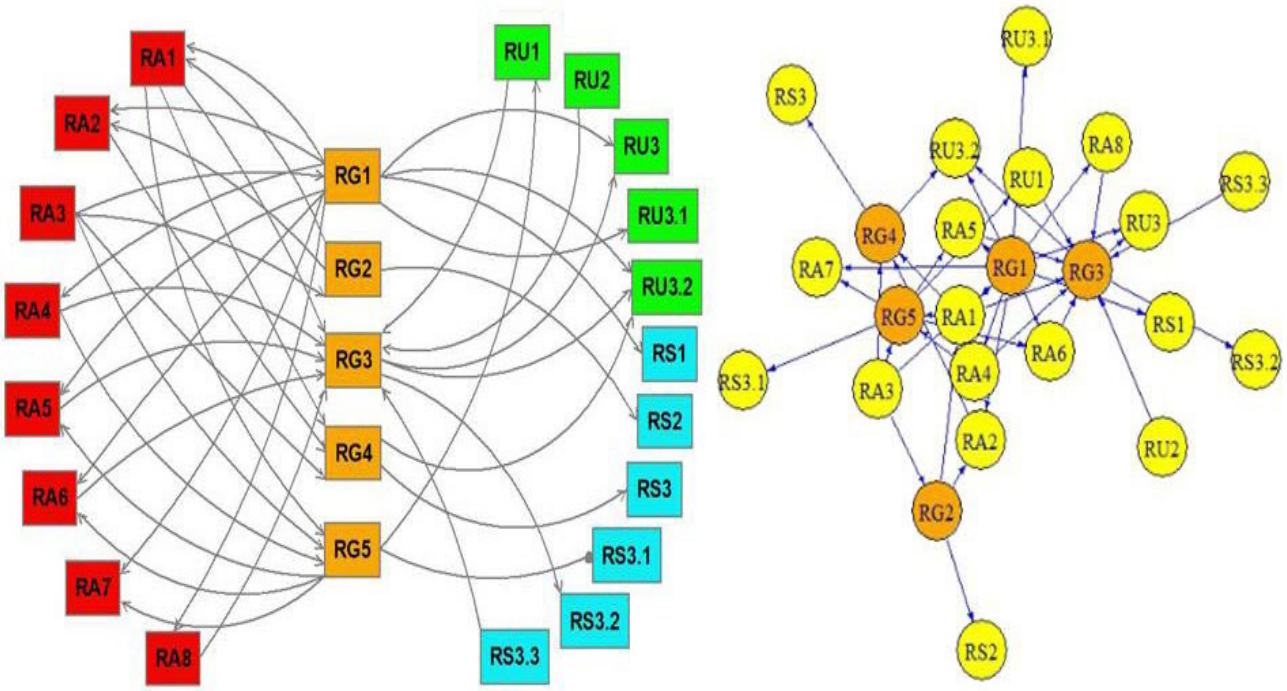


**Figure 4**. Directed network resource governance (RG): RG1-RG5 connectivity

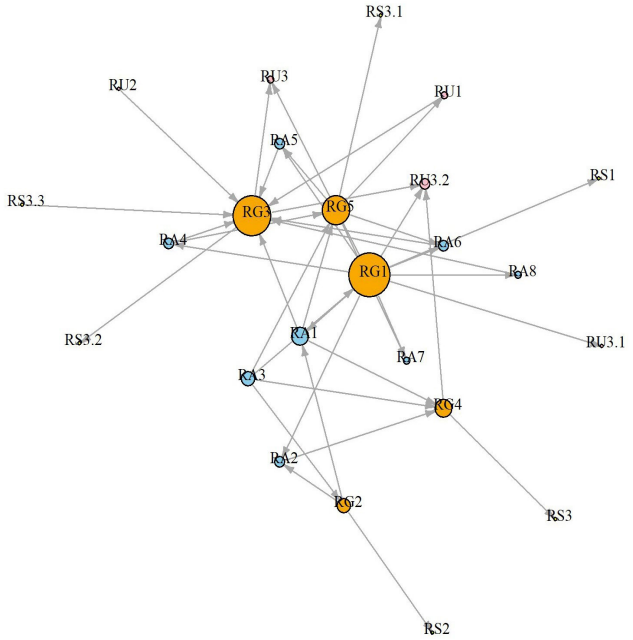


**Figure 5**. Node size based on the degree value of resource governance (RG) : RG1-RG5 connectivity

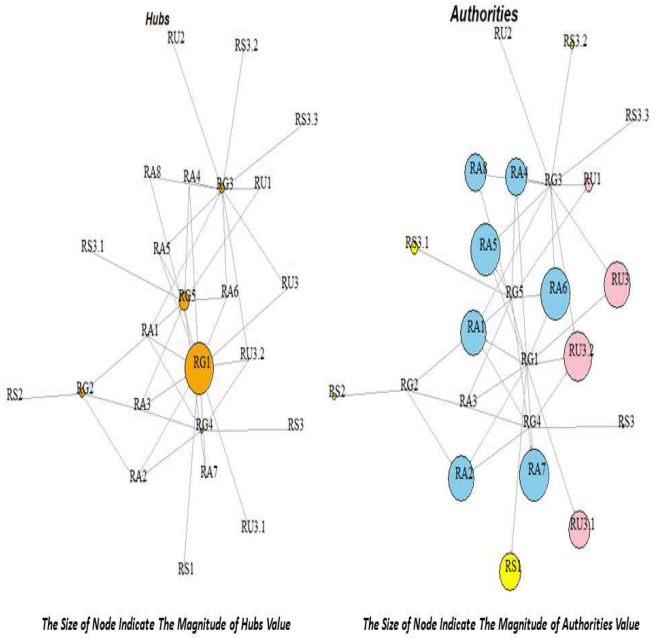


**Figure 6.** Node size based on the type of FI on resource governance (RG) : RG1-RG5 connectivity

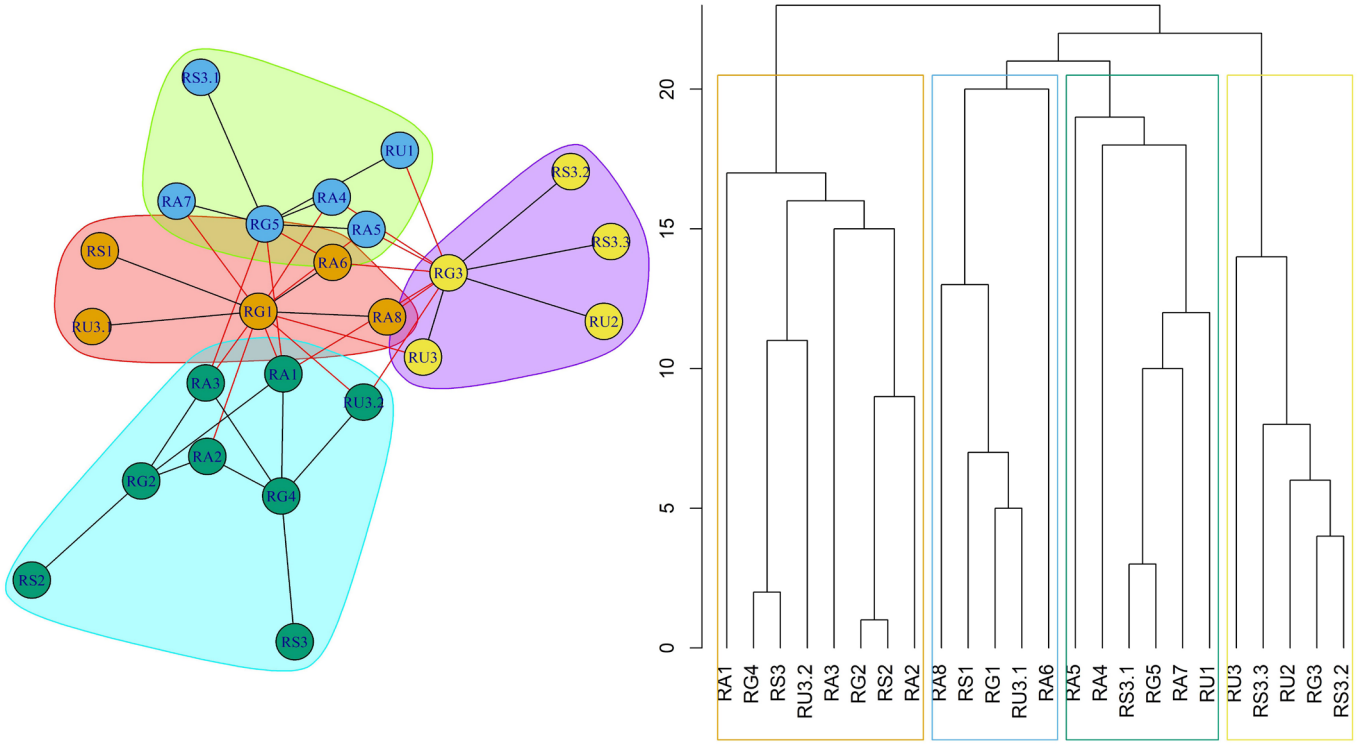


**Figure 7.** Clusterization based on the connectivity of resource governance (RG) : RG1-RG5 connectivity

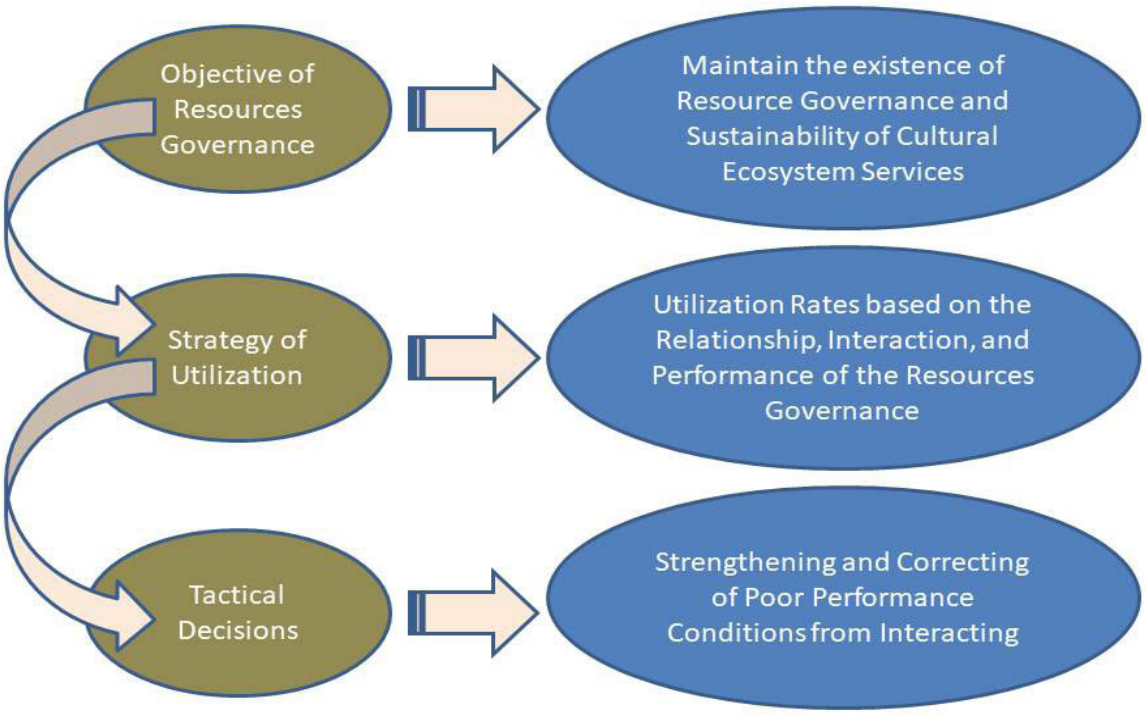


**Figure 8.** Hierarchical process of formulating a tactical strategy for strengthening resource governance

Tanjung Lesung SEZ. The development is regulated through institutional rules based on the community's acceptance of utilizing resources. The success of the development also depends on the availability of action plan programs. There are challenges to ensuring sustainable development, namely the presence of threats and negative impacts of activities that can damage resources. Continuous efforts are being made by actively involving and educating the community to oversee sustainable development in Tanjung Lesung SEZ (Mulyawati *et al*., 2023).

The clustering of components was performed using the walktrap algorithm based on the similarity of structure, patterns, and characteristics of relationships that often appear together (Munawar *et al*., 2020). The first group consists of RG2, RG4, RA1, RA2, RA3, RS2, RS3, and RU3.2, which are stakeholders involved in the development of the SEZ. The second group consists of RG1, RA6, RA8, RS1, and RU3.1, which are institutional structures, tourism and fishing communities that utilize resource units as cultural services. The third group consists of RG5, RA4, RA5, RA7, RU1, and RS3.1, which are action plans from various available programs. The fourth group consists of RG3, RU2, RU3, RS3.2, and RS3.3, which are challenges and impacts of cultural service activities. Clustering based on the relationships of RG components resulted in a modularity value of 0.29, indicating that the clusters were generally ideal. The modularity level ranges from -1 to 1, and this result falls within the positive range, indicating that the clustering result is considered quite good (Nawaz, 2019).

