SUSTAINABLE DEVELOPMENT IN INDONESIAN REGIONS: TOWARDS AN ASSESSMENT

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Abstract: Sustainable development has attracted much attention among economists and policy makers. Yet, there are few studies of sustainable development measures, particularly in Indonesian regions. This paper contributes to the literature by developing sustainable development indicators for Indonesian regions and presents an empirical assessment of sustainable development at the provincial level. Specifically, this paper reviews economic theories of sustainable development and then applies a composite index method to examine relevant indicators of sustainable development for the Indonesian regions. Various scenarios are explored to accommodate variations in Indonesian regions namely economic, social, environmental and institutional aspects of sustainable development. The finding shows the increasing trends of sustainable development level, even though there are issues about equality among the Indonesian provinces. The other result indicates that development in Indonesia emphasizes short term goals by focusing on the economic and social aspects of sustainable development and tends to ignore environment aspect.

Key words: Sustainability; sustainable development indicators; composite index; scenario analysis; regional indicators; Indonesia

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1. Introduction

In economic development, there is a trade-off between boosting economic growth and conserving the environment. Economic development which does not aim for environmental preservation may have negative impacts on the environment because of the limited capacity of the environment and risk the economic future of a nation in the long term. Concern about economic growth and sustainability was first raised by Malthus (1798) when he addressed the limitation of natural resources to satisfy the vast growth of population in England (Fauzi and Oxtavianus, 2014). Much later, Meadows et al. (1972) concluded that economic growth will be limited by the scarcity of natural resources and there will be no sustainable flow of services and goods.

This paper reviews the existing literature on sustainable development including the underlying economic theories, relevant indicators of sustainable development and economic models addressing sustainable development. The relevance of these issues in the Indonesian context is discussed and a composite index method is used to examine relevant indicators of sustainable development at provincial level in Indonesia. Four different scenarios are used to capture the variations in various natures of Indonesian provinces in terms of four sustainable development aspects, specifically economic, social, environmental and institutional aspects.

2. Literature Review

Sustainable development was first addressed at the United Nations Conference on the Human Environment in Stockholm in 1972 (Rogers et al., 2006). The discussion focussed on how to boost the economy without harming the environment. The concept was explored further in the World Conservation Strategy prepared by the United Nations Environment Programme (UNEP), the International Union for Conservation of Nature and the Natural Resources (IUCN), and the World Wide Fund for Nature (WWF) in 1980 and again at the UNEP summit in Nairobi, Kenya in 1982 (Elliott, 2006). One key result was the

establishment of a special council under the United Nations (UN), called the World Commission on Environment and Development (WCED). In 1987, the concept of Sustainable Development was formally defined in a WCED Report as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Today, this definition of sustainable development continues to be debated. Several scholars argue that the definition is too general, ambiguous and difficult to implement (O'Riordan, 1995; Mawhinney, 2002; Holmberg & Sandbrook, 1992; Lélé, 1991). Others are still keen to operationalise the definition. Some of them look at it as an issue associated with the intergenerational environment and economic sustainability (Rogers et al., 2006; Elliott, 2006), while others view it as an issue of equity and balance (Soubbotina, 2004). Ene et al. (2011) suggests that sustainable development concurrently examines the presence of environmental fortification and economic improvement from global and long term position. From these different points of view, it can be concluded that sustainable development is related to equity, economic sustainability, and environmental protection in the long term.

2.1. Defining Sustainability

Economists have different views of the meaning of sustainability. Before defining sustainability, they tried to distinguish the difference between growth and development. Daly (1990) correlated growth with physical characteristics and development with qualitative improvement. He saw growth as something caused by natural processes like assimilation or accretion, and development as something that expands capacity. Daly concluded that growth is not sustainable in the long term and suggested sustainable development. Daly (1990) mentioned two principles of sustainability. The first is sustainability in yield, when the yield rate same with the number of new generation born. The second is the rate of natural ability to reduce waste also the same with the number waste produced. These two principles which

related with regenerative and assimilative capacity are regarded as natural capital and in order to meet the sustainability, these two capacities must be maintained. Asheim (1993) stated that sustainable development requires sustainability of resource management over generations and Pezzey (1997) who noted sustainability is attained when human well-being trend is not decreasing. Alisjahbana and Yusuf (2003) also adopted the definition of sustainability as a non-declining welfare per capita of human being, by using capital as the basis of the measurement.

More recently, the definition of sustainability has been extended to distinguish weak sustainability from strong sustainability. Two neoclassical economic scholars, Solow and Hartwick, introduced the term weak sustainability to explain how natural capital can be replaced by man-made capital (Davies, 2013). In contrast, strong sustainability refers to man-made capital that cannot replace natural capital (Davies, 2013; Neumayer, 2003).

These two schools of thoughts have at least three common backgrounds (Davies, 2013). The first is there is common understanding about the meaning of capital as "stock that provides current and future utility". The second argument is that the capital will be transferred to the next generations. The third is both weak and strong sustainability are having temporal dimension.

There are several arguments on how to deal with these two concepts. Weak sustainability view sustainability from a neoclassical economic theory viewpoint and capital accumulation which includes non-renewable resources. Strong sustainability view sustainability stands from the notion of steady-state economy. In weak sustainability, the natural capital can be substituted by man-made capital, while strong sustainability does not substitutable. In strong sustainability, sustainability can only be reached if each of the two kinds of capital stock i.e. natural and man-made capital can be preserved. In weak sustainability, it requires the overall stock of capital due to its substitutability.

2.2. Sustainable Development Indicators

Different institutions almost have the same perspective about the aspects that underpin sustainable development. UN via Commission on Sustainable Development (CSD), European Union (EU) and Central Statistics Agency of Indonesia (UN, 2007; EU, 2013; Central Statistics Agency, 2014) outlined four aspects of sustainable development: economic, social, environmental and institutional aspects. OECD looked at only socioeconomic and environmental aspects (Table 1).

Table 1: **Aspects of Sustainable Development**

Institutions	Economic	Social	Environmental	Institutional
UN (2007)	√	√	√	√
OECD (2001)	√*		√	
EU (2013)	√	√	√	√
Central Statistics Agency (2013)	√	√	√	√

* Socio-economic aspect

Any discussion of sustainable development without consideration of appropriate indicator remains incomplete. Sustainable development indicators (SDI) should be management tools (United Nations, 2007), evaluation criteria (OECD, 2001; United Nations, 2007; Pintér et al., 2005), and a means to deliver ideas and values (United Nations, 2007; European Union, 2013). SDI should be supported by operational definitions (Rennings and Wiggering, 1997), related to policy priorities, flexible, and communicable (European Union, 2013; Pintér et al., 2005).

The UN (2001) via CSD provides a framework for countries to determine their own SDIs. This framework requires the themes and sub-themes of each SDI to be determined. There are six themes (equity, health, education, housing, security and population), three economic themes (economic structure, consumption and production patterns) seven

environmental themes (atmosphere, land, oceans, seas and coasts, fresh water and biodiversity) and two institutional themes (institutional framework and institutional capacity).

Other institutions use different SDIs. The Department of Economic and Social Affairs of the United Nations Secretariat (UN-DESA) assesses 50 core SDIs (United Nations, 2007). OECD (2001) considers two main sets of indicators – environmental and socio-economic, Pintér et al. (2005) proposed four main indicators covering institutional, economic, social and environmental factors. Institutional indicators comprised conflict, refugees, and governance. The social indicators were represented by gender equality, HIV/AIDS and malaria, and the economic indicators by tariffs. The environmental indicators included risk of soil degradation, vulnerability to climate change, and biodiversity weighted land use change. The EU (2013) uses 12 leading SDIs.

In the economic aspects, four institutions view that macroeconomic in terms of GDP, either nominal or real GDP, can lead to sustainable economic development. Moreover, consumption and production patterns are looked relevant in the economic aspect. While UN and Indonesia agree that global economic partnership should be as the one of the theme, OECD and EU stress that productivity are more relevant to lead to economic indicator of sustainable development. OECD recognize that productivity should be more detail to describe the SDI which can be looked in the transport, energy, and agriculture sector as one key theme to lead to SDI. Yet, EU identifies that resource productivity as sub theme can represent the issue of productivity.

On environmental aspects, climate change, ozone layer depletion and natural resources (biodiversity) are commonly perceived as the theme that should be lead to SDI. While OECD observes energy and transport as theme in the economic aspect, EU recognizes these two sectors as theme in the environmental aspects of SDI. According to EU, renewable energy is valid to explain the climate change and energy issue in sustainable development.

Furthermore, it is interesting that OECD also include waste as one of theme, while the other institutions do not include it. In waste theme, OECD identifies that waste generation and recycling should be considered as sub theme.

Social aspect mostly represented by poverty and equity. This theme leads to the ability of people to maintain their level to adopt the economic and environmental changes. Demographics and poverty are seen by all institutions to represent social aspects. OECD which combines social and economic aspects of sustainable development perceived that social aspect will lead to the ability of society to produce and consume as well as enjoy the economic development. EU is on the different view with UN and Indonesia about demographics theme of sustainable development. EU interprets demographic should be detailed as employment rate of older workers, while UN and Indonesia recognize demographic as level of population as well as tourism.

Institutional aspects of sustainable development represent governance. While UN and Indonesia see governance focuses on level of corruption and crime, EU perceives governance on the effectiveness of policy, public openness and economic instruments. EU also looks that institution aspect also focus on global cooperation, ODA particularly.

2.3. Studies of Sustainable Development Indicators in Indonesia

There have been several studies of SDI in Indonesia. These include studies of environmentally adjusted national income (EAAI), the system of integrated environmental and economic accounting (SEEA), genuine saving, Eco Region Domestic Product (ERDP), and (5) Composite Sustainable Development Index (CSDI).

EAAI was firstly introduced by Repetto et al (1989). Supported by World Research Institute (WRI), EAAI measures the SDI basically by determining the changes of the stocks of natural resources including oil, forestry and soil into the capital and flow account. By subtracting the estimates of net natural resources depreciation from GDP for the three

products, the study defines net domestic product as the representative of SDI for Indonesia. The study with Indonesian data from 1970 to 1984 concluded that even though the GDP growth from 1970 to 1984 was at 7.4% but the net domestic product/ growth rate only reached 4.0% annually. This is due to that GDP growth actually counts on the depletion of natural resources.

The SEEA (Gustami, 2012) was firstly compiled in 1997 until 2010 based on the methodology recommended by UNSD (United Nations Statistics Division). The study prepares the sustainability of Indonesia based on the asset account in terms of physical and monetary aspects of the selected environment assets such as timber, crude oil and gas, coal, as well as other minerals (bauxite, tin, gold, silver and nickel). The system is broader than the previous study on national income in the sense that the national assets counted are wider. The system explains the information of mainly on stock of environment assets, assets live and depletion of natural resources. The main result is to develop indicator which adjusts the conventional GDP with somewhat environmentally adjusted GDP. According the result of the study for 2007 until 2010, Net Domestic Product (GDP minus Depletion and Degradation) corrected to about 10% from conventional GDP.

The study on Genuine Saving was conducted by Alisjahbana and Yusuf (2003). The study was adopting the weak sustainability concept which defines sustainability as non-declining welfare per capita. The study uses genuine savings and change in wealth per capita as indicator of sustainable development.

The study concludes that change in wealth per capita during 1980 until 2000 was not sustainable. The result found that the shifting in the economy from oil and gas reliance to secondary and tertiary sector gives a positive impact in the long term. The study also found that economic crisis may reduce the savings rate and depletion of natural resources and hamper the positive trend of sustainability. Furthermore, the study recommends a more

appropriate management in mineral, forestry and environmental degradation, because these 3 sectors will be an issue in the future.

Study to develop ERDP was conducted by Yusuf (2010) for 30 provinces in Indonesia for 2005.

It is purposed that by calculating ERDP, the sustainable development indicator which is represented by ratio of ERDP over brown GRP can be determined for each province. The study found the lowest ERDP value comes from provinces that are deeply reliant to natural resources. According to this paper, there are at least 5 provinces are not sustainable due to their reliance to the natural resources to support their economy. Thus, the policy implication is that the government should apply the sustainable development agenda as well as increasing economic productivity.

Studies on preparing SDI for Indonesia were also conducted by applying composite index which was initiated by OECD in 2008 (OECD, 2008). The same approach was also applied by Indonesian scholars to determine the SDI in Indonesia, among others are Fauzi and Oxtavianus (2013), Oxtavianus (2014), Fauzi and Oxtavianus (2014). The composite index is a set of indicators or sub-indicators which do not have measurement units. Each composite index can be regarded as a model, and formulation must follow a series of certain steps that resulting composite index to be useful and generally applicable.

In the study by Fauzi and Oxtavianus (2013), the CSDI was developed based on 3 different variables which are GRP (Gross Regional Product) to represent economic aspect/dimension, Human Development Indicator (HDI) for social dimension and Environment Quality Index for the environmental dimension. The study was conducted into 2 scenarios. The first is equal weight for each indicator, and the second is the same weight between dimensions of development. As the result, the study concluded that sustainable development in Indonesia reached about two-thirds of the maximum target. The high

progress in economic and social aspects was corrected by environmental degradation. However, progress in the economic and social aspects seems to put pressure on the environment.

There are two most recent studies concerning CSDI in Indonesia i.e. Fauzi and Oxtavianus (2013) and Oxtavianus (2014). Both of these studies apply descriptive analysis to get an overview of early stage of development in Indonesia. The initial conditions used to review the various aspects of the economic, social, environmental and institutional. Initial overview indicates that development in Indonesia is still very oriented to economic and physical development. This is shown in the achievement of economic development are quite high, which is characterized by a fairly high level of GDP in a few years earlier. In addition, physical development also showed a pretty good improvement. It can be seen from the rising value of the HDI. But both of these studies also found that an indicator required to describe the condition of sustainable development in Indonesia. It is hoped that by obtaining the appropriate indicator, it will assist policy makers in determining the direction of development at a later stage.

Fauzi and Oxtavianus (2013) apply two kinds scenarios i.e. (i) same weight among indicators and (ii) same weight among aspects. The first scenario was applied with consideration that all indicators have the same impact to the level of sustainability in Indonesia. While in the second scenario, it is assumed that the environmental and social aspects should be weight more to be equal with economic aspect, thus the indicators in environmental aspect was weighted 3 times and social aspect 2 times. The overall indicators in scenario 2 were divided by 6.

In study by Fauzi and Oxtavianus (2013), each aspect of sustainable developments was constructed based on indicators that have been provided by Central Statistics Agency, i.e. GRP for economic aspect, HDI for social aspect and EQI for environmental aspect. While in

Oxtavianus (2014), the indicators were selected based on the data availability and were constructed based on second order confirmatory factor analysis. The analysis finally selected 9 indicators to construct SDI. Fauzi and Oxtavianus (2013) found that the SDI in Indonesia in 2011 was 69.02 under scenario 1 and 68.81 under scenario 2. On the other hand, Oxtavianus (2014) was more optimistic and found that in 2011, SDI in Indonesia is 80.03 and became 82.42 in 2012. Both studies conclude that the developments in Indonesia are still imbalance between economic, social, environmental and institutional aspects. On the other hand, it is also concluded that the level of sustainability in Indonesia is more about short term perspectives and not the long run ones. Moreover, development may also lead to a decline of social capital in more advance province.

Based on those previous studies, it can be concluded that the previous composite index for sustainable development in Indonesia have several weaknesses. First, study by Fauzi and Oxtavianus (2013) did not include the institutional aspect of sustainable development. Second, in Fauzi and Oxtavianus (2013) and Oxtavianus (2014) absorbed limited indicator in estimating sustainable index. Fauzi and Oxtavianus (2013) only applied three indicators while Oxtavinaus (2014) applied nine indicators to construct the index. Third, both studies did not accommodate the difference between Java and Non-Java islands as well as the difference impact of province who has oil and gas and who do not have oil and gas in their GRP.

