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Analysis of Green Economy Development Strategy Priorities in Madura Using Analytic Network Process Approach

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ABSTRACT

The purpose of the study is to analyze the priorities of the Green Economy development strategy on Madura Island. Using the Analytic Network Process (ANP) Approach. Along with the rapid economic development supported by industrial developments and sophisticated technology brings many changes to nature which ultimately cause climate change or Climate Change this can occur due to an increase in temperature on the earth's surface. quantitative research approach with the Analytic Network Process-Super Decisions method, the primary data used is obtained directly sourced from expert respondents, academic experts, policy experts and practitioners as direct actors. The results show that the analysis of strategy priorities results in the main choice of strategies that encourage regulation of fossil fuel use, monitoring of environmental activities, green sector tax incentives, and the passage of nature convergence regulations.

Keywords: Green economy, Strategy, ANP.

INTRODUCTION

The issues of environmental damage or degradation, global warming and climate change was still continue, it was affected to the human life (Abbass et al., 2022). The impact of these issues was floods, drought, tidal waves, air, water and land pollution, rise in sea level and extreme the weather events (D'Amato & Akdis, 2020).

The economic development activities in Indonesia were mostly based on natural resources, considering that Indonesia has relatively more natural resources compared to other countries (Ekananda, 2022). The natural resources such as renewable resources including crops, timber and fish, and non-renewable resources including of petroleum, minerals, natural gas and coal (Pirmana et al., 2021). Madura was an Indonesian island located at the northeastern coast of Java. The employment sectors in Madura was agriculture, fisheries and industry. Climate change and global warming will affect this sector so a green economy was needed to reduce the negative environmental impact currently, especially by increasing efficiency and switching towards renewable resources. Madura has more coastlines that was affected by environmental damage (Pirmana et al., 2021). Such conditions can lead to a further decline in the productivity of natural resources and the environment, thereby causing poverty in people whose lives depend on these natural resources and the environment.

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Indonesia was used natural resources as a sector of economic growth, in the other hand, the excessive consumption of natural resources such as industrialization, fossil energy, fishery and deforestation it will dame the environmental (Nathaniel, 2021). National development strategies and policies prioritize achieving purely economic interests rather than the interests of the environment and society (Margiansyah, 2020). Environmental resources and all natural resources attached to them as well as community economic resources are acquired and exploited excessively by the state and economic actors to realize the interests of economic growth and profit alone (Ramadhani et al., 2022). The economic was growing high, in the other side has an impact on social and environmental crises. By the issues, an appropriate economic development paradigm is needed for long-term development.

Economic development was programs or activities that aims to improve the economic well-being and quality of life for a community. To improve the economic quality that can with a green economic. Makmun (2011), green economic was part of sustainable development that can eliminate the negative impact of economic growth on the environment and scarcity of natural resources. In the World Commission on Environment and Development (WCED) report in 1987 entitled Our Common Future, sustainable development was defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This means that the development carried out is not only for now, but also for the future. The increasing intensity of sustainable development, the concept of a green economy has developed, it was a concept that supports sustainable development and the elimination of poverty. However, considering that there was no sustainable development model that was the same for all countries, the concept of a green economy was understood differently, taking into account the various constraints in each country.

In making decisions regarding priorities in green economic development, the Analytic Network Process (ANP) can be used to measure the level of sustainability strategy priority indexes in economic, social, environmental, infrastructure and institutional aspects. Therefore, the aim of this research was to identify and analyze the priority strategies for developing a Green Economy on Madura Island based on the Analytic Network Process (ANP) that can create a sustainable green economy.

STUDY LITERATURE

Green Economy Concept

Green economy was an idea that aims to improve social welfare without the risk of environmental damage (Loiseau et al., 2016). Green economy is a model of economic development approach that no longer relies on economic development based on excessive exploitation of natural resources and the environment. The green economy was a strategy to stay away from economic practices that prioritize short-term profits which have left behind various problems that are urgent to be addressed, including driving a low-carbon economy (Georgeson et al., 2017). The idea of "green economy" aims to provide great opportunities for efforts to utilize the concept of "green economy" in order to support the implementation of development that was oriented towards environmental and ecosystem aspects.

