ISSN 2541-223X

icsbe 2016
Fourth International Conference on Sustainable Built Environment

DEVELOPMENT OF ENVIRONMENTAL INDICATORS OF WEST JAVA PROVINCE

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ABSTRACT

In the last few decades, to address the growing pressure on the environment, the Government of West Java Province has introduced several environmental programs. However, those programs have not provided significant contribution to the improvement of the environmental conditions in West Java. It is believed that the failure was due to the lack of stakeholder participation during the planning and the implementation of the program, as well as the absence of an integrated and comprehensive tool for program planning, implementation and monitoring. One of the tools to assist the program planning, implementation and monitoring is an indicator-based tool, known as Environmental Indicators. Environmental Indicators for West Java potentially become an important part in managing the environmental issues in West Java due to its holistic and futuristic approach in analyzing initial environmental status in certain areas. In addition, the indicators can also be used to provide guidance during the implementation and monitoring of environmental programs. This study aims at developing the environmental indicators for West Java Province, which was started by the identification of potential environmental indicators through the use of P-S-R (*Pressure*, *State*, *Response*) approach. Once the potential indicators were identified, they were verified through the application of Delphi method and an in-depth interview with the technical team of West Java Environmental Protection Agency. The criteria used to develop the indicators were the vision and mission of West Java Province including the strategic plan of local departments in West Java, Green Province study on West Java, Sustainable Development approach, and existing environmental indicators in other cities and provinces. This study has resulted in the development of environmental indicators for West Java, which comprises of 4 components, 20 indicators and 29 sub-indicators.

Keywords: Delphi method; Environment; Indicators; West Java

1. INTRODUCTION

In recent decades, there is growing pressure on environmental conditions in West Java (Badan Pengendalian Lingkungan Hidup Daerah Jabar, 2008; Helmy, 2008; Rahmat & Wangsaatmadja, 2007; Wangsaatmaja, 2004). This is due to various reasons, such as the increasing population in West Java. In addition, the pressure on the environment in West Java is caused by the mobility and the proximity of the West Java province with the capital city of Jakarta. In the last couple of decades, the dependence of Jakarta on West Java is significantly increasing, in terms of labor, raw materials for industries, and other matters, which escalate pressures on West Java

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environment. Consequently, it is crucial for West Java governments to address the pressures (Wangsaatmadja, 2007).

To address the pressures on its environment, the Government of West Java province has conducted various programs. To address the issue of water resources, for example, the government has enacted new regulations on water resources, developed campaign programs to increase the stream water quality, as well as management of industrial pollutions (Badan Pengendalian Lingkungan Hidup Daerah Jabar, 2008; Juwana, Perera, & Muttil, 2010a, 2010b; Iwan Juwana, B.J.C Perera, & Nitin Muttil, 2009; I. Juwana, B. J. C. Perera, & N. Muttil, 2009). However, those programs have not contributed significantly to the improvement of the condition of water resources in West Java. One of the causes for the failure of the programs is the lack of support from various stakeholders in the programs (Wangsaatmaja, 2004). Therefore, a tool, that is able to bring the supports of all stakeholders in West Java, is required. An indicator-based tool is believed to be able to bring the attentions and required supports of all related stakeholders in West Java.

To date, there has not been a series or set of indicators related to the environmental conditions in West Java. This contrasts with the applications of similar indicators at the global scale. At the international scale, these indicators include: the Environmental Sustainability Index (Esty, Levy, Srebotnjak, & de Sherbinin, 2005), Corporate Sustainability Indicators (Spangenberg & Bonniot, 1998), the Barometer of Sustainability (Prescott-Allen, 2001), Environmental Pressure Indices (Jesinghaus, 1999), Taking Sustainability Seriously (Portney, 2003), Sustainability Indicator Systems (Spangenberg & Bonniot, 1998) and Pressure-State-Response (PSR)-based sustainability indicators (Spangenberg & Bonniot, 1998).