Based on the above considerations, this study attempts to compose sustainable development index at provincial level in Indonesia by adopting composite index method. Several adaptations were made, namely 20 indicators were adopted, and several scenarios which accommodate the difference between Java and Non-Java islands as well as the difference between total GRP and GRP without oil and gas.

3. Methodological Issues

In this study, composite index (CI) approach is applied. CI is recognized forits practicality in presenting performance indicator and providing signal of required policy intervention (Jacobs et al., 2004). There are several advantages of applying CI (i) CI may focus on key policy matters (Jacobs et al., 2004; Michalos et al., 2011), (ii) it simplifies the presentation of big problem into a simple format (Jacobs et al., 2004; Michalos, 2011, Baptista, 2014), (iii) it is informative (Jacobs et al., 2004; Michalos, 2011; Baptista, 2014), (iv) it provides trends for many different indicators for different time, regions and populations (Michalos, 2011; Baptista, 2014).

Moreover, for technicality reasons CI is applied in this study due to two reasons. The first is that CI approach has been widely applied and used in several empirical studies (Jacobs et al., 2004; OECD, 2008; Kondyli, 2010; Michalos, 2011; Fauzi and Oxtavianus, 2013; Baptista, 2014 and Oxtavianus, 2014). The second is that most of data are available and collected in a book entitled indicators of sustainable development (Central Statistical Agency, 2004 - 2014). Thus, in order to construct the composite index, each of indicators was grouped based on theme and sub-theme following UNCSD method (UNCSD, 2001). The indicator selection was also conducted based on the data availability. The indicators are grouped into four aspects as shown in Table 2. One important thing to understand is that the CI structure must always be checked and developed again according to the situation and condition over period (Baptista, 2014).

Table 2: Four Aspects of CSDI in Indonesia

No.	Theme	Sub Theme	Indicators	References
Economic Aspect				
1.	Economic development	Macroeconomic performance, sustainable public finance, employment, information and communication technologies, research and development, tourism	1. GRP per capita at constant price (with oil and gas; without oil and gas), 2. % of population aged 15 years and over who worked	UN (2001), UN (2007), Central Statistics Agency (2014), Kondyli (2010), Oxtavianus (2014) UN (2001), UN (2007), Kondyli (2010), Oxtavianus (2014)
2.	Global economic partnership	Trade, external financing		
3.	Consumption and production patterns	Material consumption, energy use, waste generation and management, transportation		
Environmental Aspect				
1.	Natural hazards	Vulnerability to natural hazards, disaster preparedness and response		
2.	Atmosphere	Climate change, ozone layer depletion, air quality	3. % of households that use LPG for cooking 4. Estimates of CO2 emissions from motorized vehicle, 5. Environmental Quality Index	Central Statistics Agency (2014) UN (2001), UN (2007), Central Statistics Agency (2014), Kondyli (2010), Oxtavianus (2014) Oxtavianus (2014)
3.	Land	Land use and status, desertification, agriculture, forests		
4.	Oceans, seas and coasts	Coastal zone, fisheries, marine environment		
5.	Freshwater	Water quantity, water quality		
6.	Biodiversity	Ecosystem, species		
Social Aspect				
1.	Poverty	Income poverty, income inequality, sanitation, drinking water, access to	6. % of poor people,	UN (2001), UN (2007), Central Statistics Agency (2014), Kondyli

		energy, living conditions	7. % dependency ratio	(2010), Oxtavianus (2014) UN (2007), Central Statistics Agency (2014), Kondyli (2010), Oxtavianus (2014)
2.	Health	Mortality, health care delivery, nutritional status, health status and risks	8. % infant mortality, 9. % life expectancy, 10. % HH manages sanitation, 11. % HH using clean water, 12. % women using birth control,	UN (2001), UN (2007), Central Statistics Agency (2014), Kondyli (2010), Oxtavianus (2014) UN (2001), UN (2007), Central Statistics Agency (2014), Kondyli (2010), Oxtavianus (2014) Central Statistics Agency (2014) Central Statistics Agency (2014) UN (2001), UN (2007), Central Statistics Agency (2014), Oxtavianus (2014)
3.	Education	Education level, literacy	13. % net enrolment rate of elementary school, 14. % net enrolment rate of junior school, 15. % net enrolment rate of high school,	Central Statistics Agency (2014) Central Statistics Agency (2014) Central Statistics Agency (2014)
4.	Demographics	Population, tourism	16. Total Fertility Rate	UN (2007), BPS (2014), Kondyli (2010), Oxtavianus (2014)
Institutional Aspect				
1.	Governance	Integrating environment and development in decision-making, Science for sustainable development , International legal instruments and mechanisms, Information for decision-making, Strengthening the role of major groups	17. % houses connected to phone, 18. % HH accessing internet within last 3 months, 19. Ratio women participation in the school to the men participation in the school, 20. Ratio of women wages to men wages.	UN (1996) UN (1996) Oxtavianus (2014) Oxtavianus (2014)

3.1. Estimation Procedure

In this study, CI is estimated according to seven steps following similar procedure adopted by OECD (2008), Kondyli (2010), Fauzi and Oxtavianus (2013), and Oxtavianus (2014). The seven steps include:

Step 1: Preparation of a theoretical framework.

The theoretical framework is a conceptual model that relates how theories are developed or the logic of the connection of several factors that is considered important to the problem. The theoretical framework must accurately define the phenomenon to be measured and the elements that compose them. Furthermore, the theoretical framework will be able to identify the important variables that are relevant to the definition of the problem. That framework also needed to provide a strong basis for the selection and combination of different indicators into a composite indicator.

Step 2: Identification of indicators

The indicators used should be selected based on the level of reliability, availability related, spatial coverage, relevancy with the theme and their relationship to one another. The use of proxy variables should be considered when data is difficult to obtain.

Step 3: Imputation of missing data.

Three methods are available for cases with missing data: a) to exclude records with missing data, b) single imputation (e.g. replacement of the regression, the average or median) and c) multiple imputation (e.g. Monte Carlo algorithms). This study uses a single data imputation method.

According to table 3, Fauzi and Oxtavianus (2013) employs three different SDI aspects which are economic, environmental and social, while Oxtavianus (2014) add institutional aspect in his study. To find the single indicator, Fauzi and Oxtavianus have two scenarios i.e. first, same weight among indicators and second, same weight of dimensions. In

the same weight among indicators, the three indicators were weighted equally. In the second scenario, the same dimension is obtained by assigning different weights to each of the indicators or dimensions of the weight 1 on the economic dimension, weight 3 on the social dimension and weight 2 on the environmental dimension. After giving weight to each dimension, then all the dimensions were divided by 6. Oxtavianus (2014) composes single scenario by weighting the value of the loading factor based on confirmatory factor analysis models. The weight of the indicator is calculated by determining the proportion of the absolute value of factor loading of each indicator over the total loading factor on each dimension. Furthermore, the dimensional weight is calculated based on the proportion of the absolute value of each dimension loading factor in preparing the composite index.

Table 3: Comparison of this study and previous CSDI

	Fauzi and Oxtavianus (2013)	Oxtavianus (2014)	This study
SDI aspects	3	4	4
Applied years	3 years (2009 – 2011)	6 years (2007 – 2012)	11 years (2003 – 2013)
Weight (scenarios)	Same aspects and same indicators	Same aspects	Same aspects and same indicators – based on Java and non-Java provinces
Number of indicators composed	3	9	20

Step 4: Normalization of data,

Normalization is needed because of differences in the units of measure of the indicators selected. Normalization process will produce comparable indicators. Normalization of indicators is done to maintain comparability between indicators. Normalization is emphasized for indicators that are not in percentage terms.

Step 5: Determination of weights,

Weights greatly affect the output of the composite indicator. Moreover, the indicator should be weighted according to the underlying theoretical framework or based on empirical analysis, but also can be done by taking into account the expert opinion or public opinion.

Step 6: Aggregation.

Aggregation of indicators can be linear, geometric or may be based on a multi-criteria analysis. In both linear and geometric aggregation, weights express the trade-off between the indicators, while multi criteria analysis to find a compromise between two or more of the stated goals. This study uses a linear aggregation.

Step 7: Presentation and dissemination.

Composite indicators should be able to give an accurate picture to decision makers and stakeholders. The graphical representation of a composite indicator should indicate areas that require policy intervention.

3.2. Empirical Issues

The indicators used in this study are presented in Appendix B. In this study, normalization is conducted by using the maximum-minimum method. References are used in determining the maximum and minimum values. For example, for GDP per capita, the maximum value refers to the target GDP per capita in the National Medium Term Development Plan (RPJMN) 2010-2014, while the minimum value refers to the urban poverty line in 2000. More detailed information on the maximum and minimum values of each indicator is described in Table C. In order for the normalized value between 0 and 100, the maximum and minimum use in this method also brings some consequences. The first consequence, while the indicator value below the minimum value, normalized value is set at 0. Otherwise, the second consequence, for indicators that are exceeding the maximum value,

normalized value is set at 100. Normalization of data and weight in this study are presented in Appendix C.

There are four scenarios in determining SDI for Indonesia, with consideration of weighted Java Island and non-Java Island, and comparison between total GRP as well as GRP minus GRP from oil and gas. These four scenarios are:

Scenario 1: All indicators equally weighted

$$CSDI = \frac{1}{n}\sum_{i=1}^{n} xi \quad ; n = 26, x_1 = \text{total GRP}$$

Scenario 2: All indicators equally weighted and GRP is total GRP minus GRP from oil and gas

$$CSDI = \frac{1}{n}\sum_{i=1}^{n} xi \quad ; n = 26, x_1 = \text{total GRP minus GRP from oil and gas}$$

Scenario 3: The Environmental and Social aspects of provinces in Java will be weighted more than Economics aspects. Non-Java Island will be weighted more on Economic than the other two aspects. In this scenario, GRP is total GRP.

CSDI Indonesia = (7*CSDI Java + 26*CSDI non-Java)/33

CSDI Indonesia = $[7*((Ec_j + 2Soc_j + 2Env_j + Inst_j)/6) + 26*((2Ec_{nj} + Soc_{nj} + Env_{nj} + 2Inst_{nj})/6)]/33$

Scenario 4: The Environmental and Social aspects of provinces in Java will be weighted more than Economic and Institutional aspects. Non-Java Island will be weighted more on Economic than the other two aspects. In this scenario, the GRP is total GRP minus GRP from oil and gas.

CSDI Indonesia = (7*CSDI Java + 26*CSDI non-Java)/33

CSDI Indonesia = $[7*((Ec_{jw} + 2Soc_j + 2Env_j + Inst_j)/6) + 26*((2Ec_{njw} + Soc_{nj} + Env_{nj} + 2Inst_{nj})/6)]/33$

where

CSDI = sustainable development indicator composite index

CSDI Java = sustainable development indicator composite index – Java

CSDI non-Java = sustainable development indicator composite index – Non Java

Ec_j = Economic aspect indicator for Java

Soc_j = Social aspect indicator for Java

Env_j = Environmental aspect indicator for Java

Ins_j = Institutional aspect indicator for Java

Ec_{nj} = Economic aspect indicator for non-Java

Soc_{nj} = Social aspect indicator for non-Java

Env_{nj} = Environmental aspect indicator for non-Java

Ins_{nj} = Institutional aspect indicator for non-Java

Ec_{jw} = Economic aspect indicator for Java (GRP without oil and gas)

Ec_{njw} = Economic aspect indicator for non-Java (GRP without oil and gas)

The distinction between GRP total and GRP without oil and gas was recommended by Fauzi and Oxtavianus (2013), in order to know the magnitude of oil and gas in SDI. While, the two latter scenarios are suggested by Oxtavianus (2014) where for the next CI, in order to meet the same dimension among SDI variable (aspects), weighting should also count the different between Java and non-Java provinces. This is due to consideration that Java will be high in the economic aspect value but will be low in the environmental and social aspects. While in non-Java Island is otherwise. It suspected that in non-Java island, the environmental and social aspects will be high and economic aspect will be low. Thus, it is expected that the index resulted will be balanced. Meanwhile, Fauzi and Oxtavianus (2013) gave a weight of three for social aspect and two for environmental aspect. This study gives a weigh of two for

social and environmental aspects in Java and two for economic and institutional aspects in non-Java. Under this scenario, it is assumed that the economic and institutional aspects quality in Java will be better than that in non-Java. On the other hand, the social and environmental quality in non-Java is considered to be worse than that in Java.

4. Preliminary Analysis

For several years, Indonesia has experienced significant economic growth. The growth was also supported by the growth in the regional level. However, there should be a concern how the economic growth gives impact to environmental and social conditions.

Bellows are preliminary analysis related to the economic, environmental and social performance of Indonesia during 2002 to 2013. In the discussions, it is presented three regions i.e. Java, non-Java and Indonesia to compare the different development of each aspect of sustainable development in different regions. Moreover, Indonesian regional division into Java and non-Java is based on the tendency that economies in Java are more advanced than in non-Java. While on the other hand, the environment quality of non-Java is better than Java. Thus this will be used to weight each aspect in applying different scenarios in developing CSDI in Indonesia. The distinction of the regions between Java and non-Java was also suggested by Oxtavianus (2014).

4.1. Economic Aspect

The economic aspect of CSDI consists of two indicators i.e. GRP per capita at constant year 2000 and percentage of population aged 15 years and over who worked. In this study, the GRP is distinct by GRP in total and GRP without GRP from oil and gas. The economic aspect of Java is derived from the average value of 7 provinces i.e. Jakarta Special Region, West Java, Banten, Central Java, Yogyakarta Special Region, East Java, and Bali. Moreover, the non-Java value is the average value of 26 provinces outside Java island. Economic aspect of Indonesia is the weighted average value of Java and non-Java.

$$EcA = \frac{(x1 + x2)}{2}$$

Where

EcA = economic aspect

x1 = normalized GRP per capita (constant year 2000) ($0 \leq x1 \leq 1$)

x2 = percentage of population aged 15 years and over who worked

n = 2

In general, the economic aspect of sustainable development shows an increasing trend from 2002 to 2013. It is produced from their constituent indicators which show improved results both GDP and the indicator percentage of population aged 15 years and over who worked.

In Figure 1, using the total GRP, in 2002, the economic aspects of sustainable development reached 70% for the island of Java and 67% for non-Java, but in 2013, the figure had reached 83% for Java and 78% for non-Java. While in national level, in 2002, the economic aspects achieving 68% and to 79% in 2013. This upward trend is in accordance with previous studies conducted by the Fauzi and Oxtavianus (2013) and Oxtavianus (2014). Both studies use the same GDP per capita by the year 2000 as the base indicator for the economic aspects so as to have the same numbers. According to two studies, in 2007, Java experience achievement on the economic aspects by 40% while in 2012 has reached 59%. Furthermore, non-Java reached 35% in 2002 and 54% by 2012.

In Figure 2, using the GRP without GRP of oil and gas, the economic aspects of the sustainable development of Java reached 69% in 2002 and 82% in 2013. Moreover, non-Java reached 65% in 2002 and 76% in 2013. While on average, Indonesia reached a value of 66% in 2002 and 78% by 2013.

