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# How sustainable is regional development? An application of regional sustainable account (RSA) model in East Kalimantan Indonesia

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## Abstract

East Kalimantan (Borneo) is one the richest provinces in Indonesia. Endowed with abundant natural resources such as oil, gas, coal, and forestry, economic growth in the province was among the highest in Indonesia from the 1990s to the 2000s with an average growth of more than 7% per year. Recently, East Kalimantan experienced a contraction of -1.28% in its economic growth even though the province has a high score in the human development index and environmental composite index. This study aims to address this interesting sustainable development paradox by using a comprehensive sustainable assessment method called the Regional Sustainable Account (RSA). This approach is a modification of the Location Quotient (LQ) method combined with the Geographical Information System (GIS). The results show a classification of regions according to their sustainability grade ranging from chronic unsustainable to very sustainable. The results could be used as a policy recommendation for policy makers seeking to develop their regions in a more sustainable way based on the comprehensive measure of economic, social and ecological accounts. The results could also be used by other provinces in Indonesia as an evaluation instrument for regional development.

***Keywords:*** Sustainable Development; Economic Growth; Regional Sustainable Account; East Kalimantan



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## 1. Introduction

Sustainable development has become a global and national development paradigm in both developed and developing countries. During the last three decades, the notion of sustainable development has also shifted to regional levels. Several authors such as Giaoutzi and Nijkamp (1993), Clement et al. (2003), Patterson and Theobald (1995), and Nijkamp and Vreeker (2000) have introduced the notion of sustainable regional development (SRD). These authors emphasize the importance of measuring sustainable development at the regional level, since the demarcation at the regional level is measured relatively easily. Furthermore, Clement et al. (2003) noted that SRD integrates sustainable development principles into regional development practices. In addition, Hansen (2001) stated that the assessment of SRD should also consider the conformity between indicators at the global, regional, and local levels and the integration of socio-economic indicators with spatial references. Hence, measuring sustainable development at the regional level could be seen as a practical step to integrating sustainable development and regional development principles.

In Indonesia, sustainable development is the central core of national development planning, as stated in Law 17/2007 on long-term national development planning. The importance of achieving sustainable development is also emphasized in regional development indicators as mandated in Law 23/2004, whereby achieving sustainable development is the responsibility of both national and regional governments.

Several studies have attempted to assess regional development at both the national and regional levels in Indonesia. Fauzi and Oxtavianus (2014) examined the state of sustainable development using three basic provincial data to represent economic, social, and environmental indicators (i.e., economic growth, human development index, and environment quality index, respectively). Based on these indicators, they developed a composite index of sustainable development for 30 provinces in Indonesia. Other studies such as Erlinda (2016) examined the state of sustainable development at the regional level in Jambi Province in Indonesia. The author used nine indicators representing the economic, social, and environmental aspects of sustainable development. The assessment was based on the Flag approach developed by Nijkamp and Vreeker (2000), whereby regional sustainable development indicators were measured based on critical threshold values. Both studies indicated that achieving sustainable development goals is not an easy task, especially at regional levels. Even though the regional government in Indonesia has full authority to deliver its own development agendas based on Law 23/2004 on decentralization, several factors such as global economic situations, national interest, and socio-political factors might hinder the achievement of sustainable development. Hence, measuring sustainable development at the regional level in Indonesia remains a challenging issue from both the conceptual perspective and practical perspectives (Fauzi, 2012).

Such a challenge is faced by many provinces in Indonesia. One particular interesting case of achieving a sustainable agenda is in East Kalimantan (East Borneo) Province. East Kalimantan (Figure 1) showed remarkable growth during the 1990s. The source of economic growth was driven primarily from natural resources such as oil and forest products. In recent years, however, the province has showed some contractions in its economic growth, even though it shows a positive trend in the human development index. The province has shown what is called “the development paradox” whereby the sustainable development indicators in terms of economics, social development, and the environment do not always go hand in hand. This paper attempts to assess the sustainability of regional development in this province. It seeks to address how sustainable development is achieved in the region based on social, economic, and environmental indicators. The results from this study could be extrapolated to other provinces or to the national level regarding similar challenges in pursuing sustainable development goals.