This study aims to develop a set of environmental indicators for the West Java province, which can be used by different stakeholders in West Java as a starting point to manage West Java environment. In this study, these indicators are identified specifically for the province of West Java, taking into account special characteristics of West Java, as well as involving various elements of stakeholders in West Java. The involvement of stakeholders (stakeholders) in the development of these indicators is carried out by interviews and discussion, either individually or in groups. Furthermore, the various standards, guidelines and regulations in the local, regional and global scales are used in the development of the indicators.

2. LITERATURE REVIEW

2.1. Vision, Mission and Strategic Plans of West Java

The vision of the Government of West Java province, related to the environment, is:

"*Provinsi termaju dalam aspek lingkungan hidup ditunjukkan dengan diterapkannya pengarusutamaan pembangunan berkelanjutan (sustainable development) yang ditandai oleh tingginya daya dukung lingkungan, rendahnya tingkat kerusakan dan pencemaran lingkungan, lestarinya pemanfaatan sumberdaya alam yang terbarukan maupun tak terbarukan serta tingginya peran serta masyarakat dalam pengelolaan sumberdaya alam dan pelestarian lingkungan hidup sehingga terjadi keadilan inter dan antar generasi.*"

(To be the most advanced province in the environment aspect, which is shown by the implementation of sustainable development and indicated by the environmental

support capacity, low pollution and degradation, natural resource utilization, the sustainability of renewable and non-renewable, as well as the high degree of community participation in the management of natural resources and preservation to ensure the inter and intergenerational equalities).

In the West Java vision on the environment, pillars of sustainable development i.e. social, economic, and environment, are already described. Further, this vision should be able to be measured based on the following criteria:

(1) effective use of natural resource use, no depletion of natural resources
(2) not causing pollution and other environmental impacts;
(3) improving the usability of its natural resources

The vision of the field of the environment is then elaborated through the third mission of West Java Province: "developing sustainable environment in West Java". This mission encourages managing natural resources and the environment on an ongoing basis, maintaining the functions and resources support, as well as maintaining the balance of the utilization of spaces matching between the protected areas and cultivation. This vision also points out that the sustainable environment in West Java will ensure the use of resources for the economic development of the province.

2.2. Sustainable Development

Liverman (1988) states that efforts to measure sustainable development can only be achieved when this concept is clearly defined. Since it was firstly introduced in 1987 (Brundtland, 1987), there have been extensive studies to define sustainable development. The first definition of sustainable development was proposed by the Brundtland Commission (Brundtland, 1987), which defined sustainable development as:

…development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (Brundtland, 1987, p. 87)

3. METHODOLOGY

The methodology that is used to develop the environmental indicators for West Java is shown in Figure 1.

In the above scheme, the process of developing indicators for West Java begins with the literature review. This is an important step to lay a robust foundation in the subsequent steps of this study. The result of this step is the first draft of environmental indicator list, known as Potential Environmental Indicators. The literatures which were studied include sustainable development concepts, *Pressure-State-Response*, past studies on sustainable cities, as well as various environmental performance indices. Once the Potential Environmental Indicators are developed, the next step is the first screening, which was based on the policies related to West Java Province to ensure that the developed indicators are in accordance with the needs of West Java Province. Some of the policies are the environmental vision and mission of West Java, Medium-Term Development Plan (RPJMD), Strategic Plan of Local Sector (Renstra OPD) and the Green Growth Document of West Java. The result from this step is the Potential Environmental Indicators of West Java.

