Identification of sustainable regional development in Majalengka regency

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Abstract. The objectives of this study are to assess appropriate method for sustainability level in developing Majalengka region, to apply chosen method, and to analyze the result. The methods are literature review and direct calculation to estimate sustainability level in regional development. Sustainable Development Indicators (SDI), Environmental Sustainability Index (ESI), Ecological Footprint (EF) and Wellbeing Index (WI) were assessed as an appropriate method. Wellbeing Index is used to analyze the level of sustainable regional development in Majalengka. The result of the calculation shows that wellbeing index (WI) is 75 and wellbeing stress index (WSI) is 2.72. The value of WSI is between OK and medium band, this shows that the pressure to increase human wellbeing has not override ecosystem pressure. The level of sustainability in the barometer of sustainability is in the medium position, this position is "almost sustainable" for both ecosystem and human system (households). This result is used to recommend Majalengka region stakeholders in formulating development policy.

1. Introduction

Regional development is an effort to manage resource to fulfil human need in a certain region. Due to fast growth of technology, human consumption is increasing rapidly. In order to control the increase of human consumption, a concept in managing the sustainability of the region is required. The concept is sustainable regional development. This concept is an integration of regional development practices in sustainable approach [1].

Sustainable development is a terminology that was proposed by World Commission on Environment Development in 1987. Initially, this was a report with the title Our Common Future or Brundtland Report. This report stated that global environmental problems were caused by poverty in the south and unsustainable consumption and production pattern in the north. The report proposed a strategy to be more concerned on environmental aspect [2]. Therefore, sustainable development concept is a tradeoff between today and future generation in using resources for human welfare. Sustainable development had three goals to be achieved those were social, economy and ecology goals [3].

In global perspective, millennium development goals (MDG) was created to achieve sustainable development goals with the target in 2015. Significant achievements have been made on many of the MDG targets globally, however some result has been uneven in several regions and countries [4]. MDGs which had eight goals had been transform into sustainable development goals (SDGs). SDGs

had 17 goals and 169 targets. The targets should be achieved in 2030. The 17 goals are an integration from three dimension of economic, social and environmental goals.

One of methods that examine regional development success is human development index [5]. This method is human oriented or anthropocentric. Regional development should also regard the environment not only human aspect according to the term of sustainable development.

Majalengka is one of regencies in West Java Province that has 26 sub districts. In 2016, this regency had total population 1,188,004 persons and the total area is about 120,424 hectares, so that the population density is 10 people per hectare. The GDP was dominated by agriculture, forestry and fishery sectors which was 26% [6]. In 2018, Majalengka will have an international airport therefore it is predicted the regional development of this area wil be grow fast. Identification of sustainable regional development in this area should be assessed to anticipate the impact of development growth.

Several methods for analyzing regional sustainability had been developed those are Sustainable Development Indicators (SDI); Ecological Footprint (EF); Environmental Sustainability Index (ESI) and Wellbeing Index (WI). The objectives of the research are to assess appropriate method for sustainability research in developing Majalengka region, and to apply chosen method, and to analyze the result.

2. Method
Literature review is used to choose appropriate methods for sustainability assessment. Four methods in assessing regional sustainability are reviewed, those are sustainable development indicator, ecological footprint, environmental sustainability index and wellbeing index. The four methods are compared in term of scope, strength and weakness.

Wellbeing index method is chosen to calculate regional sustainability in Majalengka Regency. Indicators for wellbeing index calculation in Majalengka Regency are human system and ecosystem. Indicators for Human System are: (1) Rate of Infant Mortality; (2) Rate of Maternal Mortality; (3) Ratio of Doctor to Population; (4) Rice yield (in tons) per hectare; (5) Ratio of Teacher to Student in Primary School; (6) Rate of Drop-out Student in Primary School; (7) Ratio of Electricity Generation to Demand; (8) Percentage of metaled road of the total length of roads; (9) Crime incidence per 100,000 population that annually reported; (10) Ratio Female to Male Enrollment in Secondary School. Indicators for Ecosystem are**:** (1) Area under cultivation of the total cultivable area in percentage; (2) Mean annual rainfall (mm); (3) Ambient CO_x in urban area; (4) Protected area in good management to the total protected areas in percentage (See Table 1).

Table 1. Scoring in Wellbeing Index [7,8].