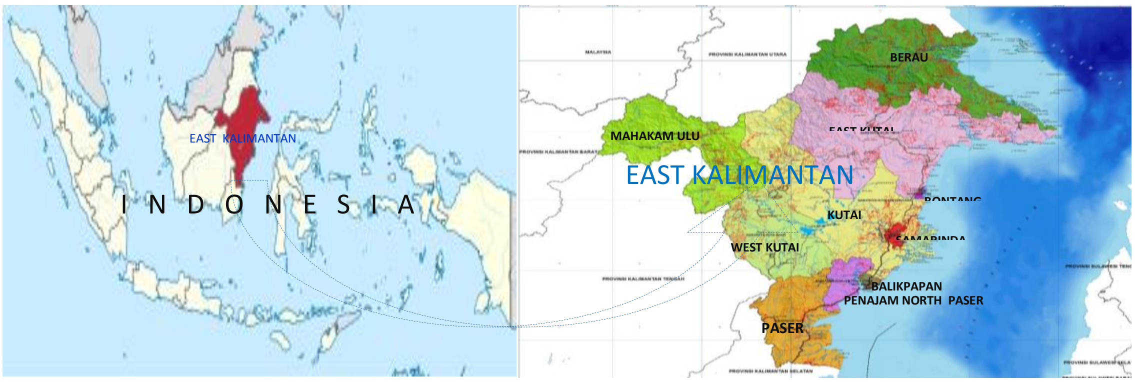


**Figure 1.** Map of East Kalimantan, Indonesia

## 2. Material and methods

The study is based on two years of secondary data (2014 and 2015) at the provincial level. The data were then decomposed regency-wise to provide two levels of sustainable development indicators: one for each regency and the aggregate indicators for the province. Indicators of sustainability for the economic, social, and environmental dimensions were developed based on various indicators previously found in the literature such as those by Wen and Chen (2008), Mohamed et al. (2014), Fauzi and Oxtavianus (2014), and Nababan et al. (2014).

The assessment of sustainability was carried out using a method called the Regional Sustainable Account or RSA. We developed this method by modifying the Location Quotient method adjusted to sustainable development. The Location Quotient (LQ) has been used to find the "competitiveness" of a region compared to other regions. The Location Quotient can only be utilized on economic issues and then modified into a wider tool for its use, which can be utilized on environmental and social issues so that this tool is more meaningful and powerful.

Some RSA assumptions are (1) during the analysis period, there is no shift in structure, economic, environmental, and social, (2) regions that are used as analysis objects are varied (3) the research object has a functional relationship with the comparison area, so that changes in certain regions will affect other regions, (4) all dimensions have the same weight, and (5) all indicators or variables only have one relationship that is either "negative" or "positive."

The RSA also adapts an approach built by Mohamed et al. (2014) to map the assessment results of each region followed by overlaying the reults on the administrative map of each region as shown in Figure 2.