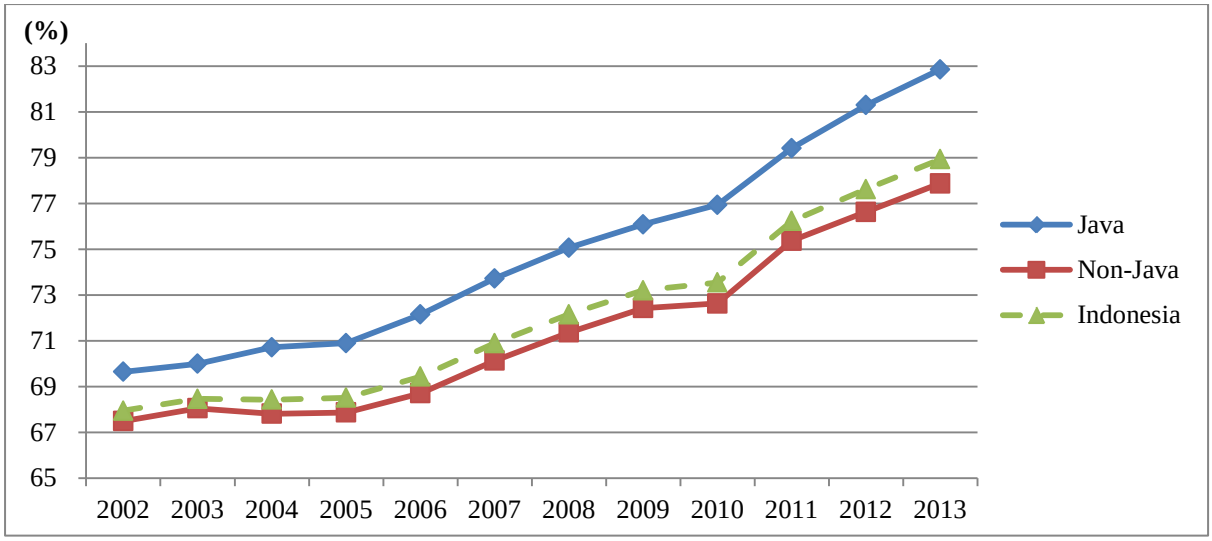

Figure 1 Economic Aspect (EcA) with total GRP, 2002 - 2013
Source: Authors' own estimates by using raw data from Central Statistics Agency (various years).

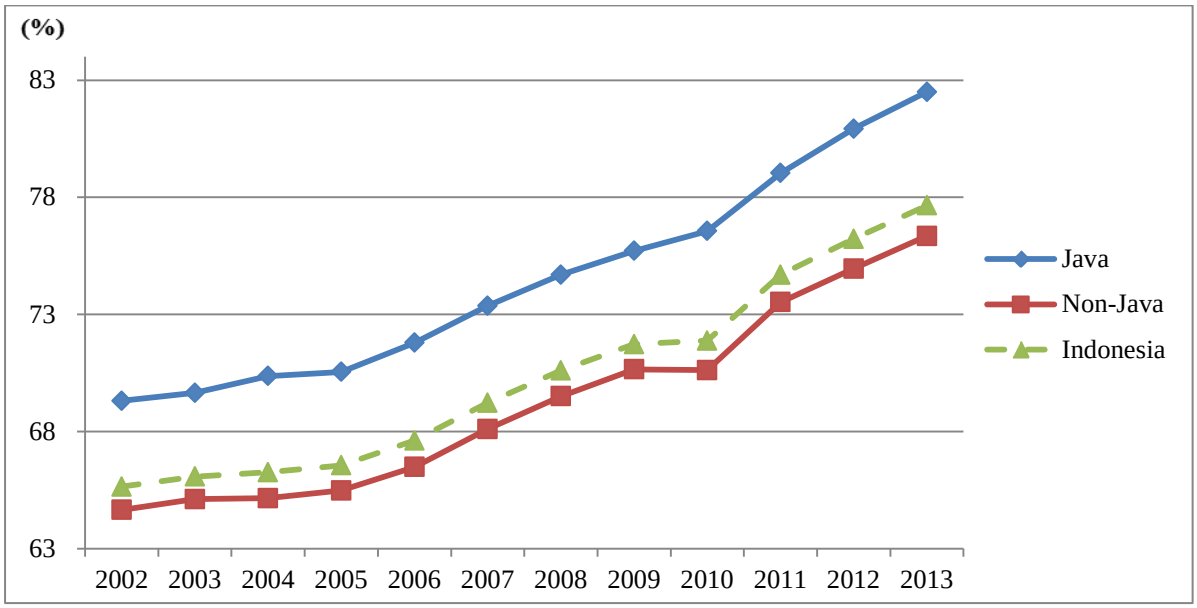

Figure 2 Economic Aspect (EcA) with GRP without oil and gas sectors, 2002 - 2013
Source: Authors' own estimates by using raw data from Central Statistics Agency (various years).

Although there are differences in the results between the achievement of economic aspects of Java and non-Java, but it appears that the increased economic development in those two areas. The results suggest the policy maker to minimize the gap between economic development between Java and non-Java. It is expected to create a more equitable development.

On the other side, Figure 3 depicts the different achievement of GRP (constant price year 2000) for 33 provinces in Indonesia in 2002 and 2013. Almost all of the provinces experience growth, but overall, there was economic inequality among provinces. The highest GRP was achieved mostly by provinces with natural resources (oil, gas and forestry) and business centre like Jakarta Special Region, East Kalimantan, Riau Islands and West Papua. While provinces which has less natural resources and business activities are left behind in terms of economic development like Gorontalo, East Nusa Tenggara, Maluku, and Nusa Tenggara Barat.

The highest GRP was achieved by Jakarta Special Region both for 2002 and 2013 at 29 million rupiah in 2002 and 48 million rupiah in 2013. This region is characterized as capital city of Indonesia, as well as centre for business and administration. The lowest GRP was experienced by Gorontalo at 1.9 million rupiah in 2002 and East Nusa Tenggara at 2.98 million rupiah in 2013. Those both provinces are characterized as new province, non-Java, less natural resources, and less infrastructure. The highest growth was experienced by DKI Jakarta Special Region which increases by about 19 million rupiah from 2002 to 2013. On the other hand there is province experiences negative growth i.e. Aceh, Papua and East Kalimantan.

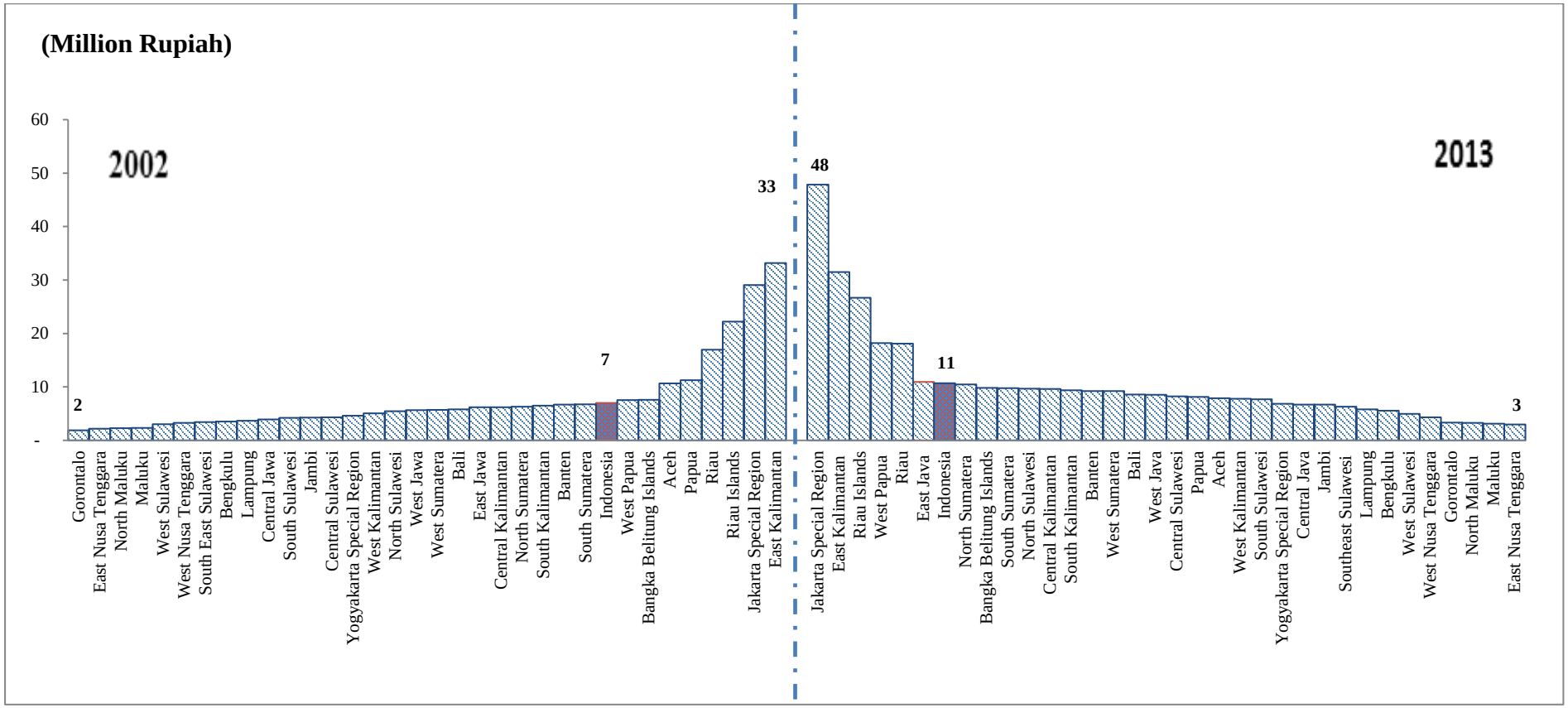

Figure 3 GRP per capita (constant price year 2000) per Province (2002 and 2013)
Source: Central Statistics Agency (2014)

4.2. Environmental Aspect

This aspect is derived from the weighted average value of some indicators which is the percentage of households that use LPG for cooking, level of CO2 from motor vehicles, and environmental quality index. These indicators are expected to be able to represent aspects of the environment in Indonesia in measuring the level of achieving sustained development.

$$EnA = \frac{x3 + x4 + 3x5}{6}$$

EnA = Environmental Aspect

x3 = percentage of households that use LPG for cooking

x4 = normalized level of CO2 from motor vehicles, ($0 \leq x4 \leq 1$)

x5 = environmental quality index

In this aspect, the environmental quality index was weighted 3 under this consideration. This index is the average of the air pollution index (Indeks Polusi Udara - IPU), water pollution index (Indeks Polusi Air - IPA) and forest cover index (Indeks Tutupan Hutan - ITH). Air pollution index uses indicators of SO2 and NO2 concentration in the air. Water pollution index uses indicators total suspended solids (TSS) concentration, dissolved oxygen (DO) and chemical oxygen demand (COD) in river water. Forest cover index is the percentage of primary and secondary forest to total forest area that has been designated by the Ministry of Forestry.

$$\text{IKLH} = \frac{(\text{IPU} + \text{IPA} + \text{ITH})}{3}$$

IKLH is presented in percentage. The percentage represents the achievement in improving the environmental quality in every province.

In Figure 4, it can be comprehended that the environmental quality getting worse during the period 2007 to 2012 for Java and non-Java island. In Java, the achievement was 53% in 2002 and although it had increased the environmental aspects of the performance

until it reaches about 55% in 2010, but the numbers has declined by 47% in 2013. Meanwhile, in the non-Java, the environmental aspect also indicates declining performance. Although it was stable for several years from 2002 at the level of 57% until 2007 at about 58%, but the achievement of the performance aspects of the environment would continue to decline to only about 50% by 2013.

By comparing Figures 3 and 4, it can be inferred that economic growth is apparently not good enough offset by the improvement in the environment. This is possible because of the high environmental exploitation support for economic growth in Indonesia. Furthermore, the high economic growth in Java was not supported by the improvement of environmental quality. While economic growth in Java is better than non-Java, Java environmental quality is worse than the non-Java.

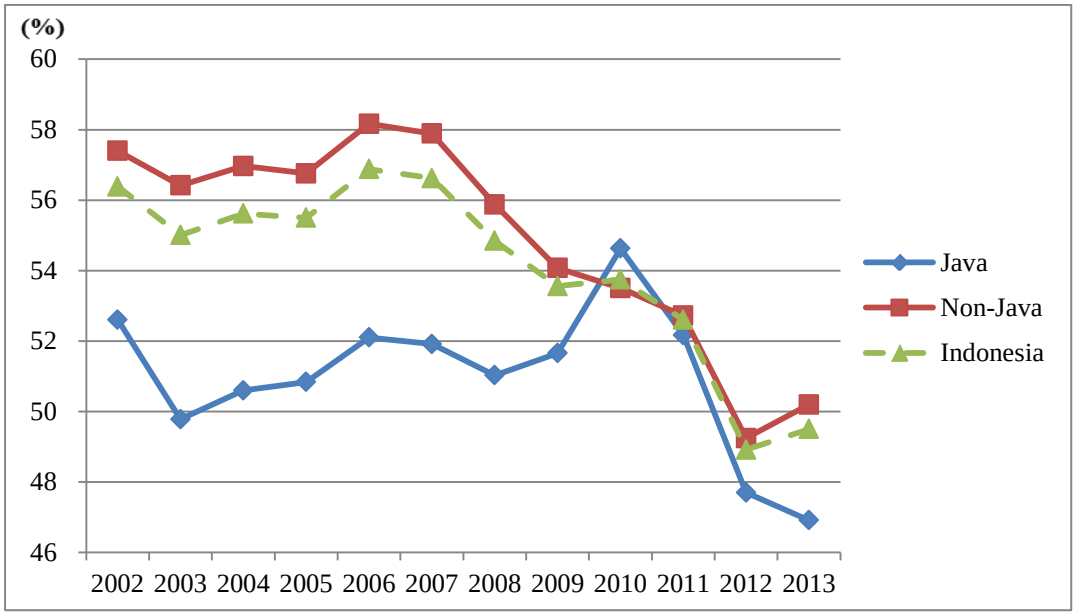

Figure 4 Environmental Aspect (EnA), 2002 – 2013
Source: Authors' own estimates by using raw data from Central Statistics Agency (various years).

4.3. Social Aspect

The social aspect is represented by 11 indicators consisting of the percentage of poor population, percentage of dependency burden, percentage of infant mortality, percentage of life expectancy, percentage of households that manages the stool, percentage of households

using clean water, percentage of women who use birth control, percentage of net enrolment rate of elementary school, percentage of net enrolment rate of junior high school, percentage net enrolment rate of high school and normalized ratio of total fertility rate. The social aspect value obtained from the average value of the indicator after normalized.

$$SA = \frac{1}{\mathrm{n}} \sum_{i=6}^{16} xi$$

Where

SA = Social Aspect

x6 = percentage of poor population,

x7 = percentage of dependency burden,

x8 = percentage of infant mortality,

x9 = percentage of life expectancy,

x10 = percentage of households that manages sanitation,

x11 = percentage of households using clean water,

x12 = percentage of women who use birth control,

x13 = percentage of net enrolment rate of elementary school,

x14 = percentage of net enrolment rate of junior school,

x15 = percentage of net enrolment rate of high school,

x16 = normalized total fertility rate, ($0 \leq x16 \leq 1$)

n = 11

Figure 5 further depicts the achievement level of social aspect of sustainable development in Indonesia. Both regions show an increasing trend. It started with the point that the level of social aspect in non-Java island was lower compared to the Java island. From 2002 to 2013, the social aspect level increases both Java and non-Java island. The Figure

shows that the level of non-Java still cannot achieve the Java level, even though both Java and non-Java island has almost the same trend in the social aspect growth level.

In 2002, the level of the social aspects of sustainable development in Java reached 68%, while the non-Java reached 61%. However, in 2013 there was an increase of up to 75% in Java and non-Java 68%. Nationally, it has also shown an increase of 62% in 2002 to 70% in 2013.