### *3.4 Governance Network Interactions*

The interconnectivity of coastal and marine cultural ecosystem resource governance can be assessed through feedback interactions (FIs), with 46 FIs identified, encompassing various types of relationships and performance. The performance of these interactions reveals that 16 are in poor condition, 21 are in general condition, and 9 are in good condition (Table 2). The performance of these interactions significantly impacts the sustainability of the governance system, and if left unattended, it may result in the collapse of the entire system or individual components (Lestari *et al*., 2023). The performance condition that urgently requires improvement is evident in all RG with RU interactions. Resource units are still not maximized to become flagships brand in utilizing cultural services. Another aspect that needs improvement is the RG1 with RA interaction with the local community. The recruitment of job vacancies and the initiative to involve the community independently is still considered unstable, particularly among tourism and fishing communities. This network interaction is partly due to the relatively inefficient and constantly changing stakeholders in

**Table 3.** A tactical strategy for strengthening the resource governance for cultural ecosystem services

| Connectivity | Components | | Interaction performance | Strengthening Strategy |
|---|---|---|---|---|
| | from | to | | |
| Resource Governance (RG) to Resource Actors (RA) | 1. Institutional structure and typology | 1. Government agencies<br>2. SEZ employees<br>3. Community Independent of cultural services<br>4. Fisherman | Poor | 1. the consistency and efficiency of government stakeholders by avoiding frequent actor turnovers<br>2. The increase in collaboration intensity among stakeholder actors and community actors |
| | 2. Cultural service activities | 1. Private sector<br>2. Fisherman | Poor | 1. The enhancement of awareness among the managers regarding the significance of resource potential as a flagship product<br>2. The increase in fishermen's activities as independent fishing tourism or guiding services |
| | 3. Support program | 1. Government agencies<br>2. Community Independent of cultural services | Poor | 1. Enhancement of environmental monitoring programs<br>2. Strengthening community capacity and knowledge in utilizing resources |
| Resource Governance (RG) to Resource Unit (RU) | 1. Institutional structure and typology | 1. Economic valuation value of resources<br>2. Value of tourist number | Poor | 1. Promotion and attraction activities need to be increased to utilize resource units as flagship product brands |
| | 2. Cultural service activities | 1. Ecosystem type<br>2. Diversity of fish resources<br>3. Economic valuation value of resources<br>4. Value of tourist number | Poor | 1. Zoning of resource utilization areas is further maximized to enhance resource valuation<br>2. Increased intensity of periodic monitoring or observation of resource conditions |
| Resource Governance (RG) to Resource Systems (RS) | 1. Institutional structure and typology | 1. Utilization of resources as cultural services<br>2. Ecosystem area | General | 1. Sustaining the condition of resource units as cultural service products |
| | 2. Cultural service activities | 1. Resource threats<br>2. Destructive activity | General | 2. Early mitigation and heightened vigilance against resource degradation due to human factors through socialization programs |
| | 3. Facility construction | 1. Various waste | General | 3. Early mitigation and heightened vigilance against resource degradation due to human factors through socialization programs |
| | 4. Support program | 1. Natural disasters | General | 4. Early mitigation and heightened vigilance against resource degradation due to natural factors through observation stations |

Source: Research data analysis results

government agencies. Improving the performance condition of these interactions can be prioritized based on the direction of their relationships (Figure 6), making it easier to determine the priority scale.

### *3.5 Tactical Strategy for Strengthening Governance*

Tactical strategies are used to formulate the strengthening of resource governance depicted based on the hierarchy process (Gavaris, 2009). The hierarchy process is transformed into goals, utilization levels, and tactical steps (Figure 8). The strengthening strategy is based on the weaknesses found in the performance of the interactions that were assessed to be in very poor condition and need strengthening. Tactical steps for utilizing the cultural ecosystem services of coastal and marine areas in the Tanjung Lesung Special Economic Zone (Table 3) can be taken by creating good collaboration. Collaboration involves resource governance (RG) and resource actors (RA) in utilizing the available resource units and systems (RU, RS). The appropriate collaboration to be implemented in Tanjung Lesung SEZ is a top-down approach, where direct management is carried out by private stakeholders and the government with community involvement. This is in accordance with regulations that stipulate the development is entrusted to the private sector. The government will monitor and evaluate the development periodically. Similar studies also mention that centralized development is quite effective in addressing various gaps in social networks (Sandström *et al*., 2015). The effectiveness of governance implementation will always collide with the implementation of social and ecological systems (Man *et al*., 2023), thus balancing both through collaboration becomes an efficient approach.

