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Indonesian Provinces SDGs Composite Index: Lampung Province Analysis

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Abstract

Publications of Sustainable Development Goals (SDGs) have mainly been conducted at a national level and separately for each goal. No prior research has been done on SDGs composite index at a provincial level in Indonesia. It is necessary to create a composite index that presents a single value at the provincial level to enable regional evaluation. The Indonesia Province SDGs composite index is developed from indicators based on Statistics Indonesia gathered from several publications. The data sources are the National Socio-Economic Survey (Susenas) and the Basic Health Research (*Riskesdas*) which were linked surveys held in 2018. Principal Component Analysis and Factor Analysis are used as the methods to select the indicators of the SDGs. Those selected indicators are then normalized using the min-max method and subsequently weighted using factor loading derived from the principal component analysis. Finally, the indicators are aggregated using an arithmetic mean to determine the composite index. The Indonesia Province SDGs composite index is an approach to measure achievement of SDGs agenda. In addition, each goal achievement is summarized as a goal index. The SDGs composite index for Lampung Province is 52.2%, meaning that Lampung Province is 52.2% of the way to fully achieving the SDGs, according to the measures used to calculate this index. The findings on goal index suggest that development is highly requested on public services such as housing and water supply.

Keywords: SDGs; composite index; principal component analysis; factor analysis

JEL classifications: C38; C43; Q01

1. Introduction

The SDGs are key to inclusive economic development and good governance. The monitoring and evaluating of SDG indicators is designed to identify what works and what does not in policy design and implementation. In this way, the subsequent programs can be optimized through the evaluation of the results (Nicolai et al. 2016).

The insights that the SDGs and their indicators generate are critical to raising awareness and promoting a debate on the efficiency of public programs and policies (OECD 2017). It can empower government to make changes in budgeting and planning. Monitoring takes place during program implementation, while evaluation occurs at the end of a program. The efficiency of the SDGs depends on the context and stage of development of a country. However, in general, the main challenges or the requirements that must be met for SDG programs to be successful (Statistics Indonesia 2018) are agreement at every level of government, capacity to sustain the efforts of the SDGs, and access to reliable data and indicators.

The Government of Indonesian has recognized the need for better statistics as a tool for evidence-based policy formulation, decision making, and better support to progress monitoring and evaluation of outcomes and impacts of development initiatives (Statistics Indonesia 2018). In 1999 Indonesian administrative structure was reformulated into a

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decentralized administration. Today there are 34 provinces in Indonesia. Administrative policies need to be formulated at the provincial level. Because of this increasing recognition of the importance of statistics, the demand for quality and timely statistics at the provincial level has increased accordingly. This improvement requires all concerned to devise new methods for evaluating measurements of the SDGs at the province level.

In response to the newly existing opportunities, government institutions have made several publications related to SGDs indicators. Regretfully, the publications have been carried out by individual government institutions separately, and no agency provides explanation regarding the interrelationships among the indicators. In addition, the quality of the data produced by each institution varies. Examining overall achievement of the SDGs in Indonesia based on these separated publications is not feasible.

On the one hand, the introduction of SDG indicators has been carried out at the national level. However, it should be noted that the picture of achievement at the provincial level is not less important as it varies considerably from one province to another. Obstacles and problems hindering the achievement of the SDGs should be immediately identified. Detailed presentation of data allows the government to examine the root causes of the disparities. By disaggregating presentation at the provincial level, policymakers and decision makers can determine the main priorities of a program to achieve their SDGs.

On the other hand, the existing presentation of the SDGs contains descriptions of each indicator in each goal, making a comparison of different aspects of the entire SDGs in each province challenging. Aggregate presentation using a composite index enables a comparison of the overall state of the SDG indicators among various provinces. Therefore, it is necessary to create a composite index that presents a single value. Thus far, there has been no research on the sustainable development goal composite index at the provincial level in Indonesia. The high dimensionality of the SDG composite index on economic development, social inclusion, and environment will assist the government in identifying sustainability challenges with regards to each goal of the SDGs. The SDG composite index is aimed to contribute to the monitoring and evaluation of progress made in the implementation of the SDGs in Indonesian provinces.

Lampung Province is located on the southern tip of Sumatera Island and serves as the gate to Java Island, which is the busiest island in Indonesia. Lampung Province has the second largest population in Sumatera. In 2018, the population is around 8.4 million, or about 14.49 percent of the total population of Sumatera. The population of Lampung is larger than that of some other provinces whose total area is far larger than Lampung Province. Due to its strategic location and capital, Lampung has big opportunities to develop significantly. However, the GDP growth is at an average of 5 percent each year and in recent years unemployment has decreased to 0.2 percent/year (*Badan Pusat Statistik* 2018).

The declining birth and death rates in Lampung Province have affected the age structure of the population. The proportion of children aged 0-14 years declined from 29.04 percent in 2010 to 27.07 in 2020. During the same period, the population of the working age group aged 15–64 years increased from 66.15 percent in 2010 to 67.29 percent in 2020. The population aged 65 years and over increased from 4.8 percent in 2010 to 5.64 percent in 2020. This caused the decline in dependency ratio from 51.16 percent in 2010 to 48.62 percentages in 2020. The decrease in the dependency load ratio indicates reduced economic burden for people in the productive age who support the population of unproductive age. Nevertheless, the GDP did not grow at a significant rate (*Badan Pusat Statistik* 2018).

Furthermore, the increasing number of people will certainly have an impact on the emergence of sustainable development. The greater the population, the more aspects to be considered in policy making in terms of infrastructure provision to improve

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social welfare. This argument leads this research to evaluate the SDGs of Lampung Province via the Indonesian Provinces SDGs composite index.

2. Literature Review

A concept of sustainable development was first introduced in the Burtland Report entitled "Our Common Future" by the World Commission on Environment and Development (WCED) in 1987. The report defines sustainable development as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Asheim 1999). As an extension of this concept, the OECD adopted the first set of guidelines on Aid and Development from Numbers 1 to 4. The concept of sustainability was succeeded to the UNCED (UN Conference on Environment and Development) held in 1992 in Rio, and even further to the UN Millennium Development Goals in 2000 (MDGs) (Ciegis & Martinkus 2009a). Thus, the sustainable development gained an important position in international development activities until the SDGs was born.