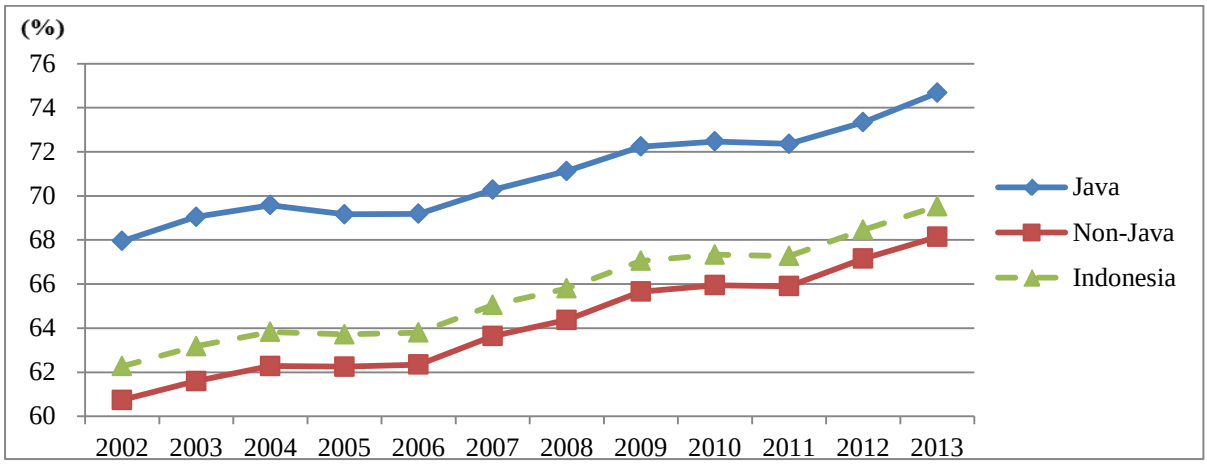

Figure 5 Social Aspect (SA), 2002 – 2013
Source: Authors' own estimates by using raw data from Central Statistics Agency (various years).

When compared with the results obtained by the Fauzi and Oxtavinaus (2013), in Java, the social aspect reaching 73% in 2009 and to 74% in 2012. Meanwhile, non-Java, in 2009 only reached 71% and reached 73% in 2012. Meanwhile, according to Oxtavianus (2014), in 2007 Java reached 79% and 81% in 2012. Non-Java reached 69% in 2007 and became 72% in 2012.

4.4. Institutional Aspect

Institutional aspect is based on four indicators i.e. percentage of homes connected to phone, percentage of households that access internet within the last three months, ratio of women participation in the school to the men participation in the school, and ratio of women wages to men wages.

$$IA = \frac{(\text{X17} + \text{x18} + \text{x19} + \text{x20})}{4}$$

Where

IA = Institutional Aspect

x17 = percentage of homes connected to phone

x18 = percentage of households that access internet within the last 3 months

x19 = ratio of women participation in the school to the men participation in the school

x20 = ratio of women wages to men wages

In general, the institutional aspects show performance improvement in both Java and non-Java (Figure 6). In Java, in 2002 the institutional aspects only reached 53% and became 61% in 2013. Meanwhile, non-Java, in 2002 only reached 51% and increased up to 56% on 2013. While in the national level, in 2002, the institutional aspects reached 52%, and increased to 57% in 2013.

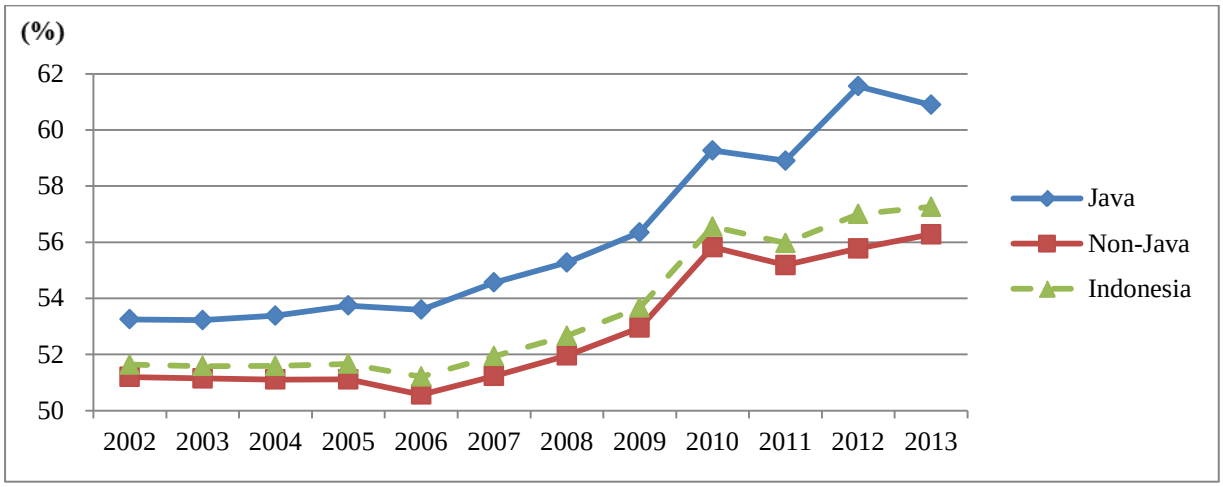

Figure 6 Institutional Aspect (IA), 2002 – 2013
Source: Authors' own estimates by using raw data from Central Statistics Agency (various years).

The above analysis shows that the development in Indonesia pays more attention to economic, social and institutional aspects but gives pressure to environment and less attention to equity.

5. Sustainable Development Index (SDI) for Indonesian Regions

The overall indexes are presented in Appendix D. Moreover, this section only presents scenarios 1 and 4. Scenarios 2 and 3 are discussed further in Appendix D. In general, based on four scenarios employed in this study, it shows an increasing tendency of sustainability index achieved among provinces in Indonesia over the period of study (2002 – 2013), but small numbers of provinces have opposite trend. The other general finding is imbalance in the increasing level of sustainability and the sustainability index itself. The high fiscal capacity will lead to high level of sustainability. The high fiscal capacity mainly drawn from a great transfer fiscal fund due to their high capacity in natural resources or the province with high locally-generated revenue. This confirms Wibowo (2011) that the poor provinces have difficulties in attaining their development target due to limitation in economic development and natural resources. The scenarios also support Tusianti (2013) and Fauzi and Oxtavianus (2013) that there was imbalance in each aspect of sustainable development. The conflicting and complementary interactions between the economic, social and environmental aspects of sustainable development are viewed as the main factors of the hardships in achieving balanced development in Indonesia.

5.1. Scenario 1

In 2013 (Figure 7), there are four provinces achieved its sustainable development index more than 70, which are Riau Islands, East Kalimantan, Jakarta Special Region and South Sulawesi. In 2012 and 2013, those provinces are among the province that has the biggest regional budget. On the other hand, there are eight provinces have sustainable development index below 60. Those provinces are West Nusa Tenggara, Papua, South East Sulawesi, West Sulawesi, Gorontalo, North Maluku, Maluku and East Nusa Tenggara. The low score of the sustainability are reflected from the low regional budget of those provinces.

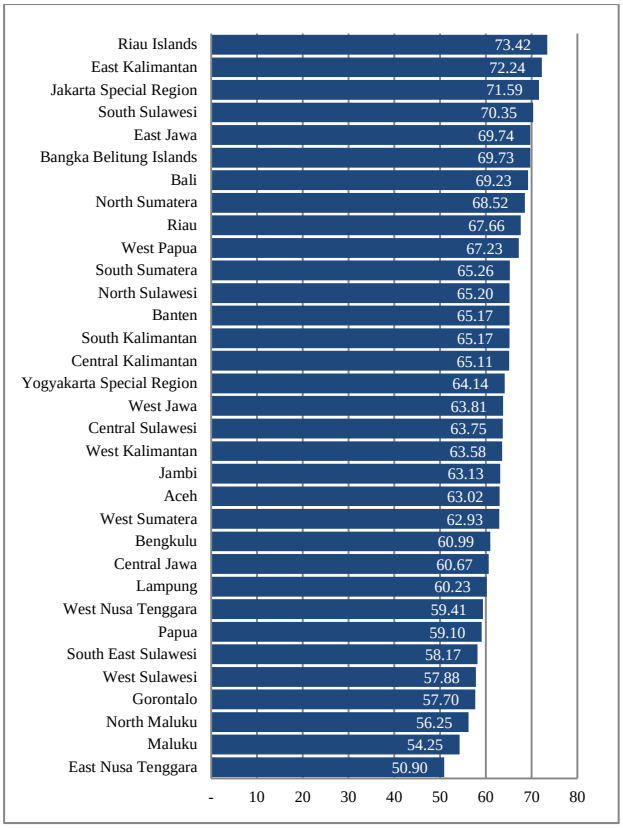

Figure 7 Sustainability Ranking of Provinces in 2013
***Source*: Authors' own estimates.**

Generally, based on scenario 1 (Figure 8), all provinces experienced increasing trend in the level of sustainability, except Aceh and Papua. Those two provinces experienced decreasing trend. From 2002 to 2013, Jakarta Special Region is the highest level of sustainability among provinces.

In Aceh, the sustainability was about 69 in 2002 and became 63 in 2013. The decreasing value was supported by the decreasing in the economic and environmental aspects. These two aspects experienced large decrease between 2002 and 2013. In 2002, the economic aspect reached 89% and became 76% in 2013 or decreasing at about -13%. And for environmental aspect was 69% in 2002 and became 53% in 2013.

In Papua, three aspects support the decreasing trend of its sustainability i.e. economic, environmental and social aspects, while institutional aspect shows an increasing trend. The economic aspect reached 93% in 2002 and became 80% in 2013 or decreasing at about -13%.

In 2002, the environmental aspect has reached 68% and became only 50% by 2013. The social aspect was also decreasing from 58% in 2002 to only 54% in 2013.

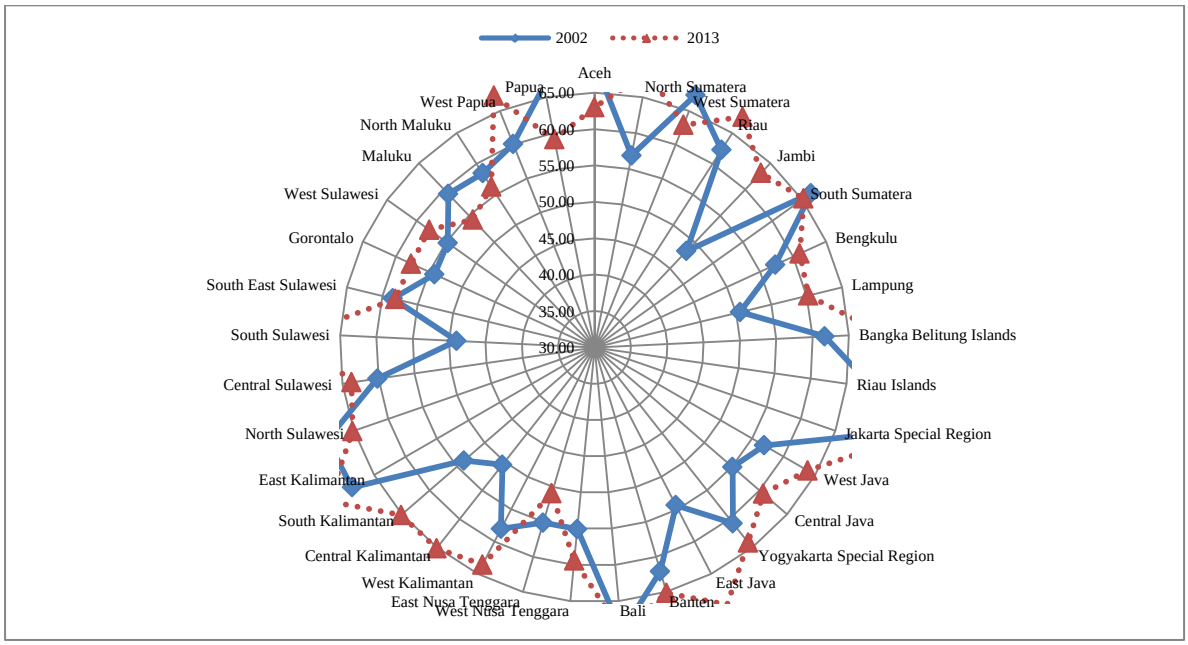

Figure 8 SDI based on scenario for 2002 and 2013
***Source*: Authors' own estimates.**

In this study, the sustainability is grouped into three categories i.e. low, moderate and high. The low sustainability is represented with blue colour in the map, was achieved when the sustainable development score below average. Moderate (green) is above average and under ¾ of the highest score, and high (yellow) for more than ¾ of the highest score.

In 2002 (Figure 9), there were nine provinces at the high level, six at moderate level, and 18 provinces in the low level. This change when in 2013, there were seven provinces at the high level of sustainability, while ten provinces were at moderate level and 16 provinces were at low sustainability. Among those high levels of sustainability provinces, only four can maintain the level which were Jakarta Special Region, Bali, East Kalimantan and Riau Islands, while at the same time, there were three provinces promoted to high level i.e. East Java, Bangka Belitung Islands, and South Sulawesi.

Provinces which remained at high levels characterized as rich provinces with natural resources, tourist destination and also national business center. They had good infrastructure

which enabled them to support development in the social and institutional sectors. On the other hand, provinces that remained at low level of sustainability are categorized as poor regions with low capacity in natural resources.

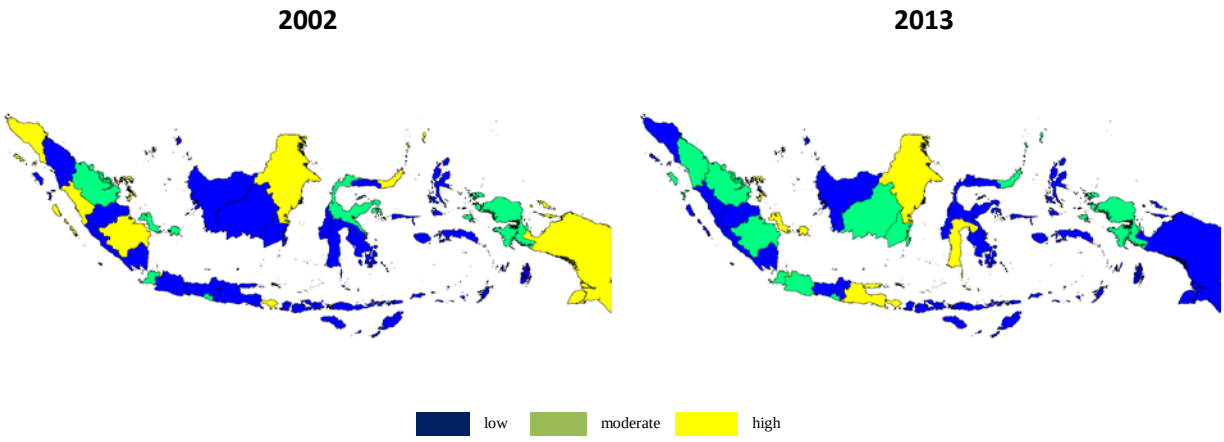

Figure 9 SDI based on group in 2002 and 2013
***Source*: Authors' own estimates.**

5.2. Scenario 4

In this scenario, GRP are without GRP from gas and oil, while the weights of the economic and institutional aspects in non-Java islands are more than social and environmental aspects. At the same time, the social and environmental aspects in Java are weighted more than economic and institutional aspects. This scenario applied to give a more equal treatment to provinces in non-Java islands which have less capacity in economic.

In Figure 10, in 2013, there were six provinces achieved sustainability index more than 70 i.e. Riau Islands, Jakarta Special Region, East Kalimantan, East Java, Bangka Belitung Islands, and Bali. At the same time, there were six provinces achieved below 60 of its sustainability i.e. West Sulawesi, West Nusa Tenggara, Gorontalo, North Maluku, Maluku and East Nusa Tenggara. The results provide almost the same picture with the previous scenarios, where the high economic capacity provinces achieved higher index. On the other side, the lower economic capacity of provinces, the lower its sustainability level.