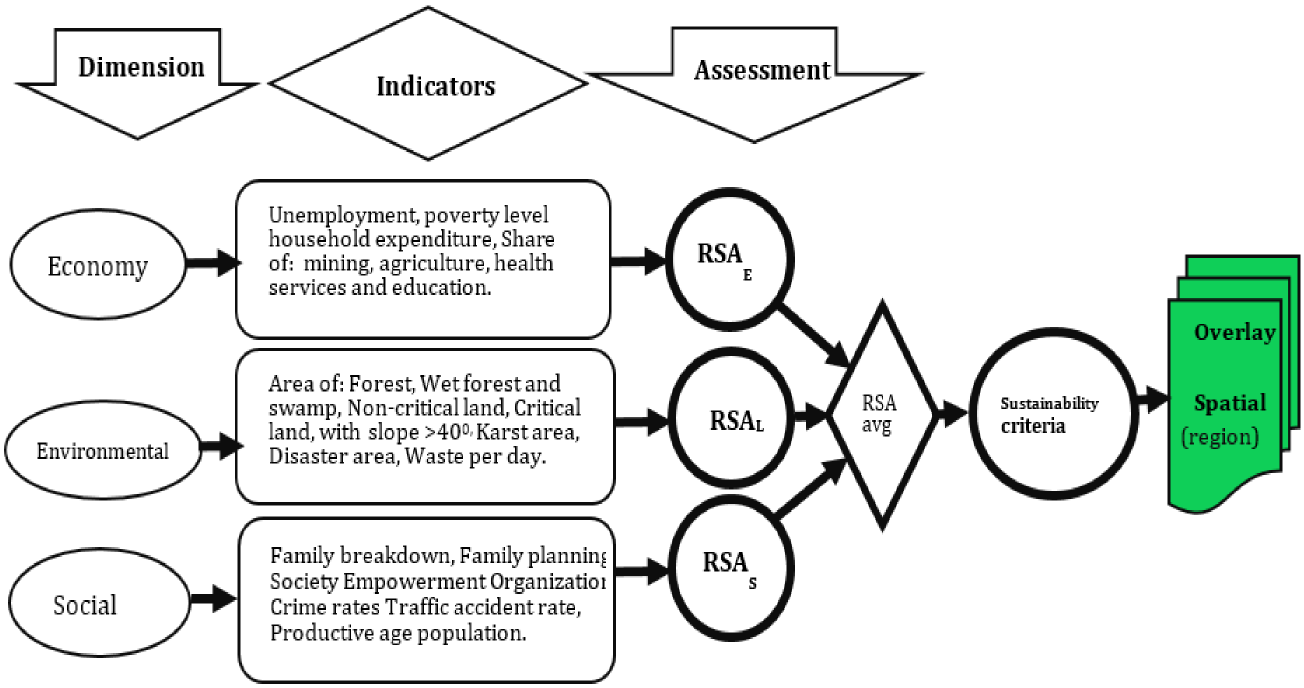


**Figure 2.** Sustainability criteria overlay adapted from Mohamed et al. (2014)

This method was developed to accommodate the notion of sustainability (i.e., profit, people, and planet), while simultaneously allowing the complexity of measurement for each indicator to be addressed. The RSA is based on the following simple formula:

$$RSA = \pm \frac{Fxy/Fx}{F.y/F..} \quad 1$$

where Fxy denotes y indicator in region x; Fx = total indicators of sustainability in region x; F.y = total indicators of y dimension; and F.. = total indicators in all regions. Once the RSA account has been calculated, the next step is to overlay the RSA with a geographical information system as suggested by Hansen (2001) to provide a visual representation of the sustainable indicators for each regency in the province. Table 1 describes the indicators being used for the assessment as well as the expected sign of those indicators in RSA measurement.

The expected sign (either positive or negative) toward a sustainable regional account was based on assessment from the literature. For example, the expected sign of the share of natural resources to the GDP was obtained from the United Nations (2013) and Opeyemi (2012). For the environmental dimension, the expected sign was obtained from various sources such as Nawir (2008), Bell (2002), Humphreys et al. (2015), Kartodihardjo and Supriono (2000), and a report from the Provincial Government of East Kalimantan (2016). The expected sign for social indicators was obtained from studies such as Wen and Chen (2008), Baiquni (2009), Adioetomo (2005), and Wirawan (2014).

**Table 1.** Indicators for Regional Sustainable Account (RSA)

| Indicators | | | | Expected Sign |
|---|---|---|---|---|
| **Dimension** | Economy ($RSA_E$) | Unemployment | $U_E$ | - |
| | | Poverty level | $P_R$ | - |
| | | Household expenditure | $C_{HH}$ | + |
| | | Share of mining to GDP | $Y_M$ | - |
| | | Share of agriculture to GDP | $Y_A$ | + |
| | | Share of health services to GDP | $Y_H$ | + |
| | | Share of education to GDP | $Y_E$ | + |
| | | $\Sigma\, RSA_E = U_E + Pp + C_{HH} + Y_M + Y_A + Y_H + Y_E$ | | |
| | Environmental ($RSA_L$) | Forest area (%) | $F_A$ | + |
| | | Wet forest and swamp (%) | $W_A$ | + |
| | | Non-critical land (%) | $NC_A$ | + |
| | | Critical land (%) | $C_A$ | - |
| | | Area with slope >40$^0$ (%) | $H_A$ | - |
| | | Karst area (%) | $K_A$ | + |
| | | Disaster area (%) | $R_{DA}$ | - |
| | | Waste per day (%) | $W_M$ | + |
| | | $\Sigma\, RSA_L = F_A + W_A + NC_A + C_A + H_A + K_A + R_{DA} + W_M$ | | |
| | Social ($RSA_S$) Number of | Family breakdown | $D_H$ | - |
| | | Family planning | $F_P$ | + |
| | | Society Empowerment Organization | $S_{EO}$ | + |
| | | Crime rates | $C_R$ | - |
| | | Traffic accident rate | $T_A$ | - |
| | | Productive age population | $P_P$ | + |
| | | $\Sigma\, RSA_S = D_H + F_P + S_{EO} + C_R + T_A + P_P$ | | |
| *Regional Sustainable Account (RSA)* | | $RSA = \frac{RSA_E + RSA_L + RSA_S}{3}$ 1 | | |

*Source: Own calculation*

In the second step of analysis, the score obtained from RSA analysis was used to determine the criteria of sustainability for each regency or city. The criteria were divided into seven categories according to the range of values of the RSA as described in Table 2.