To achieve the SDGs, the community must create goals of sustainability (Ciegis & Martinkus 2009b). The United Nations Development Summit of 25–27 September 2015 listed the 2030 agenda for sustainable development as the SDGs (OECD 2017). The 17 goals of the SDGs are a plan of action for the prosperity of people and the planet to accomplish universal peace (United Nations 2015). The Presidential Regulation Number 59 of 2017 organizes the SDGs into mainly four development dimensions: social, economic, environment, and law and good governance with 17 goals. Goals 1 to 5 are related to social development; goals 7, 8, 9 10 and 17 concern economic development; goals 6, 11, 12, 13, 14, and 15 pertain to of environmental development; and goal 16 is related to law and good governance (*Badan Pusat Statistik* 2018).

All the United Nations member states implement the 17 Sustainable Development Goals as their development targets until 2030. The targets of these goals might be measured using sustainable development indicators (Nicolai et al. 2016). However, various coverages when dealing with sustainable development including global, continental, national, regional, city, and local with different changes and situations need to observe from literally hundreds of different appropriate indicators (Robert, Parris & Leiserowitz 2005).

Each government sets its own national targets according to the national circumstances while taking into account the national planning, challenges, and strategies (OECD 2017). Good indicators are important for national planning to look at where it stands and where it is heading, yet building all the compulsory indicators will take years. Some institutions have begun promoting indicators to evaluate progress on their SDGs, but many indicators are not harmonized internationally and lack comparability (Schmidt-Traub et al. 2017). One of the most important steps in developing a composite index is the choice of indicators (Campagnolo et al. 2018). Correspondingly, this research merely focuses on indicators produced by Statistics Indonesia in 2018 which are based on an adequate statistical system (*Badan Pusat Statistik* 2018).

Sustainability indicators should show in which areas the province moves in a positive or negative direction with regards to the goal. Goal 17 is set as a prototype goal that measures a country's competency (Morse 2016), which is not suitable for this research. Some indicators are not measured against sufficient statistics or good measurement; therefore, the Government of Indonesia designates Statistics Indonesia as the primary data provider for the evaluation of the SDGs. Data from Statistics Indonesia contain reputable quality of SDG indicators. As needed in this research, the indicators can then be calculated into a composite index which represents SDG achievement in Indonesia. The composite index ranks the provinces in Indonesia according to their SGDS achievement. The rank order of SDG composite index is used to map the achievement of the SDGs in Lampung province by

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presenting indicators of achievement as a composite index.

To date, several studies have investigated the best way to select suitable indicators to develop an index from various indicators. Results from these studies suggest two ways to select the best indicators, namely multivariate analysis and multi-criteria analysis. Multivariate analysis is a quantitative analysis including sophisticated statistical approaches, while multi-criteria analysis is a qualitative analysis based on remarkable theory.

The first research to construct a composite index through multi-criteria analysis was conducted during a UN summit on the SDGs. At the summit, members reduced the indicators through the screening of indicators eligible to address the UN SDGs and data collection from other relevant sources (Campagnolo et al. 2015). Another case that demonstrates multi-criteria analysis (Schmidt-Traub et al. 2017) is work on UN SDGs index, which presented updated and revised data annually based on the empirical relationship to subjective well-being and remaining gaps in data and analysis.

The simplest way to reduce SDG indicators is found in the 'live and work city' index which only includes 10 main goals out of the 17 goals of the SDGs. The reason is to reduce the size of the separate indicators and visualize all the targeted values of the individual indicators and the sub-indices to make it easier to track the progress toward the targeted values (Fouda & Elkhazendar 2019). The African research on agriculture SDG index relies on data for indicators from five SDGs (SDGs 1, 2, 6, 7, and 15). Applying agriculture-related indicators and availability of data, the research selects indicators through multi-criteria analysis to perform the agriculture composite index (Nhemachena et al. 2018).

Three studies employing multivariate analysis to reduce indicators were carried out in Italy. The first is a study transforming Millennium Development Goal indicators into a human poverty composite index by using a principal component analysis (De Muro, Mazziota & Pareto 2011). The human poverty composite index is then compared with the Human Development Index, and the comparison shows a significant difference because the former includes larger criteria to measure welfare than the latter. Another study using a multivariate analysis is done using a two-stage principal component analysis which used to construct the SDGs of European countries. The composite index is used to divide European countries into five different welfare regions (Paoli & Addeo 2019).

Farnia, Cavalli & Vergalli's (2019) research illustrates how a composite index measures the SDG performance of Italian cities through cross section data. Examining 15 goals out of the 17 SDGs, the researchers select the indicators using a principal component analysis, weight the index using a correlation matrix, create the index using the arithmetic UN index, and display the results for the Italian cities using geographical information system. The result of the SDG composite index of the Italian cities confirms the rift between the north and south of the country. The key goals to understand the result are those related to 'good education' and 'decent work and economic growth'.

The studies reviewed above, clearly exemplified in the works undertaken by multivariate analysis that the result have be more representable to examine the complexities of Indonesian provinces. As the aim of this research is to observe the performance of Indonesian provinces in terms of SGDs, a multivariate analysis is employed.

Thus far, no prior research has been done on the sustainable development composite index on individual Indonesian provinces. Nevertheless, based on the 2018 United Nations composite index reports, Indonesia was ranked 99th among 156 UN member countries committed to SDGs (Schmidt-Traub et al. 2017). Collaborative effort to develop an initiative is needed to improve the performance in the future. Figure 1 below displays the research framework.