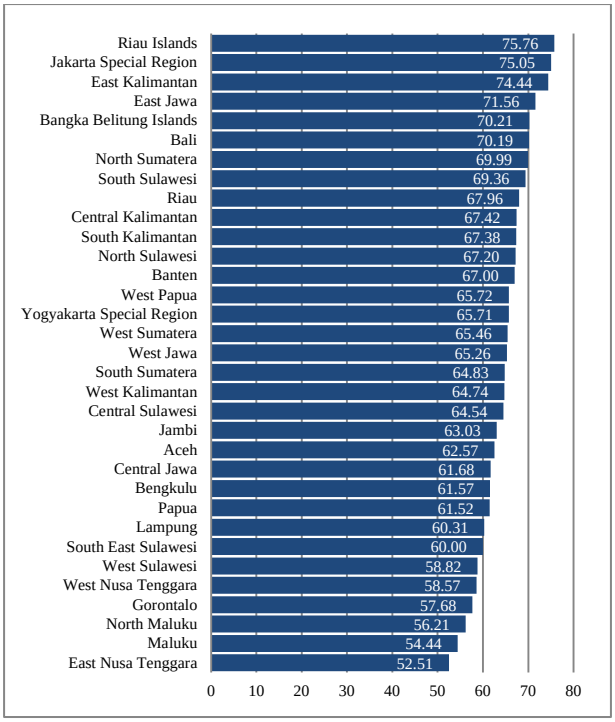

Figure 10 Sustainability Ranking of Provinces in 2013
***Source*: Authors' own estimates.**

Figure 11 depicts the dynamic of sustainability index between 2002 and 2013 among provinces in Indonesia. According to this scenario, there were three provinces declined their index, while the rests experience an increasing value. Those three provinces are Papua at -6.35%, Maluku at -2.37%, and East Nusa Tenggara at -1.19%. On the other hand, there were several provinces experienced increases in the index at more than 10% among others are South Sulawesi at 17.95%, Jambi at 16.17%, East Java at 15.12% and Central Kalimantan at 13.20%.

According to this scenario, it appears that the level of sustainable index shared quite evenly. Even though several provinces remain at the low level, this due to very low economic capacity. Moreover, in this scenario several provinces can achieve high sustainability index increase with low resources and capacities such as Central Kalimantan and South Sulawesi. This proves that these two provinces applied policies that support the development of social and environmental aspects.

The distribution of the index according to this scenario can be depicted as follow, in 2002 total index of seven provinces in Java islands were 426.62 or 60.95 on average, while in non-Java islands total index is 1516.06 or 58.31 on average. Moreover, the highest index in Java island was achieved by Jakarta Special Region at 70.03, while the lowest was Central Java at 54.41. In non-Java islands, the highest was achieved by East Kalimantan at 70.66 and the lowest was achieved by Jambi at 46.85.

In 2013, in Java island the total index was 476.45 or 68.06 on average, with the highest level was achieved by Jakarta Special Region at 75.05 and the lowest was Central Java at 61.68. At the same period, total index for non-Java islands was 1662.23 or 63.93 on average. The highest was achieved by Riau Islands at 75.76 and the lowest was East Nusa Tenggara at 52.51.

Furthermore, compared with the result from scenario 2, in 2002, total index for Java island was 425.45 or 60.78 on average. The highest was reached by Bali at 69.32 and the lowest was East Java at 54.38. At the same year, in non-Java islands, total index was 1521.01 or 58.50 on average. The highest was achieved by North Sulawesi at 68.88 and the lowest was Jambi at 47.59. In 2013, the highest index was achieved by Riau Islands at 73.42 and the lowest was East Nusa Tenggara at 50.90. At this year the total index was 1631.26 or 62.74 on average.

Based on the above figures, it can be concluded that the index under this scenario are more even among provinces both in Java and non-Java islands. Even though the result remains shows that the high index was achieved by provinces with high economic capacity.

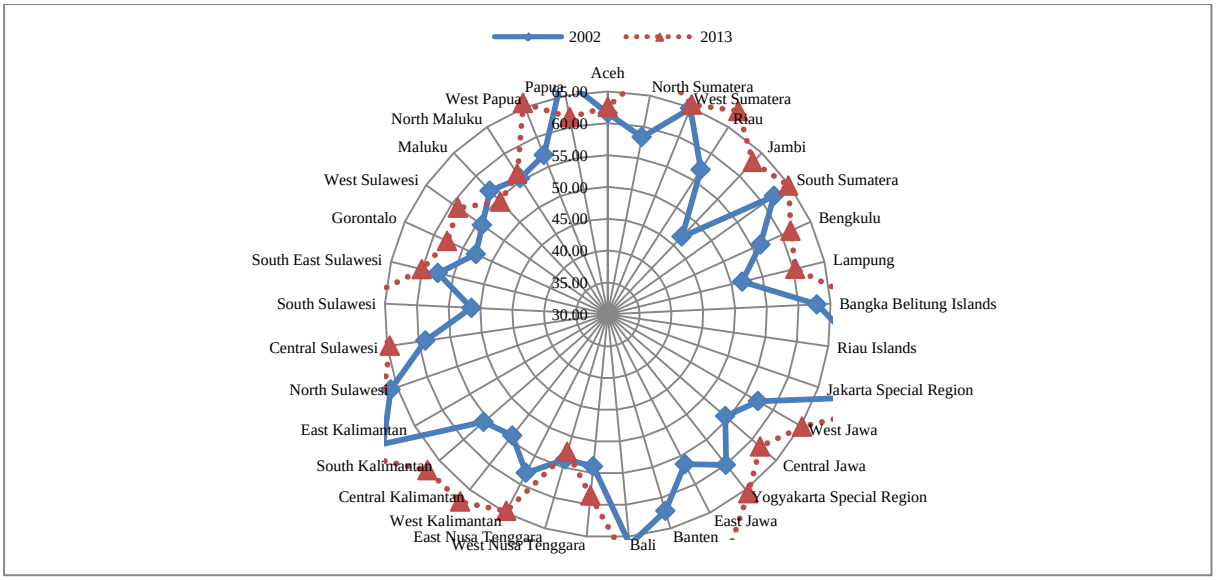

Figure 11 SDI based on scenario for 2002 and 2013
***Source*: Authors' own estimates.**

In Figure 12, it can be observed that in 2002 there were twenty provinces only achieved low level of sustainability, seven at high and the rest at moderate. This switched in 2013 where there were fifteen provinces at low level, only four at high level and fourteen at moderate level.

Based on this scenario, East Java shifted from low level in 2002 at 56.43 became high level of sustainability in 2013 at 71.56. On the other hand, Papua decreased from high to low, from 67.87 in 2002 to 61.52 in 2013. Moreover, there were three provinces remains at high level i.e. Jakarta Special Region, East Kalimantan and Riau Islands. These provinces were characterized as provinces with high economic capacity. But then, several provinces were remained at the low level of sustainability among others East Nusa Tenggara, Maluku, Gorontalo and South East Sulawesi. In contrary with the high level, these provinces were characterised as provinces with weak economic capacity.

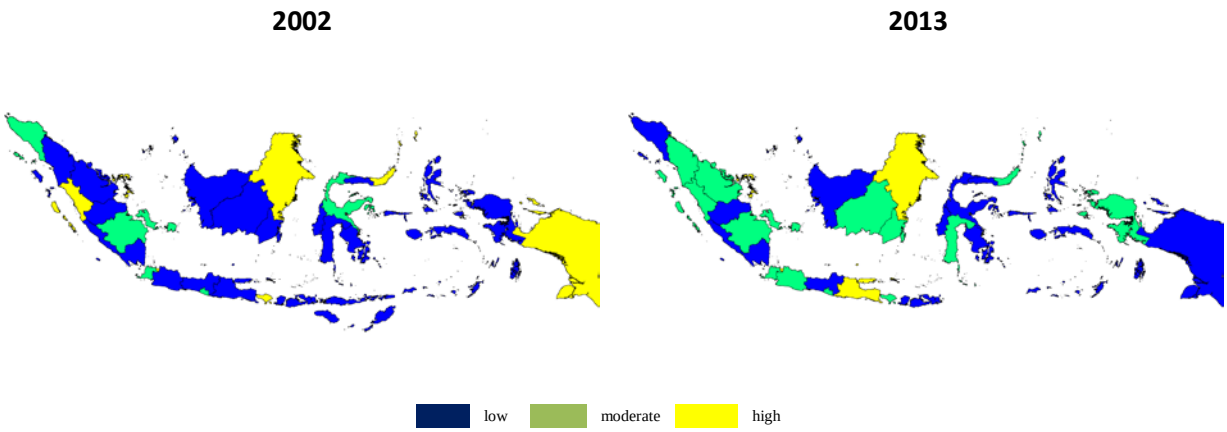

Figure 12 SDI based on group in 2002 and 2013
***Source*: Authors' own estimates.**

6. Conclusion

The need of the next generation to fulfil their necessities draws the notion of sustainability. Sustainability has several prerequisites to meet, namely, sustainability of resource management from time to time, sustainability of human well-being, the sustainable yield, and sustainability in natural capital. To measure the level of sustainability achievement, scholars have provided several indicators. Even though different authors have different ways in clustering the indicators, they share common arguments that the sustainable development indicators reflect four aspects namely economic, environmental, social and institutional aspects. Each aspect was then clustered into themes and sub-themes to construct the relevant indicators.

This study applies composite index for 33 provinces in Indonesia by using 20 indicators from 2002 to 2013. First, the preliminary analysis shows a high achievement in economic aspect, low achievement in institutional and social aspects and a decrease in environmental aspect. This confirms that development only emphasizes the short-term perspective, which focuses on the development of economic and infrastructure aspects at the expense of environment and social development.

Second, this study constructed composite index based on four scenarios i.e. (i) the same weights among indicators with GRP is total GRP, (ii) the same weights among indicators with GRP is total GRP minus GRP from oil and gas, (iii) the same weights among sustainable development aspects with GRP is total GRP, and (iv) the same weights among sustainable development aspects with GRP is total GRP minus GRP from oil and gas.

In general, according to the scenarios most of provinces were in an increasing trend between 2002 and 2013, even though numbers of provinces experienced different tendency. It is also shown that the increasing level of sustainability was not shared evenly among provinces. Moreover, all scenarios resulted a high sustainable index for provinces with high fiscal capacity and vice versa. The high fiscal capacity in a province comes from its high transfer fiscal fund from central government due to its high capacity in natural resources or the province with high locally-generated revenue as it may be a business center or tourist destination.

The findings also imply imbalance between sustainable development aspects. Development emphasizes more on the improvement of the economic and social aspects, but put pressure on the environment aspect. The results also point out the complexity in achieving balanced development in Indonesia due to conflicting and complementary interactions between the economic, social and environmental aspects of sustainable development. Furthermore, these results also confirm that there was inequality among rich and poor provinces. The poor provinces may have difficulties in attaining their development targets due to limitation in economic development and natural resources.

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Appendices

A. Aspects of Sustainable Development Indicators

Table A1: Sustainable Development Indicators: Economic Aspect

UN		OECD (Socio-economic)		EU		Indonesia	
Theme	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**
Economic development	Macroeconomic performance, sustainable public finance, employment, information and communication technologies, research and development, tourism	GDP and Population	GDP, population growth and density	Socioeconomic development	Real GDP per capita	Economic development	Macroeconomic performance, sustainable public finance, employment, information and communication technologies, research and development, tourism
Global economic partnership	Trade, external financing	Consumption	Private consumption, government consumption	Sustainable consumption and production	Resource productivity	Global economic partnership	Trade, external financing
Consumption and production patterns	Material consumption, energy use, waste generation and management, transportation	Energy	Energy intensities, energy mix, energy prices			Consumption and production patterns	Material consumption, energy use, waste generation and management, transportation
		Transport	Road traffic and vehicle intensities, road infrastructure densities, road fuel prices and taxes				
		Agriculture	Intensity of use of nitrogen and phosphate fertilisers, nitrogen balances, livestock densities, intensity of use of pesticides				
		Expenditure	Pollution abatement and control expenditure, official development assistance				

Table A2: Sustainable Development Indicator: Environmental Aspect

UN		OECD		EU		Indonesia	
Theme	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**
Natural hazards	Vulnerability to natural hazards, disaster preparedness and response	Climate Change	CO2 emission intensities, greenhouse gas concentrations	Climate change and energy	Greenhouse gas emissions, share of renewable energy in gross final	Natural hazards	Vulnerability to natural hazards, disaster preparedness and response

					energy consumption, primary energy consumption		
Atmosphere	Climate change, ozone layer depletion, air quality	Ozone Layer Depletion	Ozone depleting substances, stratospheric ozone	Sustainable transport	Energy consumption of transport relative to GDP	Atmosphere	Climate change, ozone layer depletion, air quality
Land	Land use and status, desertification, agriculture, forests	Air Quality	Air emission intensities, urban air quality	Natural resources	Common bird index, fish catches from stocks outside safe biological limits	Land	Land use and status, desertification, agriculture, forests
Oceans, seas and coasts	Coastal zone, fisheries, marine environment	Waste	Waste generation, waste recycling			Oceans, seas and coasts	Coastal zone, fisheries, marine environment
Freshwater	Water quantity, water quality	Water Quality	River quality, waste water treatment			Freshwater	Water quantity, water quality
Biodiversity	Ecosystem, species	Water Resources	Intensity of use of water resources, public water supply and price			Biodiversity	Ecosystem, species
		Forest Resources	Intensity of use of forest resources, forest and wooded land				
		Fish Resources	Fish catches and consumption (national), Fish catches and consumption (global and regional)				
		Biodiversity	Threatened species, protected areas				

Table A3: Sustainable Development Indicator: Social Aspect

UN		OECD (Socio-economic)		EU		Indonesia	
Theme	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**
Poverty	Income poverty, income inequality, sanitation, drinking water, access to energy, living conditions	GDP And Population	GDP, population growth and density	Social inclusion	People at risk of poverty or social exclusion	Poverty	Income poverty, income inequality, sanitation, drinking water, access to energy, living conditions
Health	Mortality, health care delivery, nutritional status, health status and risks	Consumption	Private consumption, government consumption	Demographic changes	Employment rate of older workers	Health	Mortality, health care delivery, nutritional status, health status and risks
Education	Education level, literacy	Energy	Energy intensities, energy mix, energy prices	Public health	Life expectancy at birth	Education	Education level, literacy
Demographics	Population, tourism	Transport	Road traffic and vehicle intensities, road infrastructure densities, road			Demographics	Population, tourism

			fuel prices and taxes				
		Agriculture	Intensity of use of nitrogen and phosphate fertilisers, nitrogen balances, livestock densities, intensity of use of pesticides				
		Expenditure	Pollution abatement and control expenditure, official development assistance				

Table A4: Sustainable Development Indicator: Institution Aspect

UN		OECD		EU		Indonesia	
Theme	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**	**Theme**	**Sub-Theme**
Governance	Corruption, crime	-	-	Global partnership	Official development assistance	Governance	Corruption, crime
				Good governance			

B. Indicators of Sustainable Development

B1. Economic aspect:

1. GRP (with oil and gas; without oil and gas): GRP is the main indicator in determining the general economic development. GRP illustrates the value added generated in a region, both in terms of sectors as well as from the side of its use. This indicator is a basic indicator of economic growth and measures the level and amount of economic output. This indicates a change in the amount of production of goods and services. In Indonesia there are two kinds of GRP per capita, which are the oil and gas (oil) and non-oil GRP per capita. Each GRP per capita has advantages and disadvantages. Non-oil GRP per capita is good enough to be used as a proxy for economic progress comparisons between regions. The reason is that in general, the oil and gas management does not involve local communities, so that the added value

that comes from oil and gas is only enjoyed by a minority of the people or even to flow out of the area.