The complexity of the social-ecological system in Tanjung Lesung SEZ reflects the dynamic nature of its development. The established connectivity exhibits a relatively dense network, as evidenced by the relational links among components of the social-ecological system and the interactions within the governance system in Tanjung Lesung SEZ. Network density can support measuring the intensity of relationships among social systems descriptively (Henry and Vollan, 2014). The perspective of the resource governance network both necessitates the integration of diverse stakeholder roles and offers a framework for sustainable development recommendations. Considered development can be achieved through merging the management programs of Tanjung Lesung SEZ by involving the local community.

## 4. Conclusion

Resource governance (RG) elements play a significant role in the sustainability of ecosystem cultural services utilization in the Tanjung Lesung Special Economic Zone (SEZ). There are various conditions of interactions and strong influences between resource governance (RG) and resource actors (RA), RU and RS. The analysis method used to assess the connectivity of the governance system is a determining factor in the success of Tanjung Lesung SEZ development, measured based on the social-ecological system's conditions in the coastal and marine areas. Both government and management stakeholders need to consider the balance between the social and ecological systems as cultural ecosystem services. Unbalanced utilization can cause the collapse of one or even all systems. Collaboration among various parties involved, particularly multistakeholder government and management with the local community, is necessary to achieve a balance. The right policy in formulating development strategies is also necessary to prevent errors and injustice in the area's utilization, which could lead to conflict within the local community.

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## Authors' Contributions

All authors have contributed to the final manuscript. Each author's contribution is as follows: ORK collected the data, designed the figures, and drafted the manuscript. ORK and LA conceptualized the research and conducted the methodology. LA, FK, and AZ; critical revision of the article. All authors discussed the results and contributed to the final manuscript.

## Conflict of Interest

The authors declare that they have no competing interests.

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## References

Abidin, Z., Handayani, W., Zaky, E. A., & Faturrahman, A. D. (2022). Perceived risk and attitude's mediating role between tourism knowledge and visit intention during the COVID-19 pandemic:

implementation for coastal-ecotourism management. *Heliyon*, 8(10):e10724.

Adrianto, L., Kurniawan, F., Romadhon, A., Bengen, D. G., Sjafrie, N. D. M., Damar, A., & Kleinertz, S. (2021). Assessing social-ecological system carrying capacity for urban small island tourism: The case of Tidung Islands, Jakarta Capital Province, Indonesia. *Ocean & Coastal Management*, 212:105844.

Anderies, J. M., Janssen, M. A., & Ostrom, E. (2004). A Framework to analyze the Robustness of Social-ecological systems from an institutional perspective. *Ecology and Society*, 9(1):18.

Aprian, M., Adrianto, L., Boer, M., & Kurniawan, F. (2023). Re-thinking Indonesian marine fisheries quota-based policy: A qualitative network of stakeholder perception at fisheries management area 718. *Ocean & Coastal Management*, 243:106766.

Badry, N. A., & Hickey, G. M. (2022). Chapter three - enhancing collaboration across the knowledge system boundaries of ecosystem governance. In J. Holzer, J. Baird, & G. M. Hickey (Ed), Pluralism in ecosystem governance. (pp. 63-88). Cambridge: Academic Press.

Baird, J., Plummer, R., & Pickering, K. (2014). Priming the governance system for climate change adaptation: the application of a social-ecological inventory to engage actors in Niagara, Canada. *Ecology and Society*, 19(1):3.

Banarsyadhimi, U. R. A. M. F., Dargusch, P., & Kurniawan, F. (2022). Assessing the impact of marine tourism and protection on cultural ecosystem services using integrated approach: A case study of Gili Matra Islands. *International Journal of Environmental Research and Public Health*, 19(12078)1-23.

Barabasi, A. L. (2002). Linked: How everything is connected to everything else and what it means for business, science, and everyday life. New York: Plume Publishing.

Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K., & Schlüter, M. (2021). The Routledge handbook of research for social-ecological systems. London: Routledge.

Berkes, F., Colding, J., & Folke, C. (2003). Navigating social-ecological system: building resilience for complexity and change. Cambridge: Cambridge University Press.

Burkhard, B., Kroll, F., Nedkov, S., & Müller, F. (2012). Mapping ecosystem service supply, demand and budgets. *Ecological Indicators*, 21:17-29.

Chaisse, J., & Dimitropoulos, G. (2021). Special economic zones in international economic law: towards unilateral economic law. *Journal of International Economic Law*, 24:229-257.

Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World Development*, 22(7):953-969.

Charles, A. T. (2001). Sustainability fishery system. Oxford: Blackwell Science Publishing.