Analytic Network Process (ANP) Concept

Analytic Network Process (ANP) was a data analysis method developed from the Analytical Hierarchy Process (AHP) method, both of which was methods used for Multi Criteria Decision Making (MCDM) decision making. ANP was used to analyze problems that general and complex in nature and cannot be arranged hierarchically because it was considers depend between elements in the hierarchy. One of the advantages of ANP was a priority measurement model based on ratios and proportions to capture interactions and influences that was oriented towards accurate prediction results and very precise decision making (Kadoić et al., 2017).

Venkataraman et al., (2014) the ANP method was a development of the AHP method that can improve the weaknesses of AHP and was able to accommodate the relationship between criteria (alternatives). ANP can be used to solve problems that have dependencies between criteria or alternatives with each other. The problem of tourism sustainability at the Mangrove Lembung Ecotourism object has a dependency between criteria (alternatives) with each other, so that the problem in economic, social, ecological, infrastructure & institutional aspects in this research was analyzed using the ANP method. The ANP method with Super Decisions 3.2 software was used to develop sustainable tourism development strategies by looking at the results of analysis of criteria or alternatives as priority development strategy options (Shirali & Nematpour, 2019). Sayyadi & Awasthi (2018),There was two types of alternative linkages, namely inner dependence and outer dependence. Inner dependence is a type of relationship between criteria that occurs in one set of elements, while Outer dependence is a type of relationship that occurs in different elements. The combination of the two inner dependence and outer dependence methods is the best way because these two methods can influence each other between clusters and between elements within one cluster so that they can be used for precise and accurate decision making as a priority strategy and concept for making sustainable development policies.

METHOD

Quantitative methods with the ANP approach are used to measure the priority index level of green economy development strategies in Madura (Saaty, 2006). This research will be conducted from January to July 2023. Primary data are obtained directly from the data source, and data collection is carried out using questionnaires. Data sources in the form of expert respondents (experts) are determined and selected deliberately based on certain considerations (Noywuli et al., 2019). While the data analysis tool used is the Network Process Analysis (ANP) method with the help of Super Decision Software version 3.10. Methods used to determine skala prioritas relatif diperoleh dari angka absolut Based on assessment individu (Saaty, 2005). The stages of data analysis include:

1. The preparation of the modeling structure is carried out based on literature review, both theoretical and empirical, and is carried out through in-depth interviews to examine deeper information and obtain actual problems in the field.
2. Weighting by experts, namely clusters that have been arranged, then comparison is carried out in a supermatrix using expert weighting methods to compare a cluster with other clusters.
3. ANP synthesis, assessment data is then collected and fed into super-decision software to be processed to

produce supermatrix-shaped output and then synthesized into priorities. The results of each respondent will be inputted on a separate ANP network.

Rater Agreement is a measure that shows the level of conformity (approval) of respondents (R1-Rn) to a problem in a cluster. The tool used to measure appraiser agreement is the Kendall Coefficient of Concordance (W; 0< W≤ 1). W=1 indicates a perfect match. To calculate Kendall's (W), we first rank each answer and then add it up. The calculation of the *Rater of Agreement* is by the formula:

W= S/(mak s)
Where:
X: Number of clusters
R : The ranking weight of each respondent
n : Number of respondents
z: Number of clusters
U : Average total value in each cluster
S : Nilai jumlah kuadrat simpangan
MaxS: Maximum squared deviation value
W: Deal Assessor

Based on previous research using the Analytical Network Process (ANP) method approach, a W value above 0.4 indicates a fairly high level of rater approval, this means that experts or experts in assessing pairwise comparison questionnaires, agree in determining criteria in the concept of sustainable tourism development otherwise if the A W value below 0.4 indicates a low level of respondent approval, this means experts or experts in assessing pairwise comparison questionnaire, disagree in determining criteria in the development of Green Economy in Madura.