ISSN 2541-223X

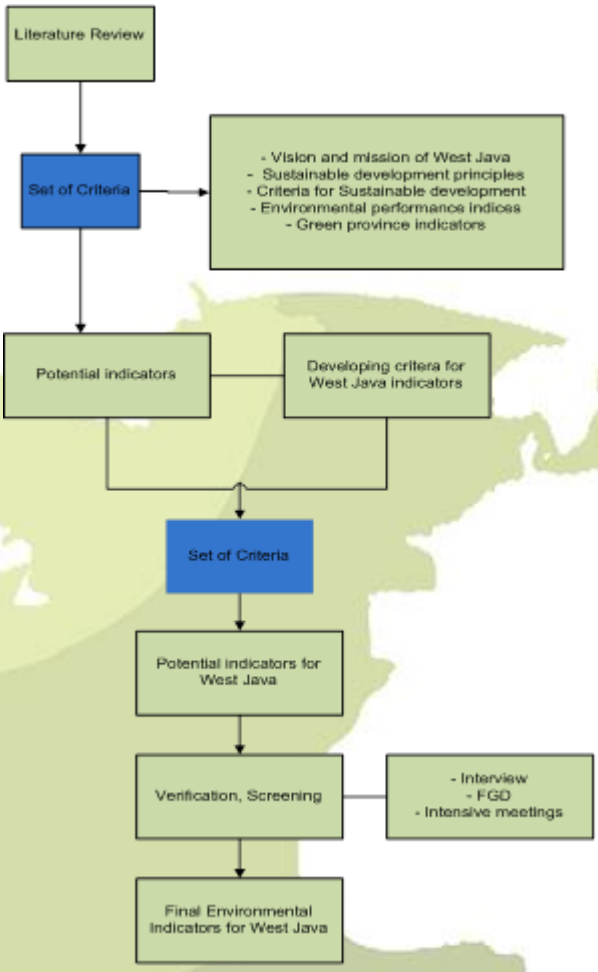

Figure 1 Methodology for Developing West Java Environmental Indicators

The second screening was then conducted on the Potential Environmental Indicators of West Java. In conducting this second screening, the following criteria were used:

1. The similarities of indicators to explain the environmental conditions in West Java
2. The significance of the indicators to explain environmental conditions in West Java
3. The applicability of the indicators in West Java
4. Whether the identified indicators are in accordance with the environmental vision and mission of West Java, Medium-Term Development Plan (RPJMD), Strategic Plan of Local Sector (Renstra OPD) and Green Growth Document of West Java

At the end, once the Potential Environmental Indicators of West Java are checked with the above criteria, these indicators are verified through the interviews with West Java stakeholders (using the Delphi method), Focused Group Discussion and intensive meetings with technical team of West Java Environmental Management Agency.

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4. RESULTS AND ANALYSIS

4.1. Development of Potential Environmental Indicators

Conceptually, the preparation of the environmental indicators for West Java is based on two main concepts, i.e. the Pressure-State-Response and Sustainability. The PSR was a model used by different indices, including ESI, to identify its indicators. This model was also adopted by the Ministry of the environment of Indonesia in the preparation of the book of environmental status, a compulsory document prepared by both the provincial and local governments in Indonesia, as shown in Figure 2.

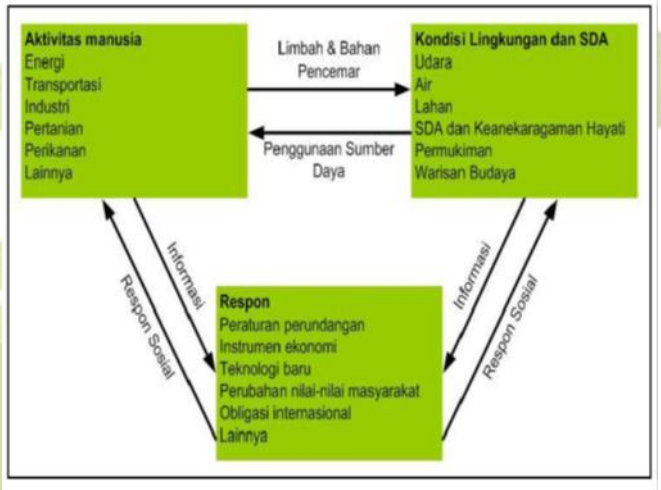

Figure 2 Methodology for Developing West Java Environmental Indicators Model Diagram of PSR (Kementerian Lingkungan Hidup, 2009)