Cicin-Sain, B., & Knecht, R. W. (1998). Integrated coastal and ocean management: Concepts and practices. Washington: Island Press.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., & van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Ecological Economics*, 25(1):3-15.

Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S. J., Kubiszewski, I., Farber, S., & Turner, R. K. (2014). Changes in the global value of ecosystem services. *Global Environmental Change*, 26:152-158.

Cross, R., & Parker, A. (2004). The hidden power of social networks: understanding how work really gets done in organizations. Boston: Harvard Business School Press.

Csárdi, G., & Nepusz, T. (2006). The igraph software package for complex network research. *InterJournal Complex Systems*, 1-9.

Cumming, G. S. (2011). Spatial resilience in social-ecological systems. London: Springer.

Dahuri, R., Rais, J., Ginting, S. P., & Sitepu, M. J. (1996). Pengelolaan pesisir terpadu. Jakarta: Pradnya Paramita.

de Andrés, M., Barragán, J. M., & Sanabria, J. G. (2018). Ecosystem services and urban development in coastal Social-Ecological Systems: The

Bay of Cádiz case study. *Ocean and Coastal Management*, 154:155-167.

De La Cruz, P. M. C. (2021). The knowledge status of coastal and marine ecosystem services - challenges, limitations and lessons learned from the application of the ecosystem services approach in management. *Frontiers in Marine Science*, 8(684770):1-27.

De Leon, R. C., & Kim, S. M. (2017). Stakeholder perceptions and governance challenges in urban protected area management: The case of the Las Piñas – Parañaque Critical Habitat and Ecotourism Area, Philippines. *Land Use Policy*, 63:470-480.

Dewan Nasional KEK. (2022). Naskah laporan akhir perkembangan KEK 2021-2022. Jakarta: SEZ National Council Secretariat.

Espeso-Molinero, P., & Pastor-Alfonso, M. J. (2020). Governance, community resilience, and indigenous tourism in Nahá, Mexico. *Sustainability*, 12(15)1-20.

Felipe-Lucia, M. R., Guerrero, A. M., Alexander, S. M., Ashander, J., Baggio, J. A., Barnes, M. L., Bodin, Ö., Bonn, A., Fortin, M. J., Friedman, R. S., Gephart, J. A., Helmstedt, K. J., Keyes, A. A., Kroetz, K., Massol, F., Pocock, M. J. O., Sayles, J., Thompson, R. M., Wood, S. A., & Dee, L. E. (2022). Conceptualizing ecosystem services using social–ecological networks. *Trends in Ecology and Evolution*, 37(3):211-222.

Gajardo, L. J., Sumeldan, J., Sajorne, R., Madarcos, J. R., Goh, H. C., Culhane, F., Langmead, O., & Creencia, L. (2023). Cultural values of ecosystem services from coastal marine areas: Case of Taytay Bay, Palawan, Philippines. *Environmental Science & Policy*, 142:12-20.

Gao, L., Bao, W., & Shi, L. (2022). Governance mechanism and performance of marine eco-economic system: Evidence from China. *Ecological Indicators*, 136:108668.

Gavaris, S. (2009). Fisheries management planning and support for strategic and tactical decisions in an ecosystem approach context. *Fisheries Research*, 100(1):6-14.

Glaser, M., Adrianto, L., Breckwoldt, A., Buhari, N., Deswandi, R., Ferse, S., Gorris, P., Paragay, S. H., Glaeser, B., Mohammad, N., Máñez, K. S., & Yanuarita, D. (2022). The governance of coastal and marine social-ecological systems: Indonesia and beyond. In T. C. Jennerjahn, T. Rixen, H. E. Irianto, & J. Samiaji (Ed.), Science for the Protection of Indonesian Coastal Ecosystem (SPICE). (pp. 407-443).

Hafsaridewi, R., Khairuddin, B., Ninef, J., Rahadiati, A., & Adimu, H. E. (2018). Pendekatan sistem sosial ekologi dalam pengelolaan wilayah pesisir secara terpadu. *Buletin Ilmiah Marina*, 4(2):61-74.

Hanifah, A., Adrianto, L., & Zairion, Z. (2022). Uncertainty in the dynamics of fish prices in social-ecological system of neritic tuna fisheries (Case study: Pasongsongan, Sumenep). *Journal of Economic and Social of Fisheries and Marine*, 10(1):75-89.

Henry, A. D., & Vollan, B. (2014). Networks and the challenge of sustainable development. *Annual Review of Environment and Resources*, 39:583-610.