However, the use of non-oil GRP also has a weakness, because it seemed to ignore the role of the oil and gas sector, which became the backbone of the economy for most regions. In regional development, especially in the era of regional decentralisation, the role of oil and gas are very significant in terms of local revenue derived from oil and gas production sharing. Revenues from oil and gas will certainly have an impact on the ability of local finance. Revenues from oil and gas will be a resource for local development, which in turn will impact on the welfare of the community. In this study, the GRP is distinct by those two approaches i.e. RGP with oil and gas and GRP without oil and gas. This distinction is purposed to address the influence of oil and gas in constructing the SDI.

2. % of population aged 15 years and more who worked: This indicator provides information on the ability of the economy to create jobs. Working as opposed to unemployment is seen as the desired position by the productive population (labor force).

B2. Environmental aspect:

3. % of households that use LPG for cooking: This indicator shows the percentage of households who use LPG for cooking instead of using electricity, kerosene, charcoal and wood. This indicator represents the minimum emission resulted from households for their cooking activities. The choice to use LPG indicates lower carbon emission can be resulted from cooking activities.
4. Estimates of CO2 emissions from motorized vehicle: Carbon dioxide (CO2) is one of the main contributors to greenhouse gases also be the cause of climate change. The increasing concentration of CO2 in the atmosphere can cause negative effects for the

economic, social and environmental problems in various countries around the world. CO2 emission estimates calculated in this publication is the CO2 emissions of cooking fuel and CO2 emissions from motor vehicles. Estimates of CO2 emissions come from the use of motor vehicles contributed by CO2 emissions derived from the use of gasoline and diesel fuel. CO2 emissions come from motor vehicles in the range of 2002-2013 is likely to increase due to the increasing number of motor vehicles.

5. Environmental quality index (Indeks Kualitas Lingkungan Hidup - IKLH). This indicator is a composite index that measures the quality of the environment.

B3. Social aspect:

6. % of poor people: the poor are people who have an average monthly per capita expenditure is below the poverty line. The purpose of a poverty measure is to allow for a comparison of poverty and assess progress in poverty reduction and program evaluation.
7. Dependency ratio: a comparison of the amount of load dependence of the economically active population of the young people and the elderly who depend economically. Dependency ratio may indicate the potential impact of changes in population age structure of the social and economic development.
8. % infant mortality: Estimates of the infant mortality rate is the probability babies die before the age of 1 year (expressed per 1,000 live births). The infant mortality rate is influenced by the availability, access and quality of health facilities; education, especially mothers; access to clean water and sanitation; poverty and nutrition
9. Estimate of life expectancy at birth: This indicator is the average age reached by a newborn is expected to live, keeping in mind the risk of death at the time of a certain age. Life expectancy at birth is death and a proxy indicator of the health condition.

10. % households manage sanitation: Provision of adequate sanitation is necessary to protect human health and the environment. This indicator monitors the progress of household access to sanitation facilities, basic social services are important and are the basis for reducing the risk of faecal bacteria (found in human feces) and frequency-related diseases.
11. % households using clean water: This indicator monitors the progress of household access to clean water sources with adequate volume and affordable distance.
12. % of married women aged 15-49 who use birth control: This indicator shows the human efforts consciously in birth control / reproductive health services. Although this indicator cannot control all the actions taken in birth control. The health benefits of contraceptive use include the ability to prevent unintended pregnancies, thereby reducing the risk of abortion, the potential complications of pregnancy and the risk of maternal death.
13. % net enrolment rate of elementary school: the proportion of primary school-age population in elementary school to the primary school age population in the region. The purpose of determining the net enrollment ratio provides a measure of the population (according to the rules) already deserve / need to go to school to attend basic education. This indicator can be used to measure the population of primary school age who are not enrolled in primary school.
14. % net enrolment rate of junior school: the proportion of junior school-age population in junior school to the junior school age population in the region.
15. % net enrolment rate of high school: the proportion of high school-age population in high school to the high school age population in the region.
16. Total Fertility Rate: Total Fertility Rate is the average number of children born by a woman throughout her life. The total fertility rate is one of the variables that directly

affect the population changes. The total fertility rate is not influenced by the age distribution of the population. Low birth rate can increase the ability of families and governments in the management of existing resources to fight poverty, protect and improve the environment

B4. Institutional aspect:

17. % houses connected to phone: Telecommunications is essential to support sustainable development and is closely related to social development, economic, and institutional. Telecommunications is also an important factor for many economic activities and improve the exchange of information among citizens. Modern communication is considered relatively environmentally friendly, because it is a potential replacement for the transport and the relatively low environmental pollution. Indicators of telecommunications can be seen from the percentage of households using fixed-line and mobile phones.
18. % HH accessing internet within last 3 months: internet is an information distribution system that can reach all and significantly shorten the time, as well as open up a range of new resources. Internet also significantly open up new economic opportunities and market more environmentally friendly. Internet can enable businesses across the country and facilitate the provision of basic services, such as health and education is currently uneven.
19. Ratio women participation in the school to the men participation in the school: this indicator illustrates the gender equality in education.
20. Ratio of women wages to men wages: this indicator illustrates the gender equality in the economic field.

C. Weight and Value Limits for Normalization

Indicator (variable)	Unit	Min	Max	Minimum and Maximum Level	Formula of Indicator
Economic Dimension					
1. GRP per capita at year 2000 constant level (x_1)	Million rupiah	1.10	37.54	Min= poverty level in 2000 at 1,099,584 rupiah/year Max= targeted GRP per capita in the Medium Term Development Goal 2009 – 2014 (RPJMN) at 37,538,350	$\text{NormX1} = \frac{(\text{X1} - 1.10)}{37.54 - 1.10} x\ 100\%$
2. % of population aged 15 years and more who worked (x_2)	Percentage	63.85	max	Min= level in 2011 Max= highest level between 2002 – 2013	$\text{NormX2} = \frac{(\text{X2} - 63.85)}{\text{max} - 63.85} x\ 100\%$
Environmental Dimension					
3. % of households that use LPG for cooking (x_3)	Percentage	0	100	Min= lowest level between 2002 – 2013 Max= highest level between 2002 – 2013	$\text{NormX3} = \frac{(\text{X3} - 0)}{500 - 0} x\ 100\%$
4. Estimates of CO2 emissions from motorized vehicle (x_5)	Thousand tons	26% from 2005 (per provin	5,000	Min= targeted level in 2020 in National Action Plan to Reduce GHG Emission (RAN GRK) Max= highest level between 2002 – 2013	$\text{NormX4} = \frac{(\text{X4} - \text{BAU})}{\text{max} - \text{BAU}} x\ 100\%$

		ce) = BAU			
5. Environmental quality index (x_6)	Percentage	0	100		$\text{NormX5} = \frac{(\text{X5} - 0)}{100 - 0} x\ 100\%$
Social Dimension					
6. % of poor people (x_6)	Percentage	0	100		$\text{NormX6} = \frac{(\text{X6} - 0)}{(100 - 0)} x\ 100\%$
7. Dependency ratio (x_7)	Percentage	36.8	98	Min = lowest level between 2002 – 2013 Max = the highest that has been achieved of one country i.e. Syrian Arab Republic (1992)	$\text{NormX7} = \frac{(\text{X7} - 36.8)}{(98 - 36.8)} x\ 100\%$
8. % infant mortality (x_8)	Percentage	0	100		$\text{NormX8} = \frac{(\text{X8} - 0)}{100 - 0} x\ 100\%$
9. Estimate of life expectancy at birth (x_9)	Years	25	61	Min and Max value based on Human Development Index (HDI)	$\text{NormX9} = \frac{(\text{X9} - 25)}{(61 - 25)} x\ 100\%$
10. % HH manages sanitation (x_{10})	Percentage	0	100		$\text{NormX10} = \frac{(\text{X10} - 0)}{(100 - 0)} x\ 100\%$
11. % HH using clean water (x_{11})	Percentage	0	100		$\text{NormX11} = \frac{(\text{X11} - 0)}{100 - 0} x\ 100\%$

12. % of married women aged 15-49 who use birth control (x_{12})	Percentage	0	100		$\text{NormX12} = \frac{(\text{X12} - 0)}{100 - 0} x\ 100\%$
13. % net enrolment rate of elementary school (x_{13})	Percentage	0	100		$\text{NormX13} = \frac{(\text{X13} - 0)}{100 - 0} x\ 100\%$
14. % net enrolment rate of junior school (x_{14})	Percentage	0	100		$\text{NormX14} = \frac{(\text{X14} - 0)}{100 - 0} x\ 100\%$
15. % net enrolment rate of high school (x_{15})	Percentage	0	100		$\text{NormX15} = \frac{(\text{X15} - 0)}{100 - 0} x\ 100\%$
16. Total Fertility Rate (x_{16})	Rate	2.1	7.5	Min and Max = targeted in RPJMN	$\text{NormX16} = 100 - \frac{(\text{X16} - 2.10)}{7.5 - 2.10} x\ 100\%$
Institutional Dimension					
17. % houses connected to phone (x_{17})	Percentage	0	100		$\text{NormX17} = \frac{(\text{X17} - 0)}{100 - 0} x\ 100\%$
18. % HH accessing internet within last 3 months (x_{18})	Percentage	0	100		$\text{NormX18} = \frac{(\text{X18} - 0)}{100 - 0} x\ 100\%$
19. Ratio women participation in the	Ratio	0	100		$\text{NormX19} = \frac{(\text{X19} - 0)}{100 - 0} x\ 100\%$

school to the men participation in the school (x_{19})					
20. Ratio of women wages to men wages (x_{20})	Ratio	0	100		$\text{NormX20} = \frac{(\text{X20} - 0)}{100 - 0} x\ 100\%$

D. Sustainable Development Index

Table D1: Scenario 1

Province	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Aceh	69.22	67.76	66.55	64.32	65.69	64.71	64.16	62.82	63.23	61.76	62.84	63.02
North Sumatera	56.86	56.88	57.96	58.39	60.27	62.05	62.81	63.47	68.21	66.37	65.76	68.52
West Sumatera	67.36	66.41	65.85	67.36	65.38	65.59	66.21	65.40	65.19	64.08	63.74	62.93
Riau	62.26	61.88	61.72	61.30	63.00	64.65	65.36	65.51	65.00	66.04	66.21	67.66
Jambi	48.28	49.55	51.03	51.29	52.76	54.03	55.26	56.92	58.30	58.23	61.61	63.13
South Sumatera	66.51	66.03	66.30	66.16	65.52	65.62	65.24	64.75	64.33	64.98	65.28	65.26
Bengkulu	57.31	57.42	58.30	58.36	58.42	57.84	58.82	59.48	60.44	61.12	58.93	60.99
Lampung	50.58	51.18	52.16	52.51	53.41	54.66	55.73	56.74	58.36	59.02	58.24	60.23
Bangka Belitung Islands	61.68	62.92	63.60	64.40	65.92	66.04	63.35	68.55	70.88	71.77	66.60	69.73
Riau Islands	68.64	68.74	68.84	69.04	69.05	70.91	69.64	69.40	73.99	74.45	70.36	73.42
Jakarta Special Region	67.47	66.15	66.85	64.45	67.07	67.81	67.91	72.83	73.03	72.35	71.91	71.59
West Java	56.92	56.99	57.87	61.20	59.37	60.78	61.76	62.01	64.19	63.72	63.99	63.81
Central Java	55.10	54.72	55.05	54.37	55.48	57.15	57.57	57.66	59.12	59.67	60.49	60.67
Yogyakarta Special Region	60.76	60.63	61.00	61.10	61.84	62.23	62.50	62.73	63.37	62.64	65.30	64.14
East Java	54.40	54.38	55.85	56.50	58.72	60.06	61.69	62.68	67.29	67.48	66.56	69.74
Banten	62.06	62.30	62.56	62.96	61.97	62.76	62.53	62.70	62.75	64.60	66.37	65.17
Bali	69.32	68.41	68.31	67.55	67.85	67.54	67.89	67.95	71.05	69.53	67.18	69.23
West Nusa Tenggara	55.08	55.63	56.06	55.45	56.08	56.85	56.87	57.47	60.26	58.89	56.79	59.41
East Nusa Tenggara	55.11	55.23	55.19	54.54	54.36	54.81	54.04	53.14	50.23	51.57	52.72	50.90
West Kalimantan	58.05	58.79	58.93	59.40	59.18	59.91	60.32	60.36	62.09	62.35	62.49	63.58
Central Kalimantan	50.50	51.22	52.83	54.02	54.66	56.18	57.87	58.49	60.33	62.47	63.96	65.11
South Kalimantan	53.74	54.53	55.91	56.17	57.17	57.96	59.60	60.73	62.22	62.78	63.12	65.17
East Kalimantan	68.46	68.96	68.77	67.74	67.60	68.98	69.35	70.02	68.67	71.56	72.12	72.24
North Sulawesi	68.89	67.90	67.61	66.12	65.47	65.06	65.83	65.35	64.95	65.86	63.13	65.20

Central Sulawesi	60.14	61.11	61.16	61.00	61.14	61.07	61.93	62.90	64.26	64.47	61.05	63.75
South Sulawesi	48.97	50.50	52.64	53.67	56.07	57.57	59.56	61.02	65.71	67.75	66.03	70.35
South East Sulawesi	58.52	59.17	58.76	58.13	58.32	59.00	58.58	58.37	57.19	57.47	58.77	58.17
Gorontalo	54.17	55.29	55.06	54.18	55.44	56.74	55.52	55.31	54.55	56.03	57.10	57.70
West Sulawesi	54.76	54.72	54.89	54.26	54.81	56.34	56.75	56.28	56.00	54.79	58.98	57.88
Maluku	59.12	57.03	57.61	57.43	58.17	58.55	58.41	58.37	56.84	55.59	55.61	54.25
North Maluku	58.43	58.79	58.87	58.01	58.74	59.35	57.95	57.25	57.43	56.22	56.44	56.25
West Papua	60.08	59.95	60.38	60.35	60.80	62.33	63.17	63.78	64.85	66.21	69.16	67.23
Papua	66.69	64.29	61.06	63.33	61.22	62.04	60.88	61.37	57.93	57.86	60.20	59.10
Indonesia	59.89	59.93	60.59	60.97	61.55	62.96	63.41	64.18	65.71	65.96	67.62	67.56

Table D2: Scenario 2

Province	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Aceh	63.13	61.26	61.42	60.44	62.16	61.95	62.11	61.59	62.21	60.77	61.90	62.15
North Sumatera	56.77	56.80	57.90	58.33	60.21	61.99	62.74	63.41	68.14	66.30	65.70	68.46
West Sumatera	67.36	66.41	65.85	67.36	65.38	65.59	66.21	65.40	65.19	64.08	63.74	62.93
Riau	55.61	55.55	55.77	55.72	57.81	59.85	60.95	61.37	61.20	62.73	63.43	65.25
Jambi	47.59	48.86	50.38	50.64	52.20	53.44	54.65	56.32	57.65	57.44	60.84	62.37
South Sumatera	64.12	63.70	64.02	63.94	63.35	63.51	63.14	62.67	62.27	62.94	63.30	63.31
Bengkulu	57.31	57.42	58.30	58.36	58.42	57.84	58.82	59.48	60.44	61.12	58.93	60.99
Lampung	50.45	51.04	52.05	52.42	53.33	54.59	55.66	56.68	58.31	58.96	58.18	60.17
Bangka Belitung Islands	61.68	62.38	63.16	64.05	65.64	65.83	63.17	68.38	70.72	71.61	66.45	69.57
Riau Islands	68.64	68.74	68.84	69.04	69.05	70.91	69.64	69.40	73.99	74.45	70.36	73.42
Jakarta Special Region	67.47	66.15	66.85	64.45	67.07	67.81	67.91	72.83	73.03	72.35	71.91	71.59
West Java	56.62	56.70	57.58	60.94	59.12	60.55	61.53	61.77	63.95	63.50	63.79	63.61
Central Java	54.84	54.44	54.74	54.03	55.12	56.80	57.19	57.29	58.74	59.29	60.11	60.30
Yogyakarta Special Region	60.76	60.63	61.00	61.10	61.84	62.23	62.50	62.73	63.37	62.64	65.30	64.14
East Java	54.38	54.37	55.84	56.48	58.69	60.03	61.66	62.64	67.24	67.42	66.51	69.69