In the picture above, three main aspects in the framework of the PSR are:

- Environmental Pressure (the pressure), which describes the pressure of human activities on the environment and natural resources
- Environmental conditions (state), which describes the quality and quantity of natural resources and the environment describing the situation, condition, and its development in the future
- Response (response), which shows the stakeholders responses towards environmental changes

Based on the framework of P-S-R, environmental indicators in West Java can be identified as follows:

- ***State*:** Land and Forest; Biodiversity, Water, Air, Ocean, Coastal Area, Climate, Natural Disaster
- ***Pressure*:** Population, Housing, Health, Agriculture, Industry, Mining, Energy, Transportation, Tourism and Hazardous Waste
- ***Response*:** Environmental Rehabilitation, Environmental Impact Assessment, Law Enforcement, Public Participation, and Governance

The results of environmental indicators identification with the P-S-R model could then be grouped based on four aspects of sustainable development, as follows:

- **Environment:** Forest Rehabilitation, Water Quality, Water Quantity, Groundwater Conservation, Natural Disaster, Habitat Protection, Coastal

Protection, Mining, Mangrove, Pollution Emission, Reuse and Recycle, Industrial Wastewater, Hazardous Waste, Clean Transportation, Urban Air Pollution, Open Space and Forest-protected Area, Water Sustainability, Water Loss

- **Social:** Public Participation, Organic Fertilizer, Agriculture, Renewable Energy, Gas Energy for industry and household, Access to Sanitation Facilities, Urban Congestion, Bicycle Use, and Public Access for Cycling, Park
- **Economy:** Fishery and Organic Food
- **Insitutional:** Forest Development Desentralisation, Laboratory Standardisation, Action Plan for Climate Change, Clean Energy Policy, PDAM Coverage, Policy on Reuse and Recycle, Mass Transport Policy, Eco-Building Policy, Urban Planning Policy, Clean Energy Policy

Further, the above-mentioned indicators were then categorized into components, indicators and sub-indicators. The component is a combination of various indicators, while the sub-indicators are the elaboration of indicators. In this structure, the component shown refers to the three main pillars in Green Growth. The potential environmental indicators in West Java are re-arranged into four components: Food Security and Natural Resources; Climate Change Mitigation and Adaptation; Urban Sustainability; and Air Quality. These components are made up of some indicators, and the indicators are made up of several sub-indicators.

4.2. Screening of Potential Environmental Indicators

After the list of potential environmental indicators for West Java is obtained, the next step is to conduct a screening against the criteria mentioned earlier. Based on the criteria, a new list of indicators were resulted as shown in Table 1.

Table 1 Identification of Indicators Based on Available Indicators and Policies in West Java

No	Component	Indicator	Sub-Indicator
1	Food security and natural resources	Forest	Forest rehabilitation
			Forest-protected area
			Public participation
			Forest management decentralization
		Agriculture	Agriculture land
			Organic food
			Pesticide use
		Water	Water quality
			Water sustainability
			Groundwater conservation
			Laboratory standardization

ISSN 2541-223X

No	Component	Indicator	Sub-Indicator
			Groundwater pollution
		Mining	Mining permit
		Natural disaster	Natural disaster vulnerability
		Habitat Protection	Ecosystem management
		Coastal protection	Coastal rehabilitation
		Fishery	
		Mangrove	
2	Mitigation and Adaptation of Climate Change	Climate change mitigation	Action plan of climate change
		Renewable energy	Clean energy policy Renewable energy Gas for domestic use
		Drinking water supply	Water loss Water company's coverage
		Waste infrastructure	Policy on Solid waste collection and dumping Reuse and Recycle Access to sanitation facilities Industrial wastewater treatment Hazardous waste
3	Urban Sustainability	Public transportation	Urban mass transport policy Traffic Congestion Clean transportation Bicycle use
		Green open space	
		Eco Buildings Policy	
		Spatial Planning Policy	
		Cycling public access,	
4	Air Quality	Clean air policy Urban air pollution	