ANP Model Procedure

The solution procedure applied in the ANP analysis process consists of 4 main steps or stages. The ANP procedure was: 1) Creating a Model Framework by structuring the problem and creating a conceptual model by identifying important components with the top order (cluster goal), the second cluster can be in the form of criteria accompanied by elements (nodes) , subcomponents to alternative clusters or similar. The process of compiling the ANP model is based on literature studies and initial observations through dept interviews with several managers of the Lembung Mangrove Ecotourism, 2) Developing a Pairwise Comparison Matrix based on a 1-9 ratio scale with the condition that in the final data analysis (limiting supermatrix) the calculated consistency ratio value is less than 0 .1 or 10%. 3) Calculating the Supermatrix with Super Decisions software through 3 stages, namely Unweighted Supermatrix, Weighted supermatrix, and limiting supermatrix, 4) Weighting the interests of clusters and nodes.

RESULT AND DISCUSSION

Presentation of ANP Analysis Data

The stages or procedures of ANP consist of 4 stages, namely 1) creating or compiling an ANP model, 2) compiling a pairwise comparison matrix 3) calculating a supermatrix, 4) analyzing the importance weights of *clusters* and *nodes.*

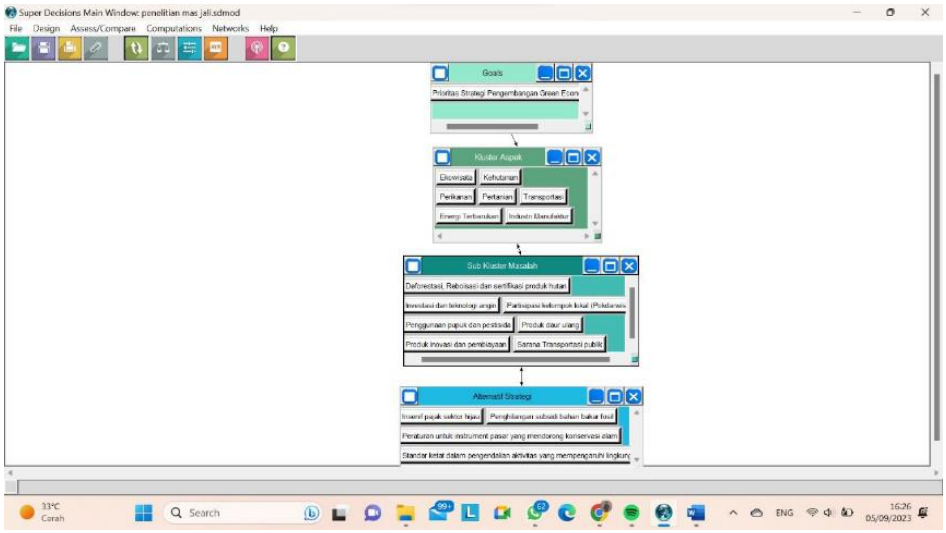


Figure 1.
ANP Model Hierarchy in *Software Super Decisions*

The ANP model consists of 4 *clusters, namely goals clusters, criteria clusters (aspects), subcriteria clusters (problems), and* alternative *clusters (strategies). The first cluster* of goals consists of 1 *node* (element) in the form of priority strategies for Green Economy development in Madura. *The second cluster* of criteria in the form of the Green Economy development sector consists of 7 *nodes,* namely forestry, agriculture, manufacturing industry, fisheries, ecotourism, renewable energy, and transportation. *The* third cluster of subcriteria is in the form of problems that have *a feedback* relationship to each *aspect cluster*, then complex tourism sustainability problems are arranged into simpler based on the level of urgency of the problem in each aspect of sustainability in the research. The *problem cluster nodes* are 1) Deforestation, reforestation, and certification of forest products; 2) Use of fertilizers and pepticides; 3) Recycled products; 4) Product innovation and financing; 5) Participation of local groups (Pokdarwis); 6) Investment and wind technology; 7) Public transportation. *The fourth cluster* of alternative strategies consists of 4 *strategy nodes*, namely 1) Eliminating fossil fuel subsidies; 2) Strict standards in the control of activities that affect the environment; 3) Green sector tax incentives; 4) Regulations for market instruments that encourage the convergence of nature.

Preparation of a comparison matrix between *nodes* in an interrelated cluster. Application of comparison matrix by providing an assessment of importance by applying a scale of 1-9. Questionnaires are prepared and distributed to respondents or keypersons applying the normal comparison matrix model without modification so that comparison assessments based on importance are automatically applied. Supermatrix calculation using 3 steps; *Unweighted Supermatrix, Weighted supermatrix,* and *Limiting supermatrix* inconsistency *requirements* less than 0.1 (10%) are met. Weighting by determining the importance weight of the determining factor using the results of a *limiting supermatrix* which then the overall priority of each alternative is calculated through the synthesis process. The results of the synthesis of priorities of key strategy choices can be seen in the Analytic Network Process Priorities Synthesis Table.