**Table 2.** Sustainability Criteria for Regencies and Cities

| No. | Range of Value | Criteria |
|---|---|---|
| 1 | $RSA > RSAavg : RSAavg > 1$ | *Good sustainable* |
| 2 | $RSA <$ RSAavg: $RSCavg > 1$ | *Sustainable* |
| 3 | $0 < RSA \leq 1$ | *Almost sustainable* |
| 4 | $RSA = 0$ | *Medium* |
| 5 | $-1 \leq RSA < 0$ | *Almost unsustainable* |
| 6 | $RSA < -1 : RSAavg < RSA$ | *Unsustainable* |
| 7 | $RSA \leq$ RSAavg: RSAavg< -1 | *Chronic unsustainable* |

Once the sustainable criteria were obtained for each regency, the calculated number was then used to provide the spatial representation of sustainability for each region using the color-coded criteria presented in Figure 3.

To determine the sustainability criteria at the provincial level, the results obtained from the regency level were then transformed into a range of class by subtracting the criteria of the highest level from the lowest level and dividing it by three, as suggested by Sudjana (1992). The sustainability criteria for the provincial level is listed in Table 3.

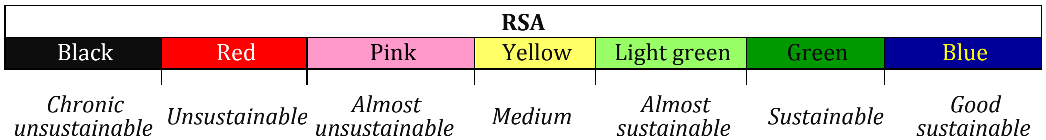


**Figure 3.** Overlay of sustainability criteria.

**Table 3.** Provincial Sustainability Criteria

| Color | Weight | Determination of Class | Value | Criteria |
|---|---|---|---|---|
| | 3 | 10 regions all blue (3 x 10 = 30)<br>1 region all light green (1 x 1 = 1)<br>30–1 = 29; 29/3 = 9.67 = 10 | 20 – 30 | Good sustainable |
| | 2 | | 10 – 20 | Sustainable |
| | 1 | | 0 – 10 | Almost sustainable |
| | 0 | - | 0 | Medium |
| | -1 | 10 regions all black (-3 x 10 = -30)<br>1 region all pink (-1 x 1 = -1)<br>-1 – -30 = 29; 29/3 = 9.67 = 10 | 0 - –10 | Almost unsustainable |
| | -2 | | –10 - –20 | Unsustainable |
| | -3 | | –20 - –30 | Chronic unsustainable |

## 3. Results and discussion

Table 4 provides the results from the RSA calculation for all indicators for each regency and city for the years 2014 and 2015. As can be seen from the table, the values of RSA vary across regions and across indicators from a high negative number to a high positive number. For example, the lowest economic accounts were experienced by the East Kutai Regency both for the years 2014 and 2015 (-1.37 for 2014 and -1.78 for 2015), while the highest economic accounts were obtained by Mahakam Ulu Regency with RSA scores of 12.62 and 11.91 for 2014 and 2015, respectively. The negative scores in the economic dimension in East Kutai were attributed to poverty and the share of the mining sector indicators, while higher positive scores in the economic dimension in Mahakam Ulu were attributed to an increase in household spending and the share of the health sector.

In terms of environmental indicators, the City of Balikpapan received a negative score for both 2014 and 2015 due to the higher percentage of critical land in this area. This can be attributed to the massive development of the city into a new settlement area and the development of other infrastructure, which affected land availability. A better score of environmental indicators was obtained by Paser Regency, as this regency has a larger conservation area and is relatively remote.

For social indicators, the highest scores were obtained by the West Kutai Regency for both 2014 and 2015 with a total score of 3.78 and 2.21, respectively. The lowest scores were received by Paser Regency and were attributed to a higher divorce rate and traffic accident rate in the region.