Band	Highest score	Indicator's score (A)	Indicator's score (B)
Good	100	The best score	The worst score
OK	80		
Medium	60		
Poor	40		
Bad	20		
Base	0	The worst score	The best score

The calculation of human and ecosystem wellbeing is by summing the score of indicator 'state of that dimension. The data of each indicator condition were obtained from various related offices in Majalengka and West Java districts. In determining the best or worst value of each indicator is used the number of IUCN Pakistan, Northern Areas' Program. Then, the score is put into Table 1 using interpolation. Lastly, the human and ecosystem wellbeing index is drawn into the barometer of sustainability.

3. Results and discussion

3.1. Sustainability assessment methodology

Sustainable Development Indicators [9] has 4 dimensions for determining sustainable indicators (economy, social, environment and institution). In assessing the sustainability, each dimension has themes, sub-themes and indicators. In 2001 there were 58 indicators, it was too large to be easily managed. Therefore, in 2007 it was revised into 50 indicators [10]. Sustainable development indicators (SDIs) may be powerful in bringing environmental concerns for the national polity. However, understandings difference on SDI's measurement procedures may give different assessments. So that it can mislead that society moves towards a sustainable development path or not [11]

The evaluation of ecological footprint is a calculation to predict the requirement of resource use and waste assimilation of human population or economy. This is corresponding to productive land area. In formal term, ecological footprint of a defined population or economy could be stated as the area of productive land and water that would be required to provide all the energy and material resources used and also to absorb all the wastes disposed [12,13].

Environmental Sustainability Index (ESI) measured impact, response and vulnerability of human of environmental change. ESI had five core components: (a) environmental system, (b) to reduce of environmental stress, (c) to reduce of human vulnerability, (d) societal and institutional capacity to respond to environmental changes, and (e) global stewardship. ESI in 2005 did not provide definitive vision of sustainability. However ESI was a powerful tool in environmental decision making and an alternative to GDP and HDI for evaluating the progress of countries, and also a useful mechanism for environmental performance baseline [14].

The ESI was initially try to list all countries by 76 components of environmental sustainability, comprising of natural resource, pollution levels, endeavor in environmental management, contributions to the protection of the global commons, and capacity of society in making a progress on environmental performance. ESI conducted in 2000, 2001, 2002 and 2005. In 2006 this shifted into Environmental Performance Index (EPI).

Environmental Performance Index (EPI) calculates 180 countries on 24 achievement index comprising of ten groups of environmental wellbeing and ecosystem endurance. These measures provide a tool at a range of countries of how far each country with established environmental policy goals. The EPI nowadays become the most advances tool in environmental science with worldwide datasets of the state of sustainability of countries around the world [15].

Wellbeing index idea is a manifestation of sustainable development concept. This index reveals indicator of human welfare without omitting ecosystem existence. "Human wellbeing is a condition in which all members of society are able to determine and meet their needs and have a large range of choices and opportunity to fulfill their potential" [8]. Five dimensions i.e. health & population, wealth, knowledge & culture, community, and equity are implemented in assessing human wellbeing. "Ecosystem wellbeing is a condition in which the ecosystem maintain its diversity and quality – and thus its capacity to support people and the rest of life – and its potential to adapt to change and provide a wide range of choices and opportunities for the future" [8]. There are five dimension in assessing ecosystem wellbeing: dimension of land area, water availability, air quality, species & genes, and use of resource.

Wellbeing assessment is a tool to measure human and ecosystem sustainability. The method had been tested and applied by (International Union for Conservation of Nature and Natural Resources (IUCN) and the International Development Research Centre (IDRC). The method is compile the 4

indexes: Human Wellbeing Index (HWI), Ecosystem Wellbeing Index (EWI), Wellbeing Index (WI), and Wellbeing/Stress Index (WSI) or human wellbeing to ecosystem stress.

Wellbeing assessment is different with other sustainable assessment, which is focusing in human and ecosystem and visualize in a graph. The graph is barometer of sustainability that show state scale to display people and environment wellbeing. Table 2 shows the comparison of 4 methods of sustainabiliy assessment.

Table 2. The Comparison of sustainability assessment.

Sustainability Assessment	Sustainable Development	Ecological Footprint	Environmental Sustainability Index	Wellbeing Index
Scope	4 dimensions: Environment, economy, social and institution	1 dimension: Environment	3 dimensions: Environment, social and economy	2 dimensions: Human and ecosystem
Strength	Comprehensive	Communicative because the value reflect reverse of natural resources	The index shows how society must act in order to be more sustainable	Barometer sustainability as a communicative information
Weakness	Complicated and require data processing	Other dimension could not be described	The index does not shows condition as a whole	Few of information is excluded in calculation

3.2. Identification wellbeing index in Majalengka Regency

Table 3 present the wellbeing index of Majalengka Regency. The score of human wellbeing index (HWI) of Majalengka Regency is 79 while ecosystem wellbeing index (EWI) is 71. Then, wellbeing index (WI) is 75 whereas wellbeing stress index (WSI) is 2.72. Human development index (HDI) in Majalengka Regency in 2016 was 65.25 [16]. The difference score between HWI and HDI due to in HDI only three aspects i.e. education, health and income of the people. The HWBI can help decision makers to integrate factors of health, social & economy, environment, and ecology to raise the level of sustainability. Therefore the decision makers may comprehend the effects on sustainability of unconventional programs [17].

Figure 1 shows the sustainable barometer of Majalengka Regency is in the blue area or in the almost sustainable range. For WSI equal to 1.0 implies that the ecosystem stress is beyond human wellbeing state [7]. The WSI in Majalengka is 2.72, this index shows that Majalengka is in medium to OK level of sustainability.

Table 3. Wellbeing index in Majalengka regency.

Index	Score
Human wellbeing	79
Ecosystem wellbeing	71
Wellbeing	75
Wellbeing stress	2.72

Wellbeing index to assess sustainable regional development had been conducted in Brazil in 2013 [18]. Touros municipality in Brazil was in a medium level of sustainability according to Barometer of sustainability. The HWI in that area was 48 point, EWI was 65 points, wellbeing /stress index was just 1.37, that means that state of people wellbeing is 1.37 time bigger than the stress caused by

environment system. Similar research conducted in Ribeirão Preto, Brazil, the score of HWI was 64 and EWI was 41. In this area human dimension was in better performance [19].
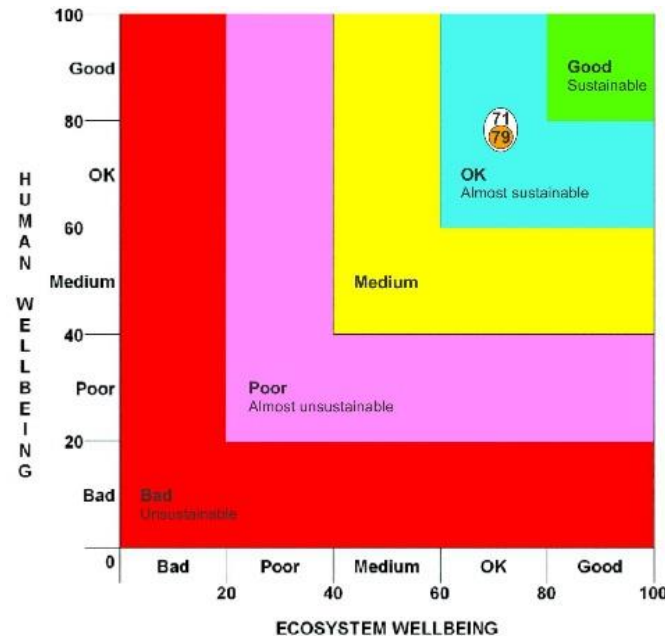

Figure 1. Sustainable barometer of Majalengka Regency.

4. Conclusion

After comparing four methods of sustainability asessment, the wellbeing index is the most appropriate in assesing sustainable regional development. The wellbeing index has effectively demonstrated the sustainability assessment of regional development. Sustainable regional development in Majalengka Regency can be obtained by using wellbeing index. The score of human wellbeing index (HWI) in Majalengka Regency is 79; in the other hand, ecosystem wellbeing index (EWI) is 71. Therefore, Majalengka wellbeing index is 75; and wellbeing stress index (WSI) is 2.72. The value of WSI is between OK and medium band, this shows that the pressure to increase human wellbeing has not override ecosystem pressure. In the barometer of sustainability, the position of HWI and EWI is the medium position, this is in the blue area or "almost sustainable" for both ecosystem and human system (households). This result can be used by Majalengka stakeholders in creating policy in regional development.

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