Table 1.
Sintesis Priorities Analytic Network Process

Name of Cluster and Nodes	Normalized By Cluster	Limiting	Rank
Cluster Goals			
Strategic priorities for Green Economy Development in Madura			
Cluster Sector			
Fishing	0.18917	0.047292	1
Ecotourism	0.16067	0.040168	2
Renewable energy	0.16054	0.040134	3
Transportation	0.14278	0.035695	4
Manufacturing industry	0.11956	0.029889	5
Agriculture	0.11418	0.028546	6
Foresty	0.11310	0.028275	7
Cluster Issues			
Innovation and financing products	0.18917	0.094585	1
Local group participation (POKDARWIS)	0.16067	0.080335	2
Investment and wind technology	0.16054	0.080269	3
Public transportation facilities	0.14278	0.071391	4
Recycled products	0.11956	0.059778	5
Use of fertilizers and pepticides	0.11418	0.057092	6
Deforestation, reforestation, and forest product certification	0.11310	0.056550	7
Cluster Strategy			
Eliminating fossil fuel subsidies	0.26444	0.066111	1
Struct standards in the control of activities that affect the environment	0.25002	0.062506	2
Regulations for market instruments that encourage the convergence of nature	0.24887	0.062218	3
Green sector tax incentives	0.23666	0.059166	4

Source: *Output Software Super Decisions* 3.2 (2023)

Based on the ratio value produced by the synthesis process in choosing strategic priorities (main), the alternative strategy chosen is the fossil fuel elimination strategy.

Green Economy Development Strategy Priorities

Prioritization of tourism sustainability strategies using *the Analytic Network Process* (ANP) method with *Super Decisions* 3.2 software. The use of the ANP motto is based on the complexity of tourism sustainability issues. *The output* of the synthesis analysis in Table 1 shows that the highest percentage weighted value in the choice of strategy in the alternative cluster is the strategy of eliminating fossil fuel subsidies by 0.264 or 26.4*%,* and the highest percentage value in the problem cluster is innovation and financing products by 0.189 or 18.9%, while the highest value in the *selected sector* cluster *nodes* or economic elements amounted to 0.189 or 18.9%.

Based on the results of the analysis of the ANP model, it can be concluded that the priority of the Green Economy development strategy in

Madura, obtained a choice of strategic priorities, namely the strategy of eliminating fossil fuel subsidies, it was influenced by factors of product innovation and financing problems, while the priority (alternative) sector that affects is the fisheries sector. The influence and relationship that occurs between elements in one *cluster with other cluster* elements was the best alternative linkage model because the combination of two types of inner dependence and *outer dependence* linkages so that *they can be used for decision making appropriately and accurately becomes a priority strategy and concept of sustainable development policy* formulation (Girsang et al., 2019).

The alternative linkage pattern based on the results of the strategy priority index in the resulting ANP model can be presented through the structure chart as follows.