Hidayah, Z. (2015). GIS application to determine critical condition and rehabilitation model of mangrove ecosystem in southern coast of Pamekasan Region Madura. *Jurnal Ilmiah Perikanan dan Kelautan*, 7(1):79-86.

Hu, X. B., Shi, P., Wang, M., Ye, T., Leeson, M. S., van der Leeuw, S. E., Wu, J., Renn, O., & Jaeger, C. (2017). Towards quantitatively understanding the complexity of social-ecological systems - from connection to consilience. *International Journal of Disaster Risk Science*, 8(4):343-356.

KemenkoPerekonomian.(2023).Evaluasiperkembangan KEK 2022. Jakarta: Communication Bureau for Information Services and Conferences, Coordinating Ministry for Economic Affairs.

Kittinger, J. N., Finkbeiner, E. M., Glazier, E. W., & Crowder, L. B. (2012). Human dimensions of coral reef social-ecological systems. *Ecology and Society*, 17(4)17.

Kluger L., Kochalski, S., Müller, M. S., Gorris, P., & Romagnoni, G. (2015). Towards an holistic analysis of social-ecological systems (SES) in the marine realm. Paper presented at the conference YOUMARES 6, Bremen, German

Society for Marine Research.

Kooiman, J. (2008). Exploring the concept of governability. *Journal of Comparative Policy Analysis: Research and Practice*, 10(2):171-190.

Kurniawan, F., Adrianto, L., Bengen, D. G., & Prasetyo, L. B. (2016a). Patterns of landscape change on small islands: A case of Gili Matra Islands, Marine Tourism Park, Indonesia. *Procedia - Social and Behavioral Sciences*, 22:553-559.

Kurniawan, F., Adrianto, L., Bengen, D. G., & Prasetyo, L. B. (2016b). Vulnerability assessment of small islands to tourism: The case of the Marine Tourism Park of the Gili Matra Islands, Indonesia. *Global Ecology and Conservation*, 6:308-326.

Kurniawan, F., Adrianto, L., Bengen, D. G., & Prasetyo, L. B. (2019). The social-ecological status of small islands: An evaluation of island tourism destination management in Indonesia. Tourism *Management Perspectives*, 31:136-144.

Lestari, P. A., Adrianto, L., Zairion, Z., & Effendi, I. (2023). Social-ecological connectivity and management factors of puerulus (*Panulirus* spp.) fisheries in the Western Coastal Waters of Lampung Province. IOP Conference Series: *Earth and Environmental Science*, 1137(1).

Levin, S., Xepapadeas, T., Crépin, A. S., Norberg, J., de Zeeuw, A., Folke, C., Hughes, T., Arrow, K., Barrett, S., Daily, G., Ehrlich, P., Kautsky, N., Mäler, K. G., Polasky, S., Troell, M., Vincent, J. R., & Walker, B. (2013). Social-ecological systems as complex adaptive systems: Modeling and policy implications environment and development economics. Cambridge: Cambridge University Press.

Lipták, F., Klasová, S., & Kováč, V. (2015). Special Economic Zone Constitution According to Cluster Analysis. *Procedia Economics and Finance*, 27(15):186-193.

Luke, D. (2015). A user's guide to network analysis in R. New York: Springer.

Mahon, R., Bavinck, M., & Roy, R. N. (2005). Governance in action. In J. Kooiman, M. Bavinck, S. Jentoft, & R. Pullin (Ed.), Fish for life: Interactive governance for fisheries. (pp. 353-378). Amsterdam: University of Amsterdam Pres.

Mahon, R., & McConney, P. (2013). A network perspective on governing interactions. In M. Bavinck, R. Chuenpagdee, S. Jentoft, & J. Kooiman, (Ed.), Governability of fisheries and aquaculture: theory and applications (pp. 301-313). London: Springer MARE Publication Series 7.

Man, Y., Liu, K., Xie, T., Zhou, F., Shi, W., Liu, Z., Wang, Q., & Cui, B. (2023). A multilevel social-ecological network approach for reconciling coastal saltmarsh conservation and development. *Journal of Environmental Management*, 345:118647.

Melbourne-Thomas, J., Wotherspoon, S., Raymond, B., & Constable, A. (2012). Comprehensive evaluation of model uncertainty in qualitative network analyses. *Ecological Monographs*, 82(4):505-519.

Millenium Ecosystem Assessment (MEA). (2005). Ecosystem and well human being: Synthesis. Washington: Island Press.

Mullon, C. (2014). Network economics of marine ecosystem and their exploitation. Boca Raton: CRC Press.