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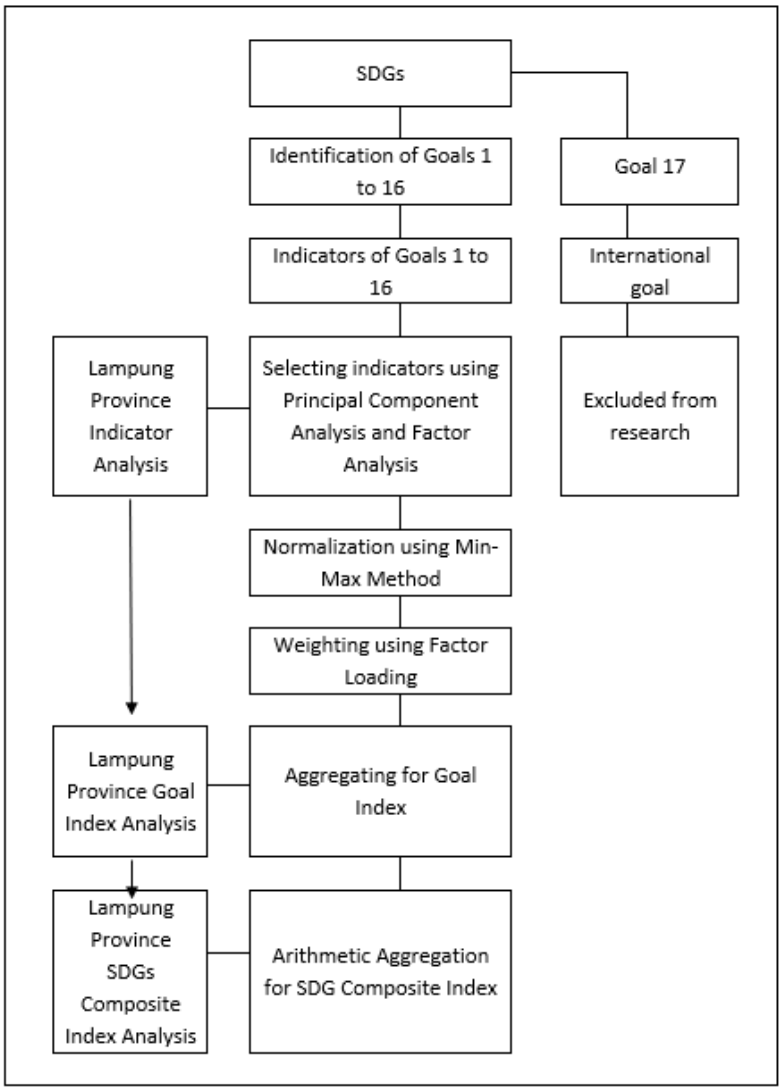

Figure 1. The Research Framework of Indonesian Provinces SDGs Composite Index

3. Method

3.1. Data Sources

Cross-section approach and secondary data sources are used in this research. The data sources in this research are the National Socio-Economic Survey (*Susenas*) and the Basic Health Research (*Riskesdas*), which were linked surveys in 2018. *Susenas* and *Riskesdas* 2018 interview the same respondents (*Badan Pusat Statistik* 2018).

3.2. Selection of Indicators

Selected indicators representing a composite index are required to create a summary based on data characteristics (Mazziotta & Pareto 2013). Due to insufficient eligible indicators to measure the SDG performance in Indonesia, the process of selecting indicators in this research focuses on checking the quality of the available indicators. The number of indicators from the SDGs is large, and some of them may be identified as non-contributing ones.

Principal Component Analysis (PCA) is an ap-

proach of data reduction to create one or more index variables from a larger set of measured variables (Mazziotta & Pareto 2013). It uses a linear combination which is basically a weighted average of a set of variables. The created index variables are called components. The overarching goal of the PCA is to determine the optimal number of components, the optimal choice of measured variables for each component, and the optimal weights of each (Härdle & Simar 2003).

In general, the main component of i is a linear combination of weighted original variables capable of explaining the diversity of data i, and can be written as follows:

$$\mathrm{Y_i} = \alpha_{\mathrm{i1}}\chi_1 + \alpha_{\mathrm{i2}}\chi_2 + \cdots + \alpha_{\mathrm{ip}}\chi_{\mathrm{p}} \qquad (1)$$

$$\mathrm{VAR(Y_i)} = \lambda_{\mathrm{I}}, \mathrm{i} = 1, 2, \ldots, \mathrm{p} \qquad (2)$$

where:

Y : number of indicators;
α : value of factor loading in matrix;
P : number of provinces.

The calculation of the correlation matrix used to identify the closeness of the relationships among the indicators can be done with the Bartlett's test. This test is used to determine if the correlation matrix is not an identity matrix. It is used when the correlation coefficient is less than 0.525, and the alpha is less than 0.05. The steps are:

(1) Ho: Indicators are not important to explain the goal index.
Ha: Indicators are important to explain the goal index.
(2) Bartlett's test

$$\chi^2 = -\left[(\mathrm{N}-1) - \frac{(2\mathrm{p}+5)}{6}\right]\ln|\mathrm{R}| \qquad (3)$$

where:
N : number of observations;
p : number of variables;
R : determinant of correlation matrix.
(3) Decision Bartlett's test will reject Ho if $\chi^2\mathrm{obs} > \chi^2\alpha, \mathrm{p(p-1)}/2$

Factor analysis approaches data reduction in the measurement of a latent variable (OECD 2008). The latent variable cannot be directly measured using a single variable, such as well-being and innovation. Instead, it is seen through the relationships it causes in a set of variables. Factor analysis is also known as the extension of PCA. According to Härdle & Simar (2003), in factor analysis the data of the analyzed variables must have a Kaiser Meyer Olkin (KMO) statistic value of at least 0.5. The KMO criteria for feasibility of factor analysis are:
KMO = 0.9 variables are very good
KMO = 0.8 variables are good
KMO = 0.7 variables are rather good
KMO = 0.6 variables are more than enough
KMO = 0.5 variables are sufficient
KMO < 0.5 variables are not feasible for factor analysis.

The formula for the Kaiser Mayer Olkin (KMO) test is:

$$\mathrm{KMO} = \frac{\sum_{\mathrm{i}}\sum_{\neq \mathrm{j}} \mathrm{r_{ij}^2}}{\sum_{\mathrm{i}}\sum_{\neq \mathrm{j}} \mathrm{r_{ij}^2} + \sum_{\mathrm{i}}\sum_{\neq \mathrm{j}} \mathrm{a_{ij}^2}}; \qquad (4)$$
$$\mathrm{i} = 1, 2, \ldots, \mathrm{p};$$
$$\mathrm{j} = 1, 2, \ldots, \mathrm{p}$$

rij : coefficient of simple correlation between variables i and j;
aij : partial correlation coefficient between variables i and j.

Indicators are employed for SDG composite index if the indicators for each goal are significant for both Principal Component Analysis and Factor Analysis. The data were tested for all Indonesian provinces so that the significant indicators would be analytically sound and applicable for Indonesian provinces where coverage and relevance of the phenomenon were being measured.

3.3. Formation of Composite Index

A composite index is a grouping of index that are combined in a standardized way to provide a useful

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statistical measure of overall sector performance over time (Sanga, Dosso & Gui-Diby 2011). An index has a unit free value of between 0 and 1 that allows several different indices to be summed up (Morse 2016). Nevertheless, one has to be cautious in its development, interpretation, and use as the index is a mean to be used for important decision-making and expression of views on the considered phenomenon (Farnia, Cavalli & Vergalli 2019).