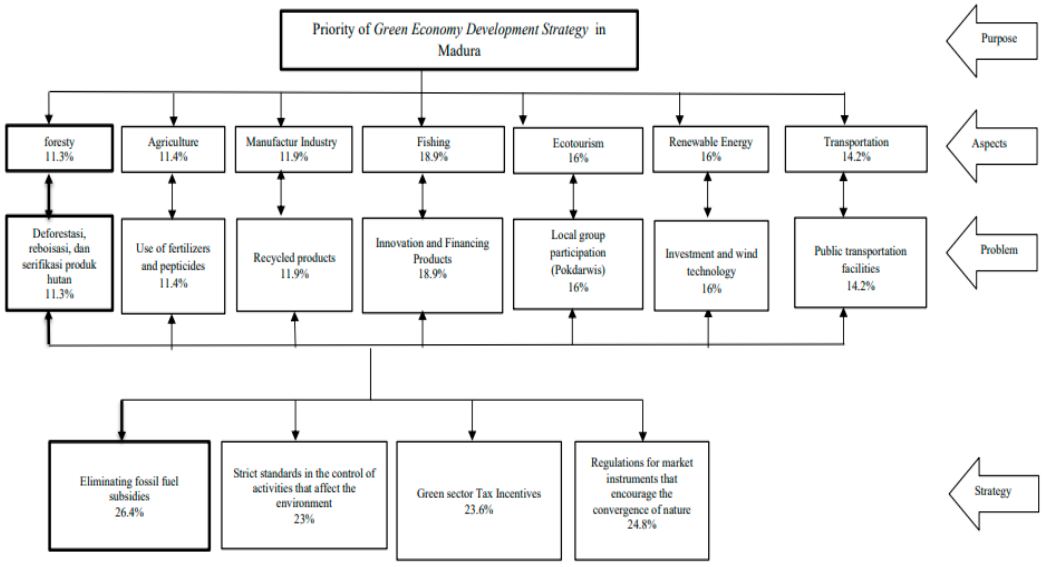


Figure 2.
ANP Model Index in Prioritizing *Green Economy Development Strategy* in Madura, *United Nations Environment Programme (UNEP)*

The selection of the fisheries sector as a priority for Green Economy development that must be improved, shows that basically the main goal to maximize the potential of Indonesia's seas needs special attention in building the national fisheries sector in order to realize fish self-sufficiency by increasing fishermen's catch production so that it is expected to improve the welfare of fishermen. Madura fisheries potential is large, Madura has a very large fishery potential both sea and land because it has a fairly large sea area. In addition, it is supported by fishing centers (fishermen) and inland fisheries scattered along the coastline of Madura island. The mainstay marine fishery products of Bangkalan Regency are Shrimp, Squid, Swallow Fish Cob, Snapper, Rajugan and Stingray. While the land fisheries produced are Goldfish, Mujaer, Bandeng, Tawes and Windu Shrimp.

The focus of development in the fisheries sector can be done by addressing the main problems. The main problems that must be solved are product problems , innovation and

financing. Furthermore, the strategy of eliminating fossil fuel subsidies in general can be a solution from seven priority sectors of Green Economy development. The removal of fossil fuel subsidies has at least two impacts. First, eliminating and shifting fossil fuel subsidies could reduce the amount of greenhouse gas emissions resulting from burning fossil fuels, as fossil fuel options become much more expensive. Second, it creates additional fiscal space that was previously used for subsidy funds. This fiscal space makes it possible to finance climate actions both for decarbonization efforts, as well as efforts to increase community resilience to the impacts of climate change. In addition, it can also be used in the context of innovating fishery products that are more environmentally friendly and financing in the form of commodities in the fisheries sector.

So it can be interpreted that the results of the analysis provide recommendations to overcome the complexity of the problem of Green Economy development in Madura can be focused on overcoming the problem of product innovation and financing, especially in the fisheries sector in Madura. So that the basic goal of developing a Green Economy to minimize environmental damage due to greenhouse gas emissions and carbon dioxide emissions can be reduced so as to create an Indonesian economy that prioritizes environmental protection.

Furthermore, based on previous research using the ANP method approach, a W value above 0.4 indicates a fairly high level of rater approval, this means that experts in assessing pairwise comparison questionnaires, agree in determining criteria in the concept of green economy otherwise if the A W value below 0.4 indicates a low level of respondent approval, this means that experts in assessing pairwise comparison questionnaires, do not agree in determining criteria in the development of Green Economy in Madura. The rater *agreement v*alue in *the cluster* of problems and strategies that have been inputted produces a value of 0.47 which is on a strong scale, this means that experts or experts in providing assessments on paired comparison questionnaires, agree in determining problems and strategies in the development of Green Economy in Madura. Here is the table of Rater Agreement value:

Table 2.
Rater Agreement Value

U value	52,5
S value	311
Nilai MaxS	152,5
W value	0,4771428

Source: Primary Data, Processed 2023

CONCLUSION

Analysis of the priority of Greeen Economy development strategy in Madura resulted in a choice of strategic priorities in the form of eliminating fossil fuel subsidies, while the main problem that must be overcome is the problem of product innovation and financing, while from the seven sectors of Green Economy development recommended the main choice to focus on Green Economy development in the fisheries sector.

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