Banten	62.06	62.30	62.56	62.96	61.97	62.76	62.53	62.70	62.75	64.60	66.37	65.17
Bali	69.32	68.41	68.31	67.55	67.85	67.54	67.89	67.95	71.05	69.53	67.18	69.23
West Nusa Tenggara	55.08	55.63	56.06	55.45	56.08	56.85	56.87	57.47	60.26	58.89	56.79	59.41
East Nusa Tenggara	55.11	55.23	55.19	54.54	54.36	54.81	54.04	53.14	50.23	51.57	52.72	50.90
West Kalimantan	58.05	58.79	58.93	59.40	59.18	59.91	60.32	60.36	62.09	62.35	62.49	63.58
Central Kalimantan	50.50	51.22	52.83	54.02	54.66	56.18	57.87	58.49	60.33	62.47	63.96	65.11
South Kalimantan	53.56	54.36	55.74	56.01	57.01	57.81	59.45	60.58	62.07	62.64	62.99	65.04
East Kalimantan	68.46	68.96	68.77	67.74	67.60	68.98	69.35	70.02	68.67	71.56	72.12	72.24
North Sulawesi	68.88	67.89	67.60	66.11	65.46	65.05	65.82	65.33	64.93	65.84	63.11	65.17
Central Sulawesi	60.14	61.11	61.16	60.98	61.09	60.97	61.80	62.78	64.13	64.34	60.93	63.65
South Sulawesi	48.95	50.49	52.63	53.66	56.06	57.56	59.54	61.01	65.69	67.74	66.01	70.34
South East Sulawesi	58.52	59.17	58.76	58.13	58.32	59.00	58.58	58.37	57.19	57.47	58.77	58.17
Gorontalo	54.17	55.29	55.06	54.18	55.44	56.74	55.52	55.31	54.55	56.03	57.10	57.70
West Sulawesi	54.76	54.72	54.89	54.26	54.81	56.34	56.75	56.28	56.00	54.79	58.98	57.88
Maluku	59.11	57.02	57.60	57.42	58.16	58.55	58.40	58.36	56.83	55.58	55.60	54.24
North Maluku	58.43	58.79	58.87	58.01	58.74	59.35	57.95	57.25	57.43	56.22	56.44	56.25
West Papua	57.93	57.68	57.96	57.86	58.48	60.06	60.91	60.93	59.91	61.91	65.30	63.86
Papua	66.69	64.29	61.06	63.33	61.22	62.04	60.88	61.37	57.93	57.86	60.20	59.10
Indonesia	59.03	59.08	59.79	60.19	60.80	62.24	62.70	63.50	65.03	65.29	66.98	66.94

Table D3: Scenario 3

Province	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Aceh	69.73	69.17	67.45	64.70	66.00	65.07	64.47	63.18	63.57	62.98	63.50	63.73
North Sumatera	58.45	58.53	59.43	59.86	61.22	63.00	63.92	64.72	68.74	67.95	67.91	70.07
West Sumatera	64.86	64.29	63.87	64.99	63.86	64.51	65.60	65.40	66.03	65.39	65.79	65.46
Riau	65.87	65.55	65.10	65.13	66.32	67.72	68.32	68.80	68.25	69.92	70.12	71.17
Jambi	47.78	48.97	50.42	50.65	52.31	53.34	55.32	57.66	59.28	59.31	62.42	64.04
South Sumatera	65.23	64.89	65.24	64.90	64.80	65.07	65.48	65.34	65.72	66.45	66.93	67.43

Bengkulu	56.37	56.45	57.24	57.18	57.57	57.50	58.48	59.19	60.25	61.33	59.94	61.57
Lampung	51.90	52.30	53.15	53.32	53.84	54.94	55.87	57.13	58.33	59.24	58.79	60.40
Bangka Belitung Islands	62.88	63.98	64.42	64.88	65.71	66.22	64.75	68.22	70.23	71.44	67.90	70.42
Riau Islands	70.34	70.44	70.54	70.77	70.62	72.69	71.27	71.30	75.67	75.95	73.57	75.76
Jakarta Special Region	70.03	69.16	69.68	68.03	70.10	70.74	71.05	75.01	75.37	75.14	75.42	75.05
West Java	57.65	57.87	58.47	60.68	59.66	61.04	62.21	62.67	64.61	64.73	65.58	65.53
Central Java	54.76	54.66	55.00	54.59	55.63	57.23	57.77	58.16	59.77	60.56	61.94	62.17
Yogyakarta Special Region	60.07	60.01	60.42	60.74	61.77	62.20	62.64	63.20	64.41	63.89	66.29	65.71
East Java	56.46	56.45	57.77	58.42	60.11	61.63	63.24	64.27	68.29	68.80	69.06	71.63
Banten	62.16	62.36	62.59	62.83	61.86	63.00	63.03	63.19	63.70	65.63	67.73	67.00
Bali	66.27	65.65	65.83	65.54	65.77	66.04	66.69	67.06	69.97	69.26	68.51	70.19
West Nusa Tenggara	53.95	54.43	54.74	54.12	54.65	55.59	55.75	56.60	58.97	57.92	56.72	58.57
East Nusa Tenggara	53.70	53.88	53.90	53.49	53.52	53.95	53.68	53.18	51.52	52.60	53.56	52.51
West Kalimantan	58.00	58.75	58.89	59.31	59.24	60.35	60.81	61.04	63.09	63.51	63.83	64.74
Central Kalimantan	54.22	54.67	56.01	57.01	57.32	58.77	60.40	61.02	63.05	64.69	66.19	67.42
South Kalimantan	56.01	56.78	57.98	58.22	58.84	59.67	61.34	62.81	64.21	64.89	65.78	67.54
East Kalimantan	70.66	71.09	70.92	70.17	69.82	70.96	71.32	72.26	71.27	73.77	74.25	74.44
North Sulawesi	66.05	65.36	65.13	63.93	63.37	63.46	64.94	64.74	65.11	66.80	65.14	67.23
Central Sulawesi	58.90	59.97	60.02	59.90	59.85	60.14	61.07	62.38	63.84	64.21	62.27	64.68
South Sulawesi	51.43	52.14	53.78	54.53	56.53	57.88	59.79	60.99	64.77	66.91	66.00	69.38
South East Sulawesi	57.41	57.71	57.55	57.05	57.26	58.33	58.31	58.52	58.20	58.86	60.13	60.00
Gorontalo	52.74	53.72	53.39	52.64	53.98	55.20	54.54	54.63	54.45	55.83	57.15	57.68
West Sulawesi	54.20	54.18	54.30	53.83	54.32	55.60	56.38	56.18	56.57	56.16	59.32	58.82
Maluku	56.83	55.04	55.52	55.20	55.75	56.15	56.19	56.52	55.55	55.24	55.36	54.46
North Maluku	55.39	56.30	56.39	55.47	56.36	57.01	56.34	55.87	56.11	55.64	56.11	56.21
West Papua	59.83	60.04	60.61	60.75	61.20	62.84	63.95	64.99	67.99	68.98	71.52	70.21
Papua	67.87	65.82	61.40	64.87	61.72	62.54	61.63	62.84	60.17	59.60	61.74	61.52
Indonesia	60.84	60.98	61.55	61.91	62.50	63.94	64.65	65.58	67.32	67.86	69.73	69.96

Table D4: Scenario 4

Province	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Aceh	61.60	60.50	60.60	59.53	61.29	61.40	61.73	61.54	62.21	61.67	62.25	62.57
North Sumatera	58.34	58.43	59.35	59.78	61.15	62.91	63.83	64.63	68.65	67.86	67.82	69.99
West Sumatera	64.86	64.29	63.87	64.99	63.86	64.51	65.60	65.40	66.03	65.39	65.79	65.46
Riau	57.02	57.11	57.17	57.68	59.40	61.32	62.43	63.27	63.18	65.50	66.41	67.96
Jambi	46.85	48.05	49.54	49.79	51.56	52.55	54.51	56.85	58.40	58.26	61.41	63.03
South Sumatera	62.04	61.78	62.20	61.94	61.91	62.25	62.68	62.56	62.96	63.72	64.29	64.83
Bengkulu	56.37	56.45	57.24	57.18	57.57	57.50	58.48	59.19	60.25	61.33	59.94	61.57
Lampung	51.74	52.12	53.00	53.20	53.74	54.85	55.77	57.05	58.26	59.17	58.71	60.31
Bangka Belitung Islands	62.88	63.26	63.82	64.42	65.33	65.94	64.50	68.00	70.02	71.23	67.70	70.21
Riau Islands	70.34	70.44	70.54	70.77	70.62	72.69	71.27	71.30	75.67	75.95	73.57	75.76
Jakarta Special Region	70.03	69.16	69.68	68.03	70.10	70.74	71.05	75.01	75.37	75.14	75.42	75.05
West Java	57.24	57.47	58.09	60.34	59.33	60.73	61.90	62.35	64.29	64.43	65.31	65.26
Central Java	54.41	54.28	54.59	54.14	55.15	56.75	57.26	57.66	59.26	60.05	61.44	61.68
Yogyakarta Special Region	60.07	60.01	60.42	60.74	61.77	62.20	62.64	63.20	64.41	63.89	66.29	65.71
East Java	56.43	56.42	57.75	58.39	60.09	61.59	63.20	64.21	68.23	68.73	68.99	71.56
Banten	62.16	62.36	62.59	62.83	61.86	63.00	63.03	63.19	63.70	65.63	67.73	67.00
Bali	66.27	65.65	65.83	65.54	65.77	66.04	66.69	67.06	69.97	69.26	68.51	70.19
West Nusa Tenggara	53.95	54.43	54.74	54.12	54.65	55.59	55.75	56.60	58.97	57.92	56.72	58.57
East Nusa Tenggara	53.70	53.88	53.90	53.49	53.52	53.95	53.68	53.18	51.52	52.60	53.56	52.51
West Kalimantan	58.00	58.75	58.89	59.31	59.24	60.35	60.81	61.04	63.09	63.51	63.83	64.74
Central Kalimantan	54.22	54.67	56.01	57.01	57.32	58.77	60.40	61.02	63.05	64.69	66.19	67.42
South Kalimantan	55.77	56.55	57.76	58.01	58.64	59.46	61.13	62.60	64.01	64.71	65.60	67.38
East Kalimantan	70.66	71.09	70.92	70.17	69.82	70.96	71.32	72.26	71.27	73.77	74.25	74.44
North Sulawesi	66.03	65.34	65.11	63.91	63.35	63.44	64.92	64.72	65.09	66.78	65.11	67.20
Central Sulawesi	58.90	59.97	60.02	59.87	59.77	60.01	60.90	62.22	63.68	64.03	62.10	64.54
South Sulawesi	51.41	52.12	53.77	54.51	56.52	57.86	59.77	60.97	64.75	66.89	65.98	69.36

South East Sulawesi	57.41	57.71	57.55	57.05	57.26	58.33	58.31	58.52	58.20	58.86	60.13	60.00
Gorontalo	52.74	53.72	53.39	52.64	53.98	55.20	54.54	54.63	54.45	55.83	57.15	57.68
West Sulawesi	54.20	54.18	54.30	53.83	54.32	55.60	56.38	56.18	56.57	56.16	59.32	58.82
Maluku	56.81	55.02	55.51	55.19	55.73	56.13	56.17	56.51	55.54	55.23	55.34	54.44
North Maluku	55.39	56.30	56.39	55.47	56.36	57.01	56.34	55.87	56.11	55.64	56.11	56.21
West Papua	56.97	57.02	57.39	57.44	58.11	59.81	60.94	61.20	61.40	63.23	66.36	65.72
Papua	67.87	65.82	61.40	64.87	61.72	62.54	61.63	62.84	60.17	59.60	61.74	61.52
Indonesia	59.70	59.84	60.47	60.87	61.49	62.99	63.70	64.66	66.41	66.96	68.87	69.13

E. Discussion of Scenario 2 and Scenario 3

E1. Scenario 2

According to scenario 2 (Figure E1), there are four provinces that achieved level of sustainability more than 70 i.e. Riau Islands, East Kalimantan, Jakarta Special Region and South Sulawesi. These provinces are provinces which have strong fiscal capability like for example; East Kalimantan in 2013 has 61.7% fiscal space, the highest among the other provinces (Ministry of Finance, 2013). This high fiscal capacity mostly comes from the high share of revenue sharing (Dana Bagi Hasil) from natural resources. This province has 58.4% of the budget for capital expenditure.

The lowest sustainability were experienced by eight provinces which achieving only less than 60 in their index. These provinces are provinces with weak fiscal capability, for example South East Sulawesi which only has regional revenue growth from 2009 – 2013 at 2%, while East Kalimantan at the same period can reach 30.7% (Ministry of Finance, 2013).

In this scenario, the economic aspect does not include the GRP from oil and gas. This difference from the scenario 1 has resulted different sustainable index in the provinces. On average, in 2002 the index was 0.58% lower than the scenario 1 and 0.32% in 2013. Under this scenario, in 2002, all provinces obtain a lower index value on the economic aspects, on average approximately -8.3%. Meanwhile, in 2013, although the average of all provinces obtains a lower index value, approximately -3.9%, but Bali is not affected. The greatest difference between the economic aspects of scenario 1 in 2002 was experiencing by Riau for about -33%, followed by Aceh approximately -31% and West Papua -16%. In 2013, the highest difference between scenario 1 and scenario 2 were experienced by West Papua at -15%, Riau by -12% and Aceh by -11%. These results show that there was province which remain rely on their natural resources while the others less rely to oil and gas.

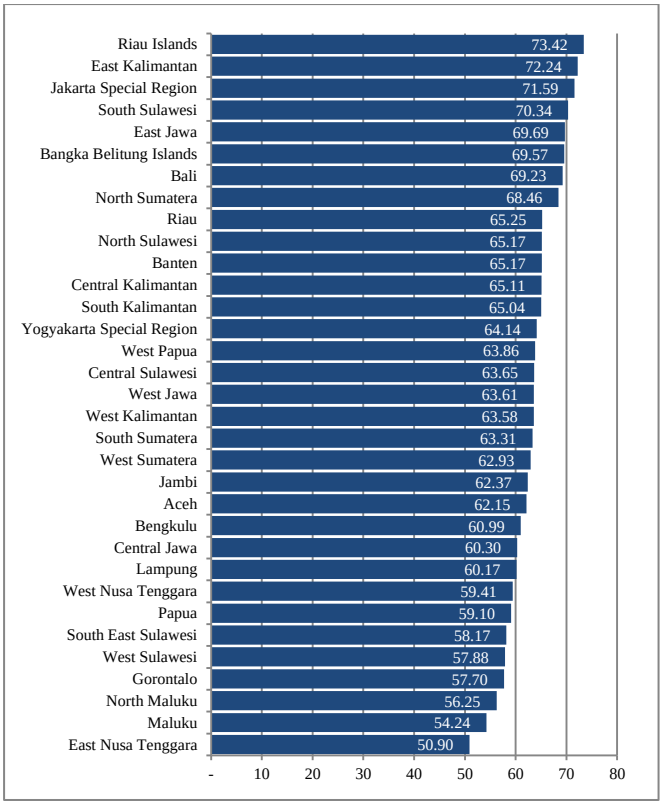

Figure E1 Sustainability Ranking of Provinces in 2013
Source: Authors' own estimates.