4.3. Delphi method and meetings with technical team of WJEMA

Based on the potential environmental indicators in West Java, a questionnaire was developed as a part of Delphi method application. Using the questionnaire, the respondents were asked about their opinions on the component, indicators and sub-indicators (Annells & Australian Institute of Nursing Research, 1997; Arnold et al., 2008; Bardecki, 1984; Beattie & Mackway-Jones, 2004; Uhl, 2006; Verhagen et al., 1998; Williams & Webb, 1994). As an important part of the Delphi method, the identification of the stakeholders is important (Briedenhann & Butts, 2006; Brouwer et al., 2008; Clayton, 1997; Dunham, 1998; Jolson & Rossow, 1971; Linstone & Turoff, 1975; Raskin, 1994; Rowe & Wright, 1999). Identified stakeholders for the questionnaire respondents were from governments and academia.

ISSN 2541-223X

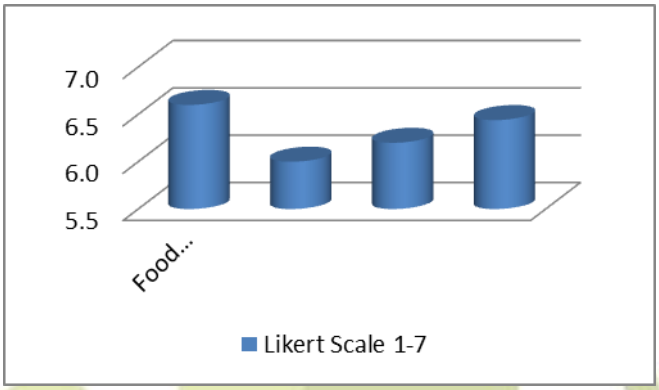

Figure 3 Respons of Respondents to Components

For the Government, the stakeholders were from: Environmental Management Agency in West Java, Department of Agriculture, Food and Security Department, Department of Energy and Mineral Resources, Office of Neighborhoods and Housing, Department of Industry, Department of Transportation, Forestry Department and Department of Water Resource Management. As for academics, respondents are from Environmental Engineering Itenas, Department of Environmental Engineering ITB, Department of Environmental Engineering Unpas, Department of Urban and Regional Planning Itenas, Department of Urban and Regional Planning Itenas ITB, Department of Civil Engineering (Water Resources) Itenas, Department of Civil Engineering (Water Resources) ITB, and the Department of Civil Engineering (water resources) UNPAR. As shown in Figure 3, for each component the responses are 6 (of 1-7 Likert-scale) or more, which indicates that the proposed components are agreed by all the respondents. Those agreed components are: (1) Food Security; (2) Climate Change Mitigation and Adaptation; (3) Urban Sustainability; and (4) Air Quality.

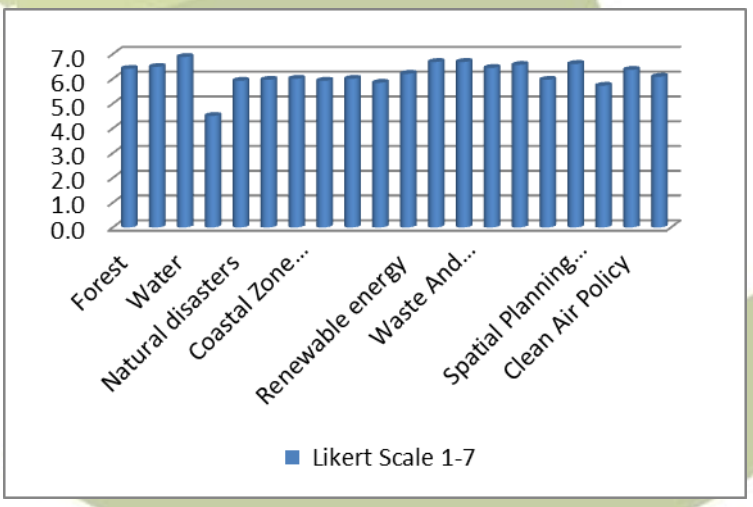

Figure 4 Respons of Respondents to Indicators

As for indicators, Figure 4 shows that the responses of experts during the Delphi implementation are more varied compared to those for the components. This is demonstrated by the range of the average value of the responses between 4.5 – 6.7 (of 1-7 Likert scale). This may be because the number of indicators that are far more numerous than the components, thus providing the opportunity for the respondent to give a more specific assessment of the above indicators.