**Table 4.** Sustainability Score (2014 and 2015)

| Indicators | Regencies/Cities | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Balikpapan | | Berau | | Bontang | | West Kutai | | Kutai Kertanegara | | East Kutai | | Mahakam Ulu | | Paser | | Penajam North Paser | | Samarinda | |
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| $U_E$ | -1.002 | -0.793 | -1.333 | -0.762 | -1.244 | -1.609 | -0.907 | -1.559 | -1.014 | -1.362 | -0.749 | -0.685 | 0.000 | -0.633 | -0.887 | -1.208 | -0.997 | -0.970 | -1.002 | -0.748 |
| $P_R$ | -0.390 | -0.472 | -0.759 | -0.909 | -0.811 | -0.973 | -1.210 | -1.714 | -1.181 | -1.417 | -1.423 | -1.713 | 0.000 | -2.111 | -1.247 | -1.499 | -1.210 | -1.457 | -0.727 | -0.873 |
| $C_{HH}$ | 1.739 | 1.591 | 0.775 | 0.737 | 0.486 | 0.466 | 0.967 | 0.928 | 0.568 | 0.672 | 0.398 | 0.394 | 1.463 | 1.280 | 0.813 | 0.931 | 2.514 | 2.416 | 3.141 | 2.786 |
| $Y_M$ | -0.001 | -0.001 | -1.257 | -1.353 | -0.033 | -0.024 | -1.056 | -1.081 | -1.518 | -1.540 | -1.628 | -1.778 | -0.192 | -0.165 | -1.509 | -1.629 | -0.742 | -0.711 | -0.305 | -0.277 |
| $Y_A$ | 0.143 | 0.133 | 1.461 | 1.467 | 0.110 | 0.119 | 1.970 | 1.927 | 1.237 | 1.367 | 1.103 | 1.081 | 11.00 | 10.432 | 1.500 | 1.508 | 2.913 | 2.796 | 0.221 | 0.232 |
| $Y_H$ | 1.204 | 1.073 | 1.523 | 1.364 | 1.000 | 0.873 | 1.477 | 1.418 | 0.841 | 0.927 | 0.250 | 0.236 | 0.227 | 2.000 | 0.727 | 0.673 | 0.045 | 0.054 | 2.523 | 2.200 |
| $Y_E$ | 1.136 | 1.007 | 1.746 | 1.510 | 0.534 | 0.434 | 1.110 | 1.069 | 0.559 | 0.607 | 0.678 | 0.683 | 0.127 | 1.103 | 0.830 | 0.786 | 2.263 | 2.131 | 2.763 | 2.490 |
| $\Sigma RSA_E$ | 2.829 | 2.537 | 2.157 | 2.054 | 0.043 | -0.713 | 2.353 | 0.989 | -0.589 | -0.746 | -1.372 | -1.782 | 12.625 | 11.906 | 0.227 | -0.439 | 4.786 | 4.259 | 6.614 | 5.810 |
| $F_A$ | 0.325 | 0.325 | 1.355 | 1.355 | 1.049 | 1.049 | 3.358 | 3.358 | 0.695 | 0.695 | 0.700 | 0.700 | 0.000 | 0.000 | 0.876 | 0.876 | 0.695 | 0.695 | 0.076 | 0.076 |
| $W_A$ | 0.276 | 0.276 | 0.001 | 0.001 | 0.351 | 0.351 | 1.893 | 1.893 | 1.498 | 1.498 | 0.406 | 0.406 | 0.000 | 0.002 | 4.393 | 4.393 | N/A | N/A | 1.191 | 1.191 |
| $NC_A$ | 0.277 | 0.277 | 1.320 | 1.320 | 0.721 | 0.721 | 0.564 | 0.564 | 0.797 | 0.797 | 0.911 | 0.911 | 1.756 | 1.756 | 0.526 | 0.526 | 0.519 | 0.519 | 0.065 | 0.065 |
| $C_A$ | -5.624 | -5.624 | -0.403 | -0.403 | -3.174 | -3.174 | -1.173 | -1.173 | -1.820 | -1.820 | -0.730 | -0.730 | -0.143 | -0.143 | -0.971 | -0.971 | -2.371 | -2.371 | -3.433 | -3.433 |
| $H_A$ | -0.854 | -0.854 | -1.341 | -1.341 | -0.715 | -0.715 | -2.642 | -2.642 | -0.447 | -0.447 | -1.217 | -1.217 | 0.000 | 0.000 | -0.920 | -0.920 | -0.541 | -0.541 | -0.298 | -0.298 |