Based on OECD (2008), the Indonesian provinces SDGs composite index involves three-steps:

(1) Normalization
This refers to converting indicators to a standardized scale using the min-max method. Normalization is a method of standardization to set different measurement units and transform highly skewed indicators.

(2) Weighting
The weighting technique for the SDGs composite index is derived from factor analysis which includes the construction of the weights from the matrix of factor loadings after rotation, given that the square of factor loadings represents the proportion of the total unit variance of the indicator explained by the factor for each province. As a result, the weight is applicable for all provinces.

(3) Aggregation
The SDG composite index summarizes the main findings from the analysis of the SGDS achievement. The SDGs composite index is a free value of units ranging between 0 and 1 which allows various different indexes to be added or summed up (De Muro, Maziotta & Pareto 2011). The schemes for formulating the SDGs composite index are:

(a) Calculation of the index for each goal
In general, the following formula is used to calculate the indicator index:

$$\mathrm{I_{ijx}} = \frac{\mathrm{c_{ijx}} - \mathrm{min_{ij}}}{\mathrm{max_{ij}} - \mathrm{min_{ij}}} = \frac{\mathrm{D_{ijx}}}{\mathrm{R_{ij}}} \qquad (5)$$

$\mathrm{I_{ijx}}$: single index of i indicator from j's goal of x province; i=1,2,3,. . . ; j=1,2,. . . ,16; x=1,2,. . . ,34;
$\mathrm{c_{ijx}}$: value of i indicator from j's goal of x province;
$\mathrm{max_{ij}}$: the maximum value of I indicator of j's goal;
$\mathrm{min_{ij}}$: the minimum value of I indicator of j's goal.

The index of an indicator can be obtained by the following process:
First, to identify the maximum value $\mathrm{max_{ij}}$ and minimum $\mathrm{min_{ij}}$ of each indicator from the indicator number for each province.
Second, to calculate the range of each indicator by subtracting the value maximum with a minimum value. So, $\mathrm{R_{ij}}$ is the range of i indicators of the j's goal specified by:

$$\mathrm{R_{ij}} = \mathrm{max_{ij}} - \mathrm{min_{ij}} \qquad (6)$$

Third, to subtract the minimum value from the current value of the i indicator on j's goal of x province. The result is the difference in value shown by $\mathrm{D_{ijx}}$. If $\mathrm{c_{ijx}}$ is the present value of the i indicator to j's goal, it can be expressed as:

$$\mathrm{D_{ijx}} = \mathrm{c_{ijx}} - \mathrm{min_{ij}} \qquad (7)$$

Fourth, to obtain the index value of the i indicator on j's goal in province x will be obtained by dividing $\mathrm{D_{ijx}}$ with $\mathrm{R_{ij}}$:

$$\mathrm{I_{ijx}} = \frac{\mathrm{D_{ijx}}}{\mathrm{R_{ij}}} \qquad (8)$$

(b) Calculation of the index for each SDG
Composite index calculation for each goal uses an arithmetic mean which uses the different weights from the matrix of factor loadings after rotation for each indicator. The calculation uses the following formula:

$$\mathrm{G_{jx}} = \sum_{\mathrm{i}}^{\mathrm{n}} \mathrm{W_{ijx}} \mathrm{I_{ijx}} \qquad (9)$$

G_{jx} : goal's index of j's goal in province x;

W_{ijx} : weight of i indicator of j's goal in province x;

I_{ijx} : single index of i indicator from j's goal of x province; i=1,2,3,. . . ; j=1, 2,. . . ,16; x=1,2,. . . ,34.

(c) Calculation of the SDG Composite Index
Composite index calculation uses the results of each goal's index from the 16 goals that are arithmetically averaged in value with the following formula:

$$SDGs_x = \frac{1}{16}\sum_{i}^{n} T_{jx} \qquad (10)$$

$SDGs_x$: SDGs composite index of province x; x=1,2,3,. . . ,34;

G_{jx} : Goal's index of j's goal in province x.

After the composite index is formed for each province, the applicability of Lampung Province case to other provinces is performed. The analysis includes strengths and weaknesses in terms of economic conditions and suggestions pertaining to conditions of SGDS achievement of Lampung Province.

Index achievement can be divided into five levels of score achievements (Prescott-Allen 2001) as follows:
Good : 80% to 100%
Fair : 60% to 80%
Medium : 40% to 60%
Bad : 20% to 40%
Poor : 0% to 20%

4. Result

4.1. Calculation of SDG Composite Index

The first stage of calculating SGDS composite index involves a KMO test, which is used to determine whether the data of indicators were suitable to explain the goal. If the KMO value is minimum 0.5, it implies that the data are sufficient for a factor analysis and that a factor analysis will be useful to explain the data. Furthermore, the Bartlett's test of sphericity output requires a significance value of less than 0.05. The results of the test are part of the principal component analysis used to identify whether the type of correlation matrix constructed to compose the main components is an identity matrix. Based on the final test results obtained for every goal, it can be concluded that the correlation matrix is not an identity matrix, which indicates that the indicators are related and therefore suitable for structural detection. The statistics in Table 1 show that 16 goals of the SDGs met all the requirements with regards to the Keizer Meyer Olkin and Bartlett's test of sphericity.

Table 1. Keizer Meyer Olkin and Bartlett's Test of Sphericity for Goal Index

Goal	Keizer Meyer Olkin	Bartlett's Test of Sphericity
1	0.5761	0.0000
2	0.5486	0.0000
3	0.5742	0.0000
4	0.6557	0.0000
5	0.5000	0.0025
6	0.5571	0.0000
7	0.5000	0.0000
8	0.5644	0.0024
9	0.5000	0.0000
10	0.5000	0.0000
11	0.5849	0.0009
12	0.5000	0.0000
13	0.6230	0.0027
14	0.5041	0.0000
15	0.5000	0.0118
16	0.7365	0.0000

Source: SPSS statistical analysis of the National Socio-Economic Survey (*Susenas*)

The second stage is to inspect the values of communalities in the SPSS output. Communalities are the proportion of variance an original indicator can be explained by the main factor. The value of communalities explains the extent to which variation of the original indicator can be explained by the factors formed. The greater the communalities of an indicator, the stronger its relation to the factors formed. Indicators with large communalities can be

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well explained through the factors obtained, and the results of the factor analysis are deemed reliable.

The third stage is examining the total variance explained and describing each factor or a contribution (share) of certain factors of all variances of the original indicators. Cumulatively, Table 3 illustrates that the indicators of the first goal explain as much as 86.9 percent of the total variance of the first goal of "No Poverty".

The fourth stage continued with a component matrix from factor analysis. The component matrix, from the principal component analysis, consists of the factor loadings of the indicators tested. These factor loadings determine which indicators form factors, thereby showing the factor loadings on the main component (extraction). Nevertheless, the extraction is still difficult to determine the dominant indicator included in the factor due to the similar value of factor loading for some indicators in a goal. Rotation is required to overcome this issue. In this study, the varimax rotation method is applied. The mechanism of the varimax rotation is to make a factor loading of the indicator only dominant for one factor. An indicator's factor loading is approached by the absolute values between 1 and 0 on each factor, which will be used as weighting for the selected indicators.

Finally, to reduce indicators, the values of the communalities and factor loading are considered. The cut-off points are set at around 0.525 for communalities and 0.65 for factor loadings. This means that if an indicator has both the communalities and factor loading values of above this cut-off, the indicator can be used as an indicator in composing SDG composite index.

The results of indicator selection using principle component analysis and factor analysis are presented in Table 3.

It should be noted that the presentation of indicators in this analysis is valid for the current condition for all the provinces, regardless of how the target needs to be achieved in relation to each goal. To understand the conditions of the achievement in the target year, the same methodology may be applied in the future. However, new data will be needed for each indicator within each goal to measure the achievement. The same indicators and the weighting technique for the SDG composite index could be applied to analyze the SGDS achievement in other provinces as they are used for Lampung Province reported in this paper.

4.2. Implications of the SDG Composite Index in Lampung Province

It is evident that the SDG achievement of Lampung Province in all but two of the sixteen goals in 2018 requires special consideration. There is 10 more years to the end of the SDGs agenda in 2030. With an overall achievement of 52.2%, Lampung Province SDG achievement can be categorized only as medium achievement. This means that Lampung Province is 52.2% of the way to fully achieving the SDGs, according to the measures used in this index. This also means only 50% of the SDG achievement has been accomplished. As presented in Figure 2, the most significant achievement relates to Goal 7, renewable energy. One reason for this success is that the issue of renewable energy enabled a candidate to win the campaign in the past election year and has been promoted as one of the development priorities by the central government. The government provides free gas and stove for cooking to every household in Lampung Province. This has had a positive effect on deforestation reduction within the Province and measurable impact on the overall ecosystem. The second-best achievement is in Goal 16. Similar to the achievement in Goal 7, this achievement can be attributed to a new service, namely free registration and archiving of birth certificates for all. Documenting births marks Lampung Province's needs for a mass movement to develop its condition in the future.

Two environmental goals remaining at the bottom are Goal 12, responsible consumption and production, and Goal 13, climate action. Food is fundamental for survival. The agricultural sector is equally

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Table 2. Communalities for SDG Indicators

Goal	Indicator	Communalities
1	Headcount index (P_o)	0.9029
	Poverty gap index (P_1)	0.9720
	Poverty severity index (P_2)	0.9522
	Proportion of population covered by social protection	0.3632
	40% poorest living in slum area	0.4811
	40% poorest based on contraceptive prevalence rate	0.6485
2	Undernourished population	0.6957
	Non-breastfed infants	0.7963
	Women with anaemia	0.4706
	Toddlers with malnutrition	0.9086
	Stunted toddlers	0.8785
3	Childbirth by health practitioner	0.8396
	Expected years to live	0.7413
	Unmet needed health facilities	0.9054
	Insured individuals	0.9567
	Smoking individuals	0.5115
	Morbidity rate	0.9149
	Vaccination rate	0.7277
4	Preschool	0.0522
	Net enrolment ratio	0.5159
	School enrolment ratio	0.9637
	Literacy	0.8117
	No Education Certificate	0.9039
	Mean year of schooling	0.8957
5	Women married under 18	0.6471
	Cell phone facilities for women	0.3853
	Quick access to family planning program	0.6757
6	Clean drinking water	0.7084
	Good sanitation	0.5620
	Handwash with soap and clean water	0.8801
7	Households with electricity	0.8366
	Households using gas as cooking fuel	0.8366
8	Economic growth rate	0.7597
	Formal labour	0.6959
	Unemployment rate	0.9323
	Economically active population	0.5333
9	Population using cell phone	0.9406
	Population with internet access	0.9406
10	Gini ratio	0.9573
	40% low income	0.9741
	Harassed people	0.0884
11	Reported crime to police	0.8545
	Households in slum area	0.7331
	Households using public transportation	0.8280
	Households using public transport with no routes	0.6193
12	Transported waste to landfill	0.8482
	Proportion of food consumption	0.8482
13	Households recycling organic waste	0.5430
	Population comprehending early warning system	0.6983
	Population participating in disaster simulation	0.5452
14	Households disposing waste to the sea	0.2417
	Consumption of more than 100 litres a day of water	0.7971
	Fish consumption	0.8918
	Households disposing waste to beach	0.8807
	Households disposing waste to sea	0.9383
15	Land to building ratio	0.7135
	Households disposing waste to land	0.7135
16	Proportion of physical violence	0.4203
	Child registered immediately after birth	0.9494
	Birth certificate for the poor	0.9865
	Children with birth certificate	0.9822

Source: SPSS statistical analysis of the National Socio-Economic Survey (*Susenas*)

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Table 3. Values of Total Variance Explained for Sustainable Development Goals

Goal	Total Variance
1	868.886
2	819.815
3	847.608
4	893.734
5	750.985
6	716.836
7	836.565
8	730.285
9	940.555
10	986.577
11	758.746
12	848.172
13	595.452
14	749.937
15	713.470
16	972.693

Source: SPSS statistical analysis of the National Socio-Economic Survey (*Susenas*)

important in promoting a sustainable food chain today, tomorrow, and well into the future. Furthermore, about 50% of Lampung Province residents work in the agricultural sector. The local government (regency) and community should work under a sustainable support system to enhance the agricultural sector in Lampung Province. The local government should take action because the transformation in the food systems require technical, policy, and capacity enhancement as well as financial support.

Climate change has become more evident in Lampung Province as extreme weather events such as a prolonged dry season causing water shortages and an extended rainy season have become more frequent. In the last decade, climate change has impacted Lampung economy and society through an accumulation of natural disasters, infectious diseases, and depletion of natural resources including food. The low ranking of these two goals, Goals 12 and 13, should be a wake-up call for Lampung Province administrators to pay more serious attention to the environmental and sustainability issues. There will always be trade-offs between development and the environment, so the government needs to regulate these two to create a balance.

Empowering women to reach their full potential requires that they have equal opportunities to their male counterparts. This means eliminating all forms of discrimination and violence against women. Goal 5 index in Lampung Province is 36.5%, indicating a low achievement in this area. The Lampung cultural kinship is patrilineal, based on a relationship to the father or descent through the male line. Men tend to have a better position in every aspect of life in Lampung. The local government needs to consider adopting cultural values that promote equal opportunities for men and women in education and work. Frankly, women have the potential to contribute to the household income which in turn would improve the family welfare and contribute to Lampung economy.

Goal 6 achievement index is central to reducing the growing number of communicable diseases. Furthermore, an inadequate sanitation system will pollute and harm the environment, especially land and water resources, thus imposing greater costs to the society and the local government in the long run. Goal 6 index in Lampung Province is 40%, indicating the 4th lowest achievement of all goals. The quality of health status in Lampung Province is influenced by the environmental condition. The percentage of households having access to clean drinking water in 2018 was 56.8%. This means that nearly half of households in Lampung Province did not use clean drinking water.

Rapid change of infrastructure promotes inclusive and sustainable industrialization between regencies and cities. The use of innovation is unavoidable in supporting the survival of many people in Lampung Province. Goal 9 index in Lampung Province is 40.8%, suggesting a medium achievement. The Province has the potential to achieve far higher given the fact that it is the south gate of Sumatera and the bridge between Sumatera and Java Island, on which the capital city is located. There is a huge opportunity that the government should capitalize to stimulate the economic growth by offering quality services to bridge Sumatera and Java.

Goal 11 index for Lampung Province is 44.6%, indi-

Table 4. Factor Loadings for SDG Indicators

Goal	Indicator	Factor Loading
1	Headcount index (P_o)	0.9502
	Poverty gap index (P_1)	0.9859
	Poverty severity index (P_2)	0.9758
	Proportion of population covered by social protection	0.6026
	40% poorest living in slum area	0.6936
	40% poorest with contraceptive prevalence rate	0.8053
2	Undernourished population	0.7839
	Non-breastfed infants	0.8920
	Women with anaemia	0.5593
	Toddlers with malnutrition	0.9533
	Stunted toddlers	0.8881
3	Childbirth by health practitioner	0.8303
	Expected years to live	0.8311
	Unmet needed health facilities	0.8865
	Insured individuals	0.9759
	Smoking individuals	0.7798
	Morbidity rate	0.6833
	Vaccination rate	0.8453
4	Preschool	0.2153
	Net enrolment ratio	0.6557
	School enrolment ratio	0.9816
	Literacy	0.8187
	No education certificate	0.9460
	Mean year of schooling	0.9459
5	Women married under 18	0.8040
	Cell phone facilities for women	0.6207
	Quick access to family planning program	0.8220
6	Clean drinking water	0.8416
	Good sanitation	0.9381
	Handwash with soap and clean water	0.7497
7	Households with electricity	0.9144
	Households using gas as cooking fuel	0.9144
8	Economic growth rate	0.7298
	Formal labour	0.8710
	Unemployment rate	0.6941
	Economically active population	0.9655
9	Population using cell phone	0.9698
	Population with internet access	0.9698
10	Gini ratio	0.9784
	40% low income	0.9870
	Harassed people	0.2973
11	Reported crime to police	0.9228
	Households in slum area	0.7454
	Households using public transportation	0.8586
	Households using public transport with no routes	0.6665
12	Transported waste to landfill	0.9210
	Proportion of food consumption	0.9210
13	Households recycling organic waste	0.7369
	Population comprehending early warning system	0.8356
	Population participating in disaster simulation	0.7383
14	Households disposing waste to the sea	0.4890
	Consumption of more than 100 litres a day of water	0.6900
	Fish consumption	0.9172
	Households disposing waste to beach	0.9372
	Households disposing waste to sea	0.9681
15	Land to building ratio	0.8447
	Households disposing waste to land	0.8447
16	Proportion of physical violence	0.6480
	Child registered immediately after birth	0.9744
	Birth certificate for the poor	0.9932
	Children with birth certificate	0.9910

Source: SPSS statistical analysis of the National Socio-Economic Survey (*Susenas*)

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Table 5. Resulting Indicators for SDG Composite Index

Goal	Purposed Indicators	Final Indicators
1	Headcount index (P_o)	(1) Headcount index (P_o)
	Poverty gap index (P_1)	(2) Poverty gap index (P_1)
	Poverty severity index (P_2)	(3) Poverty severity index (P_2)
	Proportion of population covered by social protection	(4) 40% poorest contraceptive prevalence rate
	40% poorest living in slum area	
	40% poorest with contraceptive prevalence rate	
2	Undernourished population	(1) Undernourished population
	Non-breastfed infants	(2) Not Breastfed infants
	Women with anaemia	(3) Toddlers with malnutrition
	Toddlers with Malnutrition	(4) Stunted toddlers
	Stunted toddlers	
3	Childbirth by health practitioner	(1) Childbirth by health practitioner
	Expected years to live	(2) Expected years to live
	Unmet needed health facilities	(3) Unmet needed health facilities
	Insurance population	(4) Insurance population
	Smoking population	(5) Vaccination Rate
	Vaccinated infants	(6) Morbidity rate
	Morbidity rate	
4	Preschool	(1) School enrolment ratio
	School enrolment ratio	(2) Literacy
	Net enrolment ratio	(3) No education certificates
	Literacy	(4) Mean year of schooling
	No education certificates	
	Mean year of schooling	
5	Women married under 18	(1) Women married under 18
	Cell phone facilities for women	(2) Quick access to family planning program
	Quick access to family planning program	
6	Clean drinking water	(1) Clean drinking water
	Good sanitation	(2) Good sanitation
	Handwash with soap and clean water	(3) Handwash with soap and clean water
7	Households with electricity	(1) Households with electricity
	Households using gas as cooking fuel	(2) Households using gas as cooking fuel
8	Economic growth rate	(1) Economy growth rate
	Formal labour	(2) Formal labour
	Unemployment rate	(3) Unemployment rate
	Economically active population	(4) Economically active population
9	Population using cell phone	(1) Population using cell phone
	Population with internet access	(2) Population with internet access
10	Gini ratio	(1) Gini ratio
	40% low income	(2) 40% low income
	Harassed people	
11	Reported crime to police	(1) Reported crime to police
	Households living in slum area	(2) Households living in slum area
	Households using public transportation	(3) Households using public transportation
	Households using public transport with no routes	(4) Households using public transport with no routes
12	Transported waste to landfill	(1) Transported waste to landfill
	Proportion of food consumption	(2) Proportion food consumption
13	Households recycling organic waste	(1) Households recycling organic waste
	Population comprehending early warning system	(2) Population comprehending early warning system
	Population participating in disaster simulation	(3) Population experiencing simulation disaster
14	Households disposing waste to sea	(1) Consumption of more than 100 litres a day of water
	Consumption of more than 100 litres a day of water	(2) Fish consumption
	Fish consumption	(3) Households disposing waste to beach
	Households disposing waste to beach	(4) Households disposing waste to sea
	Households disposing waste to sea	
15	Land to building ratio	(1) Land to building ratio
	Households disposing waste to land	(2) Household disposing waste to land
16	Proportion of physical violence	(1) Child registered immediately after birth
	Child registered immediately after birth	(2) Birth certificate for the poor
	Birth certificate for the poor	(3) Children with birth certificate
	Children with birth certificate	