Mulyawati, L. S., Adrianto, L., Soewandi, K., & Susanto, H. A. (2019). Impact of tsunami Sunda Strait to coastal tourism in Tanjung Lesung Special Economic Zone Pandeglang Regency Banten Province. IOP Conference Series: *Earth and Environmental Science*, 370(012065).

Mulyawati, L. S., Adrianto, L., Soewandi, K., & Susanto, H. A. (2020). Factors of coastal tourism management with DPSIR analysis (case study: Tanjung Lesung special economic zone, Pandeglang Regency, Banten Province). *Economic and Social of Fisheries and Marine Journal*, 8(1):123-137.

Mulyawati, L. S., Adrianto, L., Soewardi, K., Susanto, H. A., Kusumo, S., & Kurniawan, F. (2023). Assessing sustainability of coastal tourism based special economic zone (SEZ) in Indonesia: The case of Tanjung Lesung Coastal Area, Banten Province, Indonesia. *Urban Resilience and Sustainability*, 1(2):107-117.

Munawar, Adrianto, L., Boer, M., & Imran, Z. (2021).

Spatial analysis of coastal and marine ecosystem services at Bima Bay, West Nusa Tenggara, Indonesia. IOP Conference Series: *Earth and Environmental Science*, 744(012046).

Munawar, Adrianto, L., Boer, M., Imran, Z., & Zulfikar, A. (2020). Socio-ecological network analysis of Bima Bay, West Nusa Tenggara Province, Indonesia. *AACL Bioflux*, 13(4):2290-2301.

Nawaz, W. (2019). An Empirical study of community detection algorithms on social and road networks. *The Journal of Engineering Science and Computing*, 1(1):185-00.

Nayak, P. K., & Armitage, D. (2018). Social-ecological regime shifts (SERS) in coastal systems. *Ocean & Coastal Management*, 161:84-95.

Newman, M. (2010). Network. Oxford: Oxford University Press.

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *In Science*, 419-422.

Pueyo-Ros, J. (2018). The role of tourism in the ecosystem services framework. *Land*, 7(3):111.

Pujiyono, B., Kismartini, Yuwono, T., & Dwimawanti, I. H. (2019). Stakeholder analysis on tourism collaborative governance in Tanjung Lesung tourism, Pandeglang Regency, Banten Province, Indonesia. *African Journal of Hospitality, Tourism and Leisure*, 8(3):1-11.

Puspitawati, D., Fadli, M., Moelyadi, M., Kusumaningrum, A., Supriyadi, S., Wardani, M. P., & Anandya, A. (2022). Analysis of community social economic resilience based on coastal and marine natural resources. *Economic and Social of Fisheries and Marine Journal*, 10(1):41-54.

R Core Team. (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/ on July 20, 2021.

Raab, J., & Kenis, P. (2007). Taking stock of policy networks: Do they matter? In F. Fischer, & G. J. Miller (Ed.), Handbook of Public Policy Analysis: Theory, Politics, and Methods. (pp. 187-200).

Reyers, B., Folke, C., Moore, M. L., Biggs, R., & Galaz, V. (2018). Social-ecological systems insights for navigating the dynamics of the Anthropocene. *Annual Review of Environment and Resources*, 43:267-289.

Salgueiro-Otero, D., & Ojea, E. (2020). A better understanding of social-ecological systems is needed for adapting fisheries to climate change. *Marine Policy*, 122:104123.

Sandström, A., Bodin, Ö., & Crona, B. (2015). Network governance from the top – The case of ecosystem-based coastal and marine management. *Marine Policy*, 55:57-63.

Schlüter, M., Haider, L. J., Lade, S. J., Lindkvist, E., Martin, R., Orach, K., Wijermans, N., & Folke, C. (2019). Capturing emergent phenomena in social-ecological systems. *Ecology and Society*, 24(3):1-26.

Sofield, T. H. B., & Marafa, L. M. (2019). Revitalizing fieldtrips in tourism: Visual anthropology, photo elicitation, rapid appraisal, participant observation and Habermas. *Tourism Management*, 75:522-546.

Wu, M., Liu, C., & Huang, J. (2021). The special economic zones and innovation: Evidence from China. *China Economic Quarterly International*, 1(4):319-330.

Yudhistira, E., Kusumastanto, T., Adrianto, L., & Yulianda, F. (2021). The strategy of coastal eco-tourism based on cultural ecosystem services approach: A case study in Ciletuh Bay. *Journal of Economic and Social of Fisheries and Marine*, 9(1):1-15.