| $K_A$ | 0.772 | 0.772 | 1.554 | 1.554 | 0.017 | 0.017 | 1.627 | 1.627 | 0.316 | 0.316 | 1.411 | 1.411 | 0.000 | 0.823 | 2.003 | 2.003 | 0.351 | 0.351 | 0.000 | 0.000 |
| $R_{DA}$ | 0.000 | -2.300 | 0.000 | -0.460 | -0.111 | -0.111 | -0.296 | -0.296 | -0.478 | -0.478 | -0.548 | -0.548 | 0.000 | -0.865 | -0.979 | -0.979 | -0.440 | -0.440 | -3.310 | -3.310 |
| $W_M$ | 0.505 | 1.124 | 1.062 | 1.348 | 1.056 | 1.110 | 0.920 | 0.632 | 0.664 | 1.264 | 1.256 | 1.082 | 0 | 0 | 0.459 | 0.383 | 0.164 | 0.338 | 0.766 | 0.868 |
| $\Sigma RSA_L$ | -4.323 | -6.005 | 3.547 | 3.374 | -0.805 | -0.752 | 4.251 | 3.963 | 1.225 | 1.825 | 2.186 | 2.012 | 1.613 | 1.572 | 5.387 | 5.311 | -1.623 | -1.449 | -4.942 | -4.840 |
| $D_H$ | -0.773 | -0.900 | -0.798 | -0.331 | -1.190 | -0.998 | -0.057 | 0.000 | -0.758 | -0.829 | -2.584 | -1.885 | Na | 0.000 | -2.059 | -3.563 | 0 | -0.684 | -1.076 | -1.028 |
| $F_P$ | 1.334 | 1.463 | 1.414 | 1.579 | 1.590 | 1.781 | 0.605 | 0.000 | 0.842 | 1.528 | 1.473 | 0.000 | 0.000 | 0.000 | 1.121 | 0.000 | 1.500 | 2.104 | 1.225 | 1.384 |
| $S_{EO}$ | 0.505 | 0.508 | 1.943 | 1.967 | 0.885 | 0.880 | 3.233 | 3.295 | 1.340 | 1.340 | 1.577 | 1.550 | 4.602 | 4.702 | 1.744 | 1.746 | 0.979 | 0.990 | 0.654 | 0.658 |
| $C_R$ | -1.745 | -1.749 | -0.865 | -0.582 | -1.577 | -1.592 | -0.942 | -1.122 | -0.736 | -0.710 | -0.864 | -0.790 | 0.000 | 0.000 | -0.633 | -0.795 | -0.574 | -0.694 | -1.656 | -1.684 |
| $T_A$ | -1.418 | -1.262 | -2.139 | -1.846 | -0.932 | -1.330 | -0.658 | -1.229 | -1.149 | -1.105 | -0.646 | -1.544 | 0.000 | 0.000 | -1.325 | -1.222 | -1.504 | -1.514 | -1.081 | -0.889 |
| $P_P$ | 1.259 | 1.214 | 1.170 | 1.218 | 1.223 | 1.277 | 1.595 | 1.260 | 1.174 | 1.131 | 1.132 | 1.123 | 1.425 | 1.404 | 1.181 | 1.224 | 1.117 | 1.188 | 1.131 | 1.185 |
| $\Sigma RSA_S$ | -0.838 | -0.725 | 0.725 | 1.975 | -0.000 | 0.032 | 3.779 | 2.205 | 0.713 | 1.355 | 0.087 | -1.545 | 6.027 | 6.106 | 0.029 | -2.609 | 1.519 | 1.390 | -0.802 | -0.376 |
| Total | -2.332 | -4.194 | 6.429 | 7.403 | -0.763 | -1.432 | 10.382 | 7.157 | 1.429 | 2.434 | 0.900 | -1.316 | 20.265 | 19.585 | 5.643 | 2.263 | 4.682 | 4.200 | 0.870 | 0.594 |
| Average | -0.777 | -1.398 | 2.143 | 2.468 | -0.254 | -0.477 | 3.461 | 2.386 | 0.476 | 0.811 | 0.300 | -0.439 | 6.755 | 6.528 | 1.881 | 0.754 | 1.560 | 1.400 | 0.290 | 0.198 |
| Sustainability Criteria Class | Year 2014 | value >1 | | 2.143 + 3.461+6.755 + 1.881 + 1.560 = 15,800 | | | | | | | | | 15,800/5 | | | | 3,160 | | | |
| | | value ≤ -1 | | - | | | | | | | | | - | | | | - | | | |
| | Year 2015 | value >1 | | 2,468 + 2,386 + 6,528 + 1,400 = 12,782 | | | | | | | | | 12,782/4 | | | | 3,195 | | | |
| | | value ≤ -1 | | -1,398 | | | | | | | | | -1,398 | | | | -1,398 | | | |