Source: SPSS statistical analysis of the National Socio-Economic Survey (*Susenas*)

cating a medium achievement. There are 4.3% of households in Lampung Province living in slum settlements. Poor living conditions make slum dwellers more vulnerable to certain diseases. Poor water quality, for example, is a cause of many major communicable illnesses including malaria, diarrhea, and tuberculosis. The government should enact Law Number 1 of 2011 on housing and settlement. The Law stipulates that the aim of public housing development is to ensure decent and affordable housing and settlement for all citizens in a healthy, safe, harmonious, orderly, well-planned, integrated, and sustainable environment.

The development program of Lampung Province is in line with the short and medium-term development plan (RPJMD) of Indonesia and aims to eliminate poverty and unemployment by improving the quality of human resources, technological development, and economic performance, and equally distributing development based on the situation, potential, and challenges. This development program relates to Goals 1 and 8 of the SDGs and has a gap between the target of the agenda and the conditions of today. Goal 8 index suggests a medium achievement. Furthermore, inequalities among the regencies and cities are a long-standing issue in Lampung Province that needs addressing through improved public policies.

As mentioned in the previous section, the 2030 agenda for sustainable development rightfully points out that sustainability has three dimensions: economic, environmental, and social. Economic sustainability has a whole strand of literature, and the World Bank and IMF devote a great deal of attention to debt and fiscal sustainability. Achievement on economic goals related to Goals 8, 9, and 10 is below 50%. This low achievement can be attributed to insufficient infrastructure in Lampung Province because the Province depends its economic growth on the service sector. Public expenditure and budgeting reviews should be geared to identify a priority in public infrastructure to develop the economy. The same can be said about environmental sustainability related to Goals 6, 11, 12, 13, 14, and 15, which remain having the lowest index for Lampung Province.

There have been requests for increased government support on social sustainability related to Goals 1 to 5 such as maternal and child health programs, vaccinations, and tackling malnutrition through nutrition assistance programs. The increasing number of competent health practitioners and evenly distributed health workers in remote rural areas are required. More importantly, the government should be aware that empowering citizens to understand preventive measures is equally important as providing health care facilities.

The percentage of population below the poverty line in Lampung province is the tenth highest of all provinces in Indonesia at 13.1% and higher than the national rate of 9.7%. The poor are mostly in western part of Lampung Province where development is hindered due to the geographical aspects of Bukit Barisan Mountains. This further shows that the handling of poverty problems has not been satisfactorily managed across Lampung Province.

As of 2018, Lampung Province progress towards the goals was uneven. Most of goal indices for Lampung Province are around 50% (Goals 3, 4, 6, 8, 9, 10, 11, 14, and 15). Lampung Province has less than a decade to achieve another half to meet the targets set forth for 2030. In addition, the annual performance review of the SDGs is important. The provincial government should carefully select its priority based on the data, understand the contribution of the goal achievement to development, and then make its very best efforts to achieve the goal.

Lampung Province ranks 23rd of all provinces, close to South Sumatera at 24th and Bengkulu at 25th places (Figure 3). This indicates that development in Indonesia is still centralized on Java Island where the capital city is located. Local autonomy in Indonesia can be interpreted as more power residing in provinces with natural resources to develop their regions as they see fit. Therefore, provinces with little to no natural resources such as Lampung have limited power, even still receiving support from

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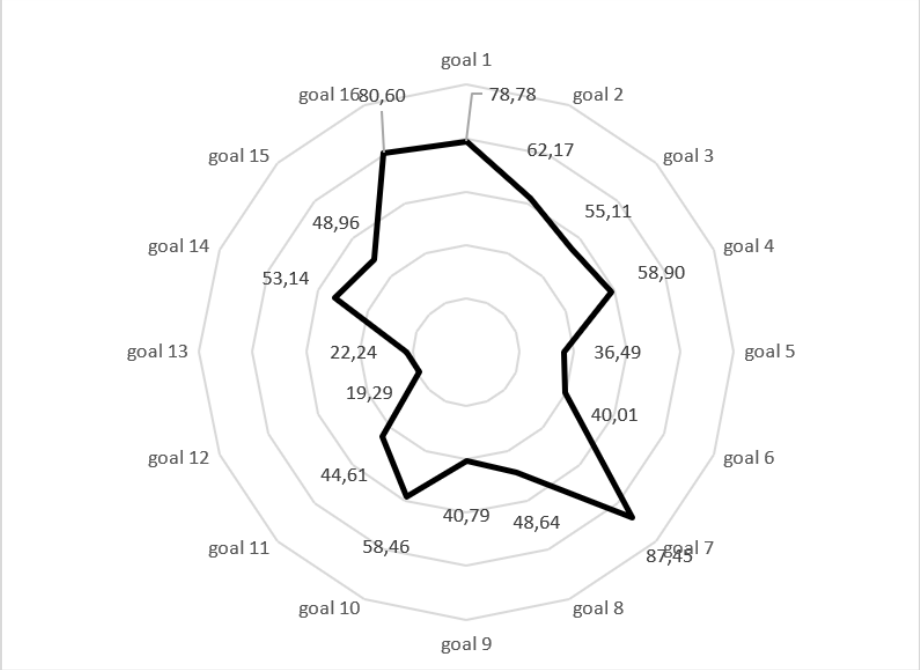

Figure 2. SDG Goal Index
Source: *Susenas* and *Riskesdas* 2018

the central government. Lampung should advance the service sector as the gateway of Sumatera and tourism to promote inclusive economy for the residents of the Province.

With less than 10 years remaining to the 2030 deadline, Lampung government must feel a sense of urgency. The SDG composite index of Lampung Province suggests the unequal distribution of opportunities and life experiences across the urban and rural areas. Inequalities based on gender, age, race, and income are considerable, and these must be addressed. Achieving the 2030 agenda requires immediate and accelerated actions along with collaborative partnerships among the various governments – local, regional, provincial, national, and other stakeholders at all levels. The objective is to be more effective, cohesive, and accountable.

5. Conclusion

The SDGs can be used as a basic concept for constructing a composite index to measure the development of the Indonesian provinces based on the indicators published by Statistics Indonesia. Utilizing the principal component analysis and factor analysis methods, 51 out of 62 indicators available on Susenas and Riskesdas are selected. To arrive at the SDG composite index, the data of the selected indicators are normalized using the min-max method, the weights are derived from the factor loadings, and the composite index are aggregated using arithmetic calculation.

The SDGs composite index of Lampung Province is 52.2%, categorized as medium. This means that Lampung Province is 52.2% of the way to fully achieving the SDGs, according to the measures used in this index. Two environmental goals are at the lowest places, namely Goals 12 and 13. This indicates that development in Lampung Province should further consider environmental sustainability.

The results therefore suggest that priority should be placed on the goals with the lowest index, Goals 12 and 13, and maintenance should be performed

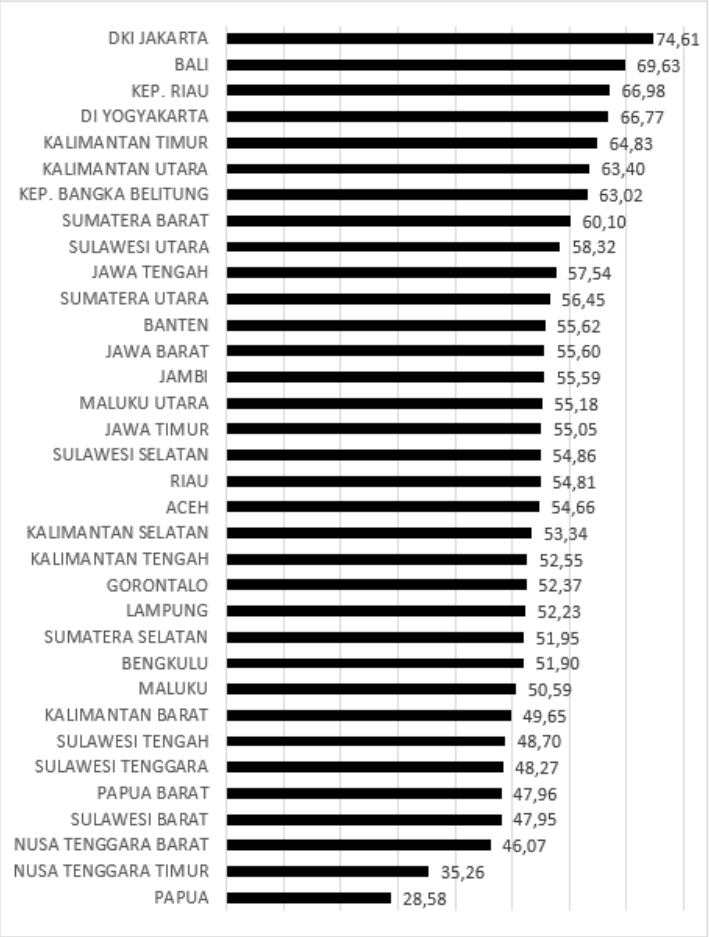

Figure 3. Indonesian Provinces SDG Composite Index, 2018

on the goals with the highest index, Goals 7 and 16. Development in Indonesia is centralized on some aspects as evidenced in Lampung Province. Free services such as the provision of and the record keeping of birth certificates and gas as a cooking fuel as a countermeasure to reduce forestation have been successful SDG programs in Lampung Province. This success should inspire other similar programs in the future, particularly in the highly requested public services such as housing and water supply.

Progress on the social and economic dimensions of sustainable development will require local government leaders to examine inequality and disadvantaged population within their cities and regencies. Poverty rates are higher than that of the national level due to the infrastructure and public services that are below the national standard. To tackle these systemic inequalities, local government leaders need to adopt long-term, targeted social policies and also invest in the review of more disaggregated data to better identify specific areas for improvement.

The SDGs composite index data can be implemented as material for policy evaluation in each department on local government if viewed according to a group of objectives. By examining the goal and the original indicators, each ministry and department could assess the strengths and constraints of policy implementation based on the data. In ad-

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dition, the SDG composite index data can also be customized as an evaluation of policies and priorities to address problem areas at each provincial level. Priority handling of problems could then be based on the results of the goal index.

Overall, the findings suggest that deliberate national programs and targeted interventions are required in terms of systematic infrastructure of public services such as water distribution system, housing, and sanitation. Examples would include targeted maternal and child health programs, vaccinations, and tackling malnutrition through nutritional assistance programs.

As with all composite measures, the SDG composite index has some limitations. The provincial level data are based on Statistics Indonesia. For this study, the authors are only able to track 61 of the indicators directly at provincial level. For all other indicators, some or all of the data had to be transferred to the provincial level from the national level statistics. Thus, there is the necessity for collecting data to complement the indicators used in the preparation of the SDG composite index, at both the national and provincial levels.

The results of the rankings should be interpreted with caution and only after reviewing the calculation, which contains important information about the methods used to obtain the estimates. In terms of methodology for further studies, multiple weighting methodology may be applied based on the budget and priority of development to evaluate the balance between the budget allocation and the goal achievement.

The analysis reported in this paper focuses at the provincial level especially Lampung Province. Further studies are required to analyze and compare the SGDS achievement in all provinces in Indonesia. The data should be tested for all Indonesian provinces so that the significant indicators would have analytical soundness and applicability for Indonesian provinces where coverage and relevance of the phenomenon are being measured. Analysis of the SDG composite index as a new measurement to understand multidimensional development can be applied to Lampung Province and other Indonesian provinces.

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