Like scenario 1, in this scenario majority of provinces experienced increasing its sustainability (Figure E2). But there are several provinces experience a decreasing level, among them the highest are Papua at -7.6% and Maluku at -4.9%. In this scenario the economic aspect of Papua decreased by 10%. Maluku experienced an increase in economic aspect by about 1%, while its environmental aspect decreased by 29%, social aspect improved by 4.5% and institutional aspect increased by 2.3%.

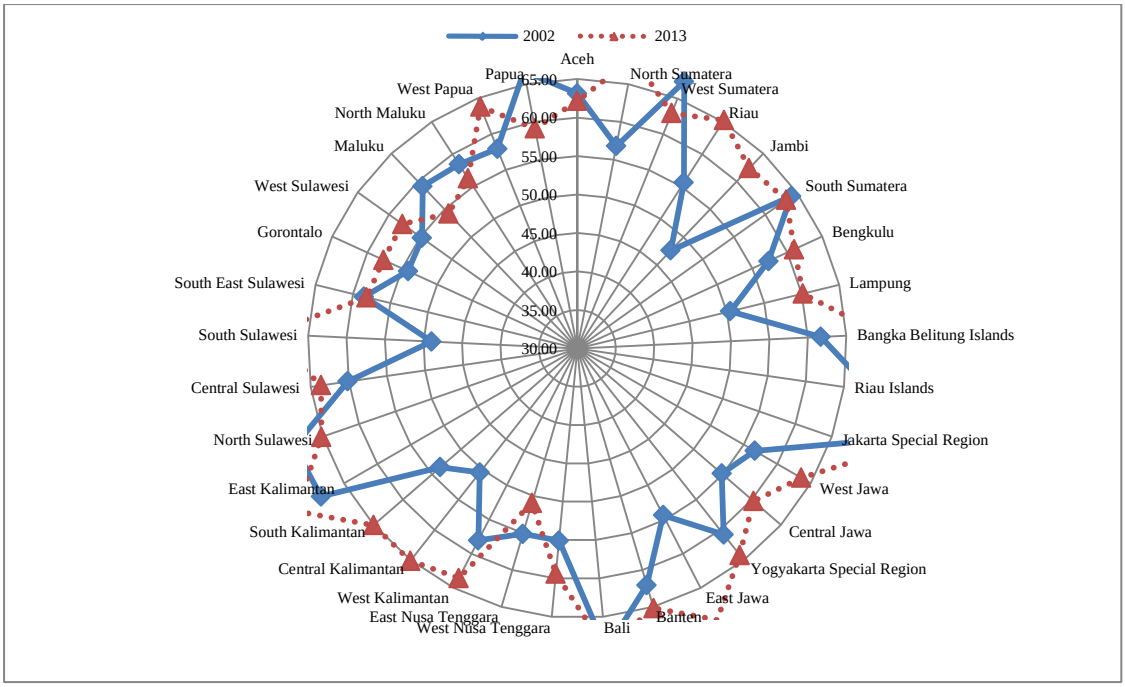

Figure E2 SDI based on scenario for 2002 and 2013
Source: Authors' own estimates.

In Figure E3, it appears that there are many changes in the sustainability groups. In 2002, there are 19 provinces at the low level, while in 2013, there are 16 provinces. The interesting thing is that there are more provinces that can achieve high sustainability from six provinces in 2002, becoming eight in 2013. The low levels of sustainability are characterized with provinces with low economic capacity, less natural resources and low fiscal capacity. On the other hand, the high level sustainability was achieved by the provinces with high natural resources, tourist destination and business center.

There was province experienced decrease in their level of sustainability from high to low level i.e. West Sumatera, and from high to moderate i.e. North Sulawesi. Otherwise, there are increases in the level of sustainability from low to high i.e. South Sulawesi, North Sumatera, and East Java, and from moderate to high i.e. Bangka Belitung Islands.

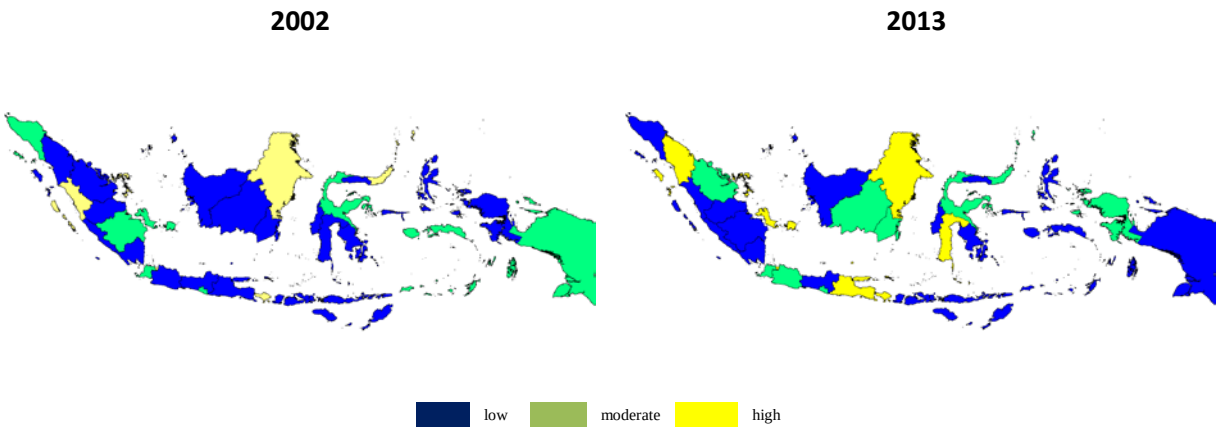

Figure E3 SDI based on group in 2002 and 2013
***Source*: Authors' own estimates.**

E2. Scenario 3

In this scenario, it is purposed to observe the difference level of sustainability index when the weight of economic and institution aspects in non-Java island more than in Java, and the weight of environmental and social aspects in Java more than in non-Java. It is expected that the result will give a more reliable and equitable than the previous scenarios.

The results show that there are nine provinces achieved sustainability index more than 70, and seven provinces achieved less than 60 in 2013 (Figure E4). Like the previous scenarios, the high sustainability index was achieved by provinces which have natural resources, business center and tourist destination i.e. Riau Islands, Jakarta Special Region, East Kalimantan, East Java, Riau, Bangka Belitung Islands, West Papua, North Sumatera and Bali. On the other hand, the same pattern was also happened in the low sustainability level where the provinces are categorized as provinces which have less natural resources and low fiscal capacity i.e. West Sulawesi, West Nusa Tenggara, Gorontalo, North Maluku, Maluku and East Nusa Tenggara.

From these results, it can be concluded that the different weights of each aspect give different sustainability index but does not give different pattern. The result shows that the high sustainability index achieved by provinces with high natural resources, tourism

destination and business center. On the other side, the low sustainability index achieved by provinces with low fiscal capacity, less natural resources nor business activities.

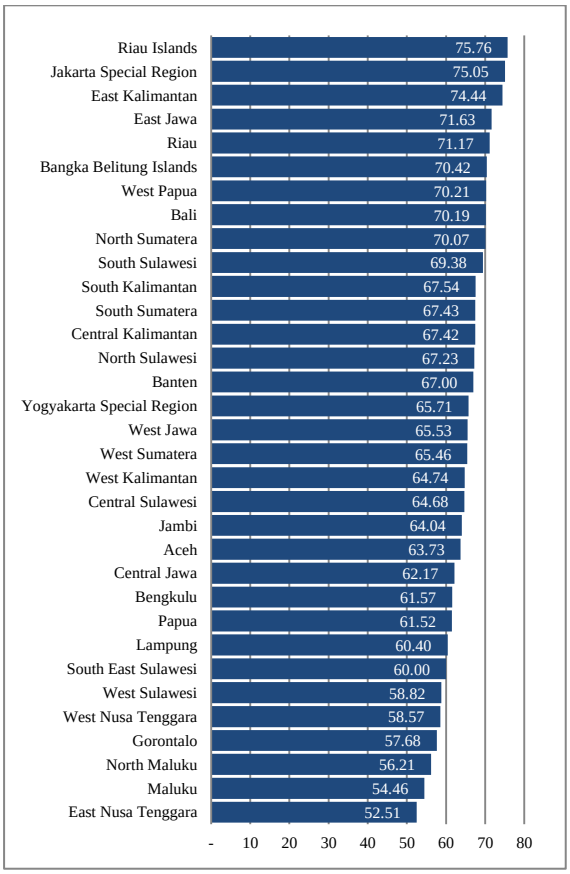

Figure E4 Sustainability Ranking of Provinces in 2013
Source: Authors' own estimates.

In Figure E5, sustainability index increased in all provinces with the exception of Papua, East Nusa Tenggara, Maluku and Aceh. The highest increased achieved by South Sulawesi at 18%, followed Jambi at 16.3%, and East Java at 15.2%. On the other hand, the decreased index experienced by Papua at 6.4%, Aceh at 6%, Maluku at 2.4% and East Nusa Tenggara at 1.2%.

By weighting more on economics and institutional aspects for Non-Java islands, and weighting more on social and environmental aspects for Java islands, it is expected that the indexes will be spread evenly. But the result does not confirm that. Based on this scenario, on average index of Java Islands in 2002 is 61.06% or 427.40 in total, while non-Java Islands achieved 1540.6 in total or 59.25% on average. The highest level of Java was achieved by

Jakarta Special Region at 70.03 and the highest of non-Java islands was achieved by East Kalimantan at 70.66. Moreover, in 2013, Java island achieved 477.28 in total or 68.18 on average, while, non-Java island achieved 64.44 on average or 1675.47 in total. In this year, the highest level was achieved by Jakarta Special Region at 75.05 in Java and 75.76 by Riau Islands in non-Java islands.

Even though there are increases in level of index between 2002 and 2013 for both of regions, but the average values shows that based on this scenario, discrepancy between these two regions are still large. Moreover, the highest levels were achieved by provinces with more on economic capacity.

Compared with the result on scenario 1, in 2002 in Java island, the highest level was achieved by Bali at 69.32 and the index achieved 60.86 on average. Still in the same scenario, in 2013, the average was 66.34 with the highest was 71.59 by Jakarta Special Region. Furthermore, for non-Java island, in 2002, the highest of 69.22 was observed in Aceh with the average being 63.12. In 2013, the highest was achieved by Riau Islands at 73.42 with the average being 63.12.

These results do not give much different with the scenario 3 where on average the high index were achieved by provinces in Java island, while the provinces in non-Java islands remained achieved low level of sustainability. Thus, these results suggest that the different weight in different aspects do not result in different pattern of sustainability index.

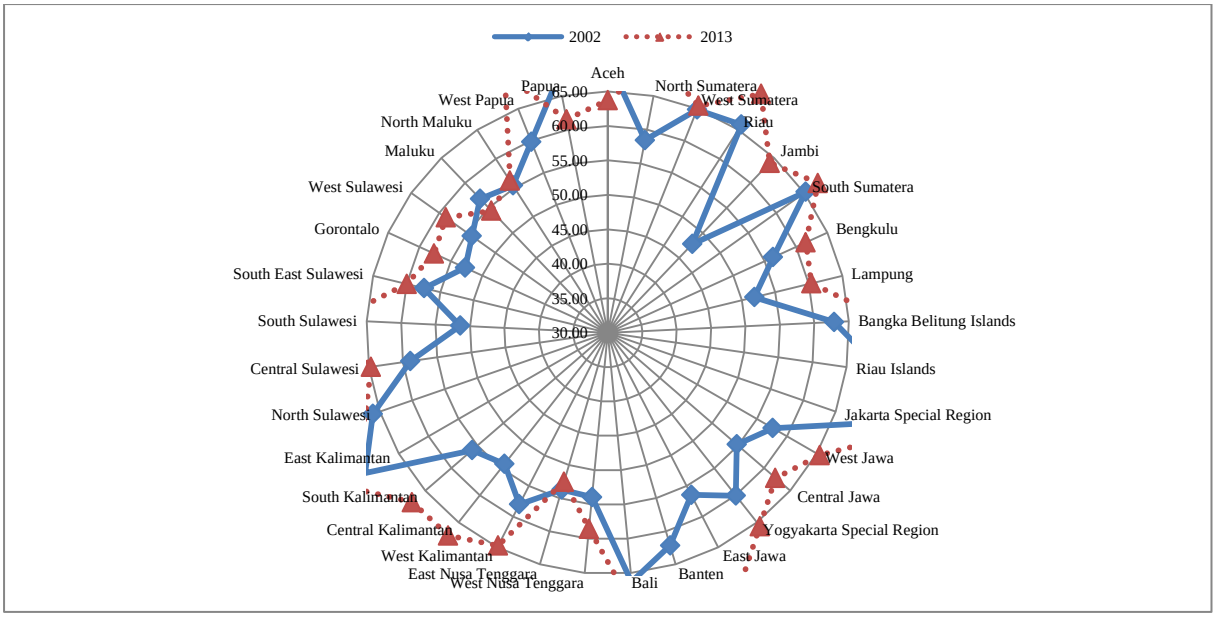

Figure E5 SDI based on scenario for 2002 and 2013
***Source*: Authors' own estimates.**

According to Figure E6, the number of the low sustainable index fell from 19 in 2002 to 15 in 2013. At the same time, the number of high sustainable index decreased from 9 in 2002 to only 5 in 2013. In this scenario, the high indexes are still dominated by provinces with high economic capacity caused by natural resources and business activities. In 2002, high index was achieved by South Sumatera, Riau, North Sulawesi, Bali, Papua, Aceh, Jakarta Special Region, Riau Islands, and East Kalimantan. While in 2013, Riau, East Java, East Kalimantan and Jakarta Special Region achieved the high sustainability index. At the same scenario, the provinces with lack of economic capacity achieved low level of sustainability such as East Nusa Tenggara, Maluku, and Papua. This confirms that the different weight on different aspect does not give very much different on the pattern of sustainability index. The high index remains achieved by rich provinces, while the poor province can only afford the low level of index.

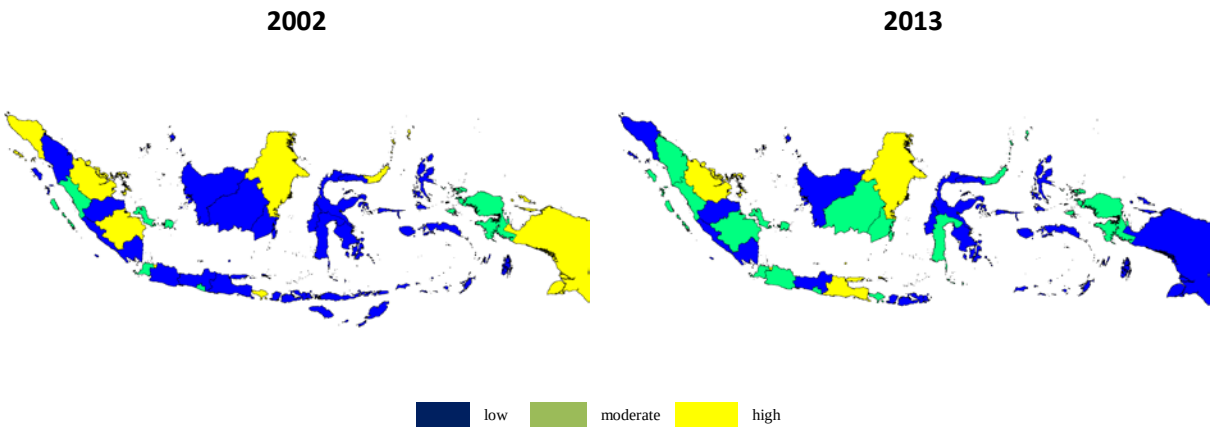

Figure E6 SDI based on group in 2002 and 2013
***Source*: Authors' own estimates.**