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However, it can be seen from Figure 4 that there is only one indicator which received average response below 5, which is Mining indicator. As for the other 20 indicators, the average responses from the experts are in the range of 6.5 –8.5. This indicates a strong approval for those indicators. The Mining indicator is still considered appropriate to be included in the list of environmental indicators for West Java because the response value is higher that the average of Likert value (the value of 4). Its final approval to include Mining indicator as one of the environmental indicators of West Java was done after subsequent screening procedures.

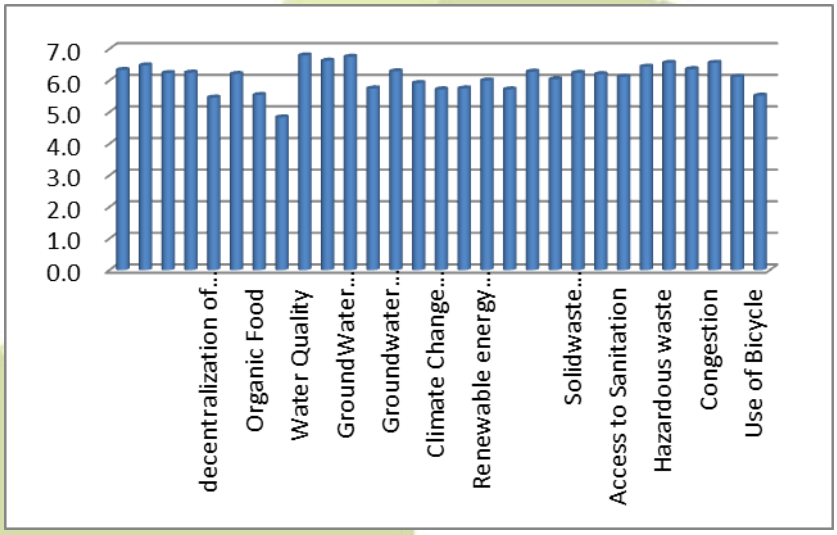

Figure 5 Response of Respondents to Sub-indicators

The other results obtained from the questionnaires are related to the sub-indicators. Figure 5 shows that the average responses, for 28 out of 29 sub-indicators, ranges between 5.5 – 6.8. It is only the sub-indicator of Chemical Fertiliser has the average responses less than 5. However, this indicator is still considered to be included in the Environmental Indicators of West Java because the response value is higher than 4 (as the average value of 1-7 Likert scale).

After this Delphi application, it was recommended that Chemical Fertilizers is further discussed in meetings with the technical team of West Java Environmental Management Agency for its inclusion in the Environmental Indicators of West Java.

5. CONCLUSION

This study has successfully identified the Environmental indicators of West Java, which can be used by the stakeholders in West Java to undertake the initial assessment of environmental condition in West Java Province. In this study, the Environmental Indicators for West Java is divided into components, indicators and sub-indicators. The component is composed of various indicators, while the indicators are composed of different sub-indicators. The components chosen for the Environmental Indicators of West Java refer to the three main pillars of Green Growth, the study on Green Province undertaken previously, with the Air Quality as the additional proposed component. The components of the Environmental Indicators of West Java are: Food Security and Natural Resources; Climate Change Mitigation and Adaptation, Urban Sustainability, and Air Quality. The elaboration of this component is the formation of 20 (twenty) and indicators 39 (thirty-nine) sub-indicators.

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