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RESEARCH ARTICLE

SUSTAINABILITY VARIABLES AND INDICATORS SMALL ISLANDS: LITERATURE REVIEW

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Abstract

The development of small islands in the last few decades has not shown optimal and sustainable results. This problem occurs on small islands with a high population density coupled with high socio-cultural and economic activities with dense settlements as estimating indicators. This study aims to determine the variables and indicators that are able to formulate an index of the sustainability of small island development. This research method uses a scientific literature study approach related to the sustainability of development and management of small islands so that from the literature review, the most appropriate variables and indicators are used to formulate a new index in determining the sustainability of small island development.

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Introduction:-

The development of small islands so far has not shown optimal results and their development does not lead to sustainable development (Supriatna, 2007). This happens on islands that have a population density that is equipped with dense settlements. The high population with limited land has an impact on the symptoms of environmental damage including pollution and resulting in the degradation of marine ecosystems such as mangroves and sea fish. According to Budiharjo and Sujarto (1999), the development of the islands also needs to be expressed various developments in ideas, thoughts and approaches that are sustainable.

Sustainable development is a way of looking at activities carried out systematically and planned in the framework of improving the welfare, quality of life and the environment of mankind without reducing access and opportunities for future generations to enjoy and use them. In the process of sustainable development there is a planned change process, in which there is exploitation of resources, direction of investment in technological development orientation, and institutional changes, all of which are in harmony, and increase the potential of the present and the future to meet the needs and aspirations of the community (Burhanuddin et al., 2012). According to Sarte (2010),

From many studies in the field of sustainable development, the size of the criteria and the number of research indicators must be limited, because the number of criteria that are too large will confuse decision makers. But too few criteria, on the other hand, might not be enough to provide all the relevant information needed (Pourebrahim, Hadipour et al. 2010). To evaluate the sustainability of an area's development objectively, we must build an index system especially for island areas which are still rather rare (Zhou, Xiao et al, 2007).

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As discussed by Susilo, (2007) sustainable development in small islands must cover at least 3 aspects, namely ecological, economic, and social. The ecological, economic and social benefits that are obtained as a result of the development must be substantial in fact must also be balanced in all aspects. The imbalance between these aspects as a result of environmental pollution, over-exploitation of natural resources, the benefits of uneven use of natural resources in the community, the emergence of individualistic characteristics and violations of laws and regulations, for example, will result in the development of small islands becoming unsustainable. In the research conducted by (Susilo, 2007) indeed only two variables were studied which represented two important aspects of sustainable development, namely ecological and economic aspects.

The sustainability index of small island development that will be prepared is a tool to assess the sustainability of small islands in terms of sustainable regional development. The preparation of this index can help establish a sustainable development of the environment and help to shape the direction of the development of small islands in order to create a good environment. So we need an approach that is able to solve the problem of developing small islands while still paying attention to the main sustainability principles related to the socio-cultural, economic and ecological aspects.

This study aims to determine the most appropriate variables and indicators in formulating the small island development index. It is hoped that this research can be used in modeling the planning and management of small islands in Indonesia in a sustainable manner.

Research Methods:-

This research is a literature study by examining 27 journals related to the sustainability of development and management of small islands. The study of scientific literature on previous research is described based on the method and the results of the research and then made in the form of a matrix of indicators used, so that the results will be obtained with the most appropriate variables and indicators to be formulated as an index of the sustainability of small island development.

Results and Discussion:-

Sustainability Index:

Sustainable development is a process of change from various development attributes that interact with each other to achieve development goals, namely a balance between socio-economic benefits and the preservation of natural resources. An assessment of the sustainability of development can be carried out at the "process" stage as well as at the outcome stage.

The assessment of the sustainability of small island development can be done through two approaches, namely the assessment of all development attributes and an assessment of the balance between socio-economic benefits and the preservation of natural resources and the environment or what is known as an economic-ecological (or ecological-economic) model. One of the natural resources in the environment of small islands is the marine fish resource which is used by local fishermen as a source of economic activity for the local community.

The assessment approach to the goals of sustainable small island development is to assess how far there has been a balance between socio-economic benefits and the preservation of natural resources and the environment. This approach is known as the economic-ecological model or the bioeconomic model (Susilo, 2007).

The sustainability index of the waterfront area is the process of evaluating and grouping certain indices in terms of the sustainability of its users. Sustainability indexes can help stakeholders to develop coastal plans that are environmentally friendly both directly and indirectly in reducing the negative impacts of developing marine ecosystems (Feng et al., 2014). Furthermore, based on the ecological theory of the city, the variables related to determining the sustainability of the city will be analyzed using the equation model / structural data analysis technique (SEM) which is one of the multivariate analyzes analyzing the relationship of complex and simultaneous variables (Azwar et al., 2013).

Solving urban problems including in coastal areas can be done with the concept of sustainable cities which have also become an option in the late twentieth century. Sustainable cities basically means a cohesive relationship between the city and the environment. Sustainable cities must realize that cities need to meet social,

environmental, political and cultural and economic and physical goals (Baldemir, E., et al, 2013). As happened in various coastal cities, for example Semarang, which is a coastal area development activity and as well as responding to problems and challenges of development, is carried out designing a management policy design based on the concept of sustainable edge city in the form of policy and strategy directives (Laras et al., 2011).

Previous studies related to sustainable development and management of small islands:

In this section, we will explain the position of research on previous theories or studies that discuss sustainability indices and models as well as the development of small islands. From the results of the study of previous studies, we will see the difference from previous studies that examine the index and sustainability model, especially in the sorting of variables and indicators used so that this research will be found novelty which will strengthen and develop the concept of the formulation of a sustainable development index that has been widely developed.

Research conducted by Liangju Yu in 2010, titled research Assessment of sustainable development of coastal zones: A case study from Yantai, China has the aim of introducing an assessment of coastal development progress, designed with indicators representing environmental subsystems (ENS), social subsystems (SOS) and economic subsystems (ECS), index variables used are population density, number of researchers, proportion of research and DGP, level of contribution of science and technology.

In a study conducted by Amiruddin Tahir in 2012, with the title Small Island Vulnerability Index: The Case of Barrang Lompo-Makasar Island aims to determine parameters that affect small island vulnerability, calculate and project vulnerability index of small islands, and design strategies adaptation to changes in sea level, the variables used are sea level rise (SR), beach erosion (ER), wave height (GL), average tide (PS), tsunami events (TS), growth (PD) and density resident (KP), elevation (EL) and slope (SL), coastal typology (TP), land use (PL), residential settlement (PP) typology, coastal habitat (HP), mangrove ecosystem (MR), coral reef ecosystem (TK), seagrass beds (LM) and marine conservation (KL).

Research conducted by Sylvira A. Azwar in 2013, titled the model of sustainable urban infrastructure in the reclamation of the north coast of Jakarta, aims to examine the concept of sustainable urban infrastructure in the reclamation of the north coast of Jakarta, which is an approach that integrates the urban development component of the capital community, namely urban infrastructure needs and city ecological components, with index variables: land use, transportation, open space buildings, infrastructure and energy networks.

Furthermore, the research conducted by Citra Persada in 2014, entitled Determination of the Status of Urban Infrastructure Sustainability (Case Study: Bandar Lampung City), aims to formulate criteria and indicators of urban sustainable infrastructure development, assess the level or status of sustainability of urban infrastructure and identify influential factors in development urban sustainable infrastructure, the variables used are environmental criteria, social criteria, economic criteria and technological criteria and governance criteria.

Research by Chengdong Wang in 2016, titled Measuring regional sustainability with an integrated socio-economic-natural approach: a case study from the Yellow River Delta region in China aims to provide a reference standard for measuring regional sustainability, the index variable used is the Social subsystem energy, energy per capita and population empowerment, energy economy subsystem, use of individual fuel, electricity to total energy ratio, energy / dollar ratio, investment ratio of energy subsystem natural energy.

Research conducted by Andi Yurnita in 2017, with the title Sustainable Model of Beach Reclamation Case: Makassar City Beach, aims to formulate a reclamation model that can be applied to coastal areas using a sustainability index, in this study the researchers determined the sustainability index in aspects based on aspects physical (buildings, infrastructure and coastal resources) applied to the reclamation site.

In a study conducted by Suparman Supardi in 2017, with the title Analysis of Sustainable Development of Coastal Cities (Case Study: Baubau City, Southeast Sulawesi Province), aims to analyze the sustainability of Baubau City development based on ecological, economic, social, infrastructure and technology dimensions, and law and institutional. The results showed that Baubau City was quite sustainable in the technological infrastructure dimension (74.77) and the institutional legal dimension (65.87), but not sustainable in the ecological dimension (32.90) and the economic dimension (41.87), and was not sustainable in the social dimension (20.61).

The research conducted by Edwarsyah, Rina Safrina in 2017, with the title The Status and Sustainability Status of Outermost Small Islands: Case Study of the Pulo Raya Coastal Area of Aceh Jaya, aims to identify the potential of the coastal natural resources of Pulo Raya Island and assess the status of the coastal sustainability index of Pulo Raya Island. Sustainability analysis is carried out using the Rapfish approach. Rapfish analysis is carried out on five dimensions (ecology, economics, socio-culture, technology, and institutions). Attributes on each dimension / factor most influential are the condition of the aquatic environment (ecological dimension); profitability of seaweed cultivation (economic dimension); social togetherness (social cultural dimension); type of vehicle (technological dimension); and the availability of fisheries groups.

After reviewing the previous studies and theories that have been carried out, it can be said that there have been many studies that formulate sustainability variables and indicators, especially in urban and coastal areas, but have not shown specifically the arrangement of variables and indicators in the development of small islands, so that indeed a research is needed to analyze the sustainability index that is most suitable for use in small islands. The index that has not yet been formulated is the sustainability index for the development of small islands and is then used as the basis for developing models of sustainable island development as a basis for regional development policies.

The following is a diagram of the research position of the studies that have been carried out related to sustainable development and small islands:



Figure 1:- Position in previous studies.

The study of journals related to sustainable development which will be the basis of researchers in developing variables and indicators that are most appropriate in formulating the sustainability of small island development.

Table 1:- Position of research on the arrangement of variables and indicators of development sustainability.

No.	Researcher/Year	Socio Cultural Variable										Economic Variables										Ecological Variables														
		HDI	Population	Health Level	Level of education	Local Cultural Values	Participation	Perception	Character / Behavior	Prosperity level	Community Institution	Income	Business / Work Opportunities	Transportation	Energy sources	Waste management	Clean / Drinking Water	Market	Building Conditions	Catch of the sea	Employment	PAD	Mangrove Ecosystem	Coral Reef Ecosystem	Seagrass Ecosystem	Fisheries Resources	Disaster	Biodiversity	Glacier/sea space	Sea Water Quality	Waste Management	Sea level rise	Air quality	Land Use		
1	ZHOU Jia, 2007	✓									✓																									
2	Setiawan, 2007														✓	✓																				
3	Susilo, 2007																																			
4	Feng Li, 2009								✓																											
5	Liangju Yu, 2010	✓																																		
6	Pourebrahim, 2010		✓																																	
7	Rosales, 2011														✓	✓	✓																			
8	Farhan, 2012		✓																																	
9	Tahir, 2012		✓																																	
10	Burhamuddin, 2012														✓	✓	✓																			
11	Azwar, 2013														✓	✓																				
12	Selintung, 2013															✓																				
13	Persada, 2014	✓	✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
14	Xiong qin, 2015																																			
15	Widodo, 2015	✓	✓																																	
16	Karlina, 2015																																			
17	Wang, 2016		✓																																	
18	Mandala, 2016		✓		✓	✓	✓	✓																												
19	Fernandes, 2017		✓																																	
20	Pakzad, 2017																																			
21	Wardhani, 2017		✓																																	
22	Andi Y, 2017																																			
23	Supandi, 2017	✓	✓	✓	✓																															
24	Edwaryyah, 2017																																			
25	Ervianto, 2018	✓	✓																																	
26	Marasabessy, 2018		✓																																	
27	Handayani, 2018	✓	✓																																	

Source: from various journal references and proceedings.

The Concept of Sustainable Small Island Development:

Basically the concept of small island development refers to the concept of development of coastal areas even though the ecosystems that exist in small islands may be more diverse than in the mainland coastal areas or large islands. In addition, considering that the small island is separated from the mainland (mainland), the accessibility factor can be a significant development constraint in the previous section which has been touched on one of the boundaries of the

small island. Other restrictions given by several other experts are as follows. A small island is an island with an area of less than 1,000 km² and / or a population of less than 100,000 people (Brookfield, 1990). Similar definitions are also used in Japan (Nakajima and Machida, 1990).

Reid (1995) in Kay and Alder (1999) suggested that the concept of sustainable development has 4 main influences in the management of coastal areas, namely:

1. Integrated concept of "equity", environment and economy in the paradigm of decision making;
2. Specially considered economic aspects;
3. Special consideration for environmental aspects;
4. He considered specifically the socio-cultural aspects

Next he stated the requirements for sustainable development to be realized, namely:

1. Integration between conservation and development;
2. Satisfaction with basic human needs;
3. Opportunities to meet human needs that are "non material";
4. Developing towards social justice and welfare;
5. Respect and support cultural diversity;
6. Providing opportunities for social self-determination and fostering self-dependence; and
7. Maintain ecological integrity

Cicin-science and Knecht (1998) suggested that sustainable development includes 3 emphases, namely:

Economic development to improve the quality of human life;

Development in accordance with the environment;

Development in accordance with welfare justice, i.e. justice in distributing benefits from development which includes:

1. "Intersocietal equity" for example between groups in the community respects the special rights of local communities and others;
2. "Intergenerational equity" that is not to limit opportunities or choices for future generations;
3. "International equity" is fulfilling obligations (bonds) to other nations and the international community given the reality of global interdependence.

The dependence of economic development on effective management of natural resources and on maintaining sustainable results from ecosystems on the concept of sustainable development, gave rise to the concept of ecologically sustainable development (OECD, 1993). In principle, the meaning of the concept of sustainable development with the concept of ecologically sustainable development is the same, only emphasis is placed on the importance of guaranteeing and passing on to future generations a quantity of natural capital that can provide an economically sustainable outcome and environmental services including natural beauty (amenities).

Insular small islands do have many constraints in development, especially from an economic aspect, the small size is not really a weakness if producers and consumers are local (Brookfield, 1990). However, there are rarely such conditions in this era of globalization so that the small size of the island often becomes an obstacle to economic development (Hess, 1990). Small islands usually have to bear the burden of greater contributions to build infrastructure, education, research, marketing, etc. so that trading activities run smoothly (Hein, 1990). If this cannot be done then economic development on the small island will be slow. This also means that the small island is very dependent on aid and outside the island (Hein, 1990).

Ecologically, insularity also has the consequence of having to make an evaluation of endemic species and decrease the resilience of flora, fauna, and humans, from outsiders (Hein, 1990). Besides the existence of ecological vulnerability, the small island environment also contains many advantages (Hein, 1990b). Despite many obstacles, there are a number of small islands that have succeeded in building into developed islands (Webster, 1990).

Conclusions And Upcoming Research:-

From various previous studies, it can be concluded that the variables chosen for determining the sustainability of small island development can be categorized in the socio-cultural, economic and ecological aspects. This variable

will be arranged indicators or factors found in previous studies. The indicators compiled by researchers are 48 indicators that can be seen in the table below.

Table 2:- Variables and indicators of the sustainability of small island development.

Variable	Indicator	
Socio-cultural	1	Human Development Index (HDI)
	2	Population growth
	3	Population density
	4	Nutritional status of the community
	5	Life expectancy
	6	Infant, mother and child mortality rates
	7	Number of Diseases
	8	Number of Health Workers
	9	Level of education
	10	Local Cultural Values
	11	Society participation
	12	Community Perception
	13	Community Behavior
	14	Number of poor people
	15	Community Institution
	16	Criminality
The economy	1	Income
	2	Business / Work Opportunities
	3	Street
	4	Port / dock
	5	Sea Transportation
	6	Electric Energy Sources
	7	Waste management
	8	Drinking / Clean Water Services
	9	Drinking / Clean Water Quality
	10	Means of trade
	11	House condition
	12	Catch of the sea
	13	Labor
	14	Unemployment number
	15	Local Own Revenue (PAD)
	16	Telecommunication
Ecology	1	Mangrove Ecosystem
	2	Coral Reef Ecosystem
	3	Seagrass Ecosystem
	4	Fisheries Resources
	5	Coastal Abrasion Disaster
	6	Extreme Waves Disasters
	7	Earthquake Disasters
	8	Rob Flood Disaster
	9	Marine biodiversity
	10	Green open space
	11	Sea Water Quality
	12	Waste Management
	13	Drainage Network
	14	Sea level rise
	15	Air quality
	16	Land Use

Source: Journal review results.

Future Research:

Future research is expected to be able formulate a new index based on variables and indicators that have been prepared so that it can be used to measure the sustainability of small island development and can make an appropriate model based on the sustainability index of small island development.

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