Once the regional accounts for the economic, environmental, and social dimensions were calculated, the results were used as a basis for calculating the sustainability scores for each region as listed in Tables 5 and 6.

**Table 5.** Sustainability Score Among Regencies in 2014

| City/Regency | Score | Criteria | Color Code |
|---|---|---|---|
| Berau | 2.1429 < 3.1600 | Sustainability | (dark green) |
| East Kutai | 0.3001 | Almost sustainable | (light green) |
| Bontang | -0.2543 | Almost unsustainable | (pink) |
| Kutai Kartanegara | 0.4764 | Almost sustainable | (light green) |
| Samarinda | 0.2900 | Almost sustainable | (light green) |
| Balikpapan | -0.7772 | Almost unsustainable | (pink) |
| Penajam North Paser | 1.5605 < 3.1600 | Sustainable | (dark green) |
| Paser | 1.8809 < 3.1600 | Sustainable | (dark green) |
| West Kutai | 3.4608 > 3.1600 | Good sustainable | (dark blue) |
| Mahakam Ulu | 6.7550 > 3.1600 | Good sustainable | (dark blue) |

As can be seen from Table 5, in 2014, most regencies fell under the category of "sustainable" with different levels ranging from "almost sustainable" to "good sustainable." Two regencies (i.e., Bontang and Balikpapan) received a "pink flag": indicating that they will fall under the category of unsustainable due to negative scores in the composite index of sustainability.

In the following year, as listed in Table 6, the City of Balikpapan fell from "almost unsustainable" in 2014 to "chronic unsustainable" in 2015 as indicated by the "black flag" of sustainability. Similarly, East Kutai Regency also fell from "almost sustainable" in 2014 to "almost unsustainable" in 2015. This result indicates that continuing decline in economic accounts and the shift in social accounts from a positive score in 2014 to a negative score in 2015 contributed to the shift in the sustainability criteria of this regency. Figure 4 provides a spatial description of sustainability indicators regency-wise for both 2014 and 2015.

**Table 6.** Sustainability Score Among Regencies in 2015

| City/Regency | Score | Criteria | Color Code |
|---|---|---|---|
| Berau | 2.4676 < 3.1954 | Sustainable | |
| East Kutai | -0.4387 | Almost unstainable | |
| Bontang | -0.4775 | Almost unsustainable | |
| Kutai Kartanegara | 0.8113 | Almost sustainable | |
| Samarinda | 0.1981 | Almost sustainable | |
| Balikpapan | -1.3979 | Chronic unsustainable | |
| Penajam North Paser | 1.4001 < 3.1954 | Sustainable | |
| Paser | 0.754 | Almost sustainable | |
| West Kutai | 2.3856 < 3.1954 | Sustainable | |
| Mahakam Ulu | 6.5285 > 3.1954 | Goods sustainable | |


**Figure 4.** Map of sustainability score (regency-wise) for 2014 and 2015

**Table 7.** Provincial Sustainability Criteria in 2014 and 2015

| Criteria | Weight | 2014 | | 2015 | |
|---|---|---|---|---|---|
| | | Number of regions | (2x3) | Number of regions | (2x5) |
| (1) | (2) | (3) | (4) | (5) | (6) |
| *Good sustainable* | 3 | 2 | 6 | 1 | 3 |
| *Sustainable* | 2 | 3 | 6 | 3 | 6 |
| *Almost sustainable* | 1 | 3 | 3 | 3 | 3 |
| *Medium* | 0 | 0 | 0 | 0 | 0 |
| *Almost unstainable* | -1 | 2 | -2 | 2 | -2 |
| *Unsustainable* | -2 | 0 | 0 | 0 | 0 |
| *Chronic unsustainable* | -3 | 0 | 0 | 1 | -3 |
| Total | | | 13 | | 7 |
| General sustainability criteria for East Kalimantan Province | | Sustainable | | Almost sustainable | |

Using the formula described in Table 3, the results from the regency-wise assessment were then converted into provincial level assessment to provide overall sustainability criteria at the provincial level. Table 7 provides the sustainability assessment for 2014 and 2015 at the provincial level.

As can be seen from Table 7, the overall score of sustainability for East Kalimantan Province fell from 13 in 2014 to 7 in 2015, and the overall sustainability criteria fell from "sustainable" in 2014 to "almost unsustainable" in 2015. This also can be seen in the spatial description in Figure 5 where the green color in 2014 for East Kalimantan Province changed to light green in 2014.


**Year 2014** **Year 2015**

**Figure 5.** Map of sustainability change for East Kalimantan Province

Even though regional development shifted only slightly from sustainable to almost unsustainable at the provincial level, this does not mean that the current existing policy of growth based on the natural resource extraction in East Kalimantan could be maintained. The dependency on the extraction of natural resources to support regional development has imposed significant environmental and social costs on the regions, especially on those regions with limited land availability such as Balikpapan and regions with a high dependency on coal resources. Massive development in the city has imposed environmental costs with an increase in the amount of critical land, while volatility in the global prices of natural resources such as coal has imposed a significant burden on regional development for regions that depend on coal as a source of revenue.

## 4. Concluding remarks

Sustainable development has been and will be an important goal for regional development as mandated by law and the global agendas. Nevertheless, challenges remain regarding how to assess the sustainability of regional development. Regional sustainable accounting or RSA is considered an important tool for assessing how regions achieve their sustainable development agendas. This tool could be used as a "development-dashboard," as it provides a simple and meaningful signal on sustainability assessment at both the regency and provincial level. The results from this study indicate that, when economic, social, and environmental factors have been taken into account in regional development indicators, the state of sustainability can be identified and the sub-indicators that contribute to "good" and "bad" sustainability can be identified. In the East Kalimantan case, economic and social indicators such as poverty, unemployment, and family breakdown rate along with environmental indicators such as critical land contribute significantly to sustainability scores in the regions.

From this study, lessons learned could be drawn. For example, a development policy that encourages the development of renewable resources (reducing mining activities) as well as inclusive growth should be adopted to achieve sustainable development. It is important to reduce the amount of critical land and preserve wetland areas to maintain flow of goods and services that support regional development.

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## Appendix: Data for RSA calculation

| INDICATORS | | THE RATIO OF EACH INDICATOR IN EACH REGION | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | REGIONS (REGENCIES/CITIES) | | | | | | | | | | | | | | | | | | | | REFERENCE | |
| | | $Fxy/Fx$ | | | | | | | | | | | | | | | | | | | | $F.y/F$ | |
| | | BALIKPAPAN | | BERAU | | BONTANG | | WEST KUTAI | | KUTAI KARTANEGARA | | EAST KUTAI | | MAHAKAM ULU | | PASER | | PENAJAM NORT PASER | | SAMARINDA | | EAST KALIMANTAN | |
| | | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| ECONOMIC | Unemployment | 0.0756 | 0.0595 | 0.1005 | 0.0572 | 0.0938 | 0.1207 | 0.0684 | 0.1170 | 0.0765 | 0.1022 | 0.0565 | 0.0514 | 0.0000 | 0.0475 | 0.0669 | 0.0906 | 0.0752 | 0.0728 | 0.0756 | 0.0561 | 0.0754 | 0.0750 |
| | Poverty level | 0.0248 | 0.0244 | 0.0483 | 0.0469 | 0.0516 | 0.0502 | 0.0770 | 0.0885 | 0.0752 | 0.0731 | 0.0906 | 0.0884 | 0.0000 | 0.1090 | 0.0794 | 0.0774 | 0.0770 | 0.0752 | 0.0463 | 0.0450 | 0.0637 | 0.0516 |
| | Household expenditure | 0.2647 | 0.2737 | 0.1180 | 0.1269 | 0.0740 | 0.0802 | 0.1472 | 0.1597 | 0.0864 | 0.1156 | 0.0605 | 0.0678 | 0.2226 | 0.2203 | 0.1237 | 0.1601 | 0.3825 | 0.4158 | 0.4780 | 0.4793 | 0.1522 | 0.1721 |
| | Share of mining to GDP | 0.0005 | 0.0005 | 0.6313 | 0.6109 | 0.0168 | 0.0108 | 0.5300 | 0.4883 | 0.7624 | 0.6956 | 0.8176 | 0.8031 | 0.0966 | 0.0746 | 0.7579 | 0.7358 | 0.3727 | 0.3213 | 0.1530 | 0.1250 | 0.5021 | 0.4516 |
| | Share of agriculture to GDP | 0.0100 | 0.0100 | 0.1023 | 0.1100 | 0.0077 | 0.0089 | 0.1379 | 0.1445 | 0.0866 | 0.1025 | 0.0772 | 0.0811 | 0.7700 | 0.7824 | 0.1050 | 0.1131 | 0.2039 | 0.2097 | 0.0155 | 0.0174 | 0.0700 | 0.0750 |
| | Share of health services to GD | 0.0053 | 0.0059 | 0.0067 | 0.0075 | 0.0044 | 0.0048 | 0.0065 | 0.0078 | 0.0037 | 0.0051 | 0.0011 | 0.0013 | 0.0010 | 0.0110 | 0.0032 | 0.0037 | 0.0002 | 0.0003 | 0.0111 | 0.0121 | 0.0044 | 0.0055 |
| | Share of education to GDP | 0.0134 | 0.0146 | 0.0206 | 0.0219 | 0.0063 | 0.0063 | 0.0131 | 0.0155 | 0.0066 | 0.0088 | 0.0080 | 0.0099 | 0.0015 | 0.0160 | 0.0098 | 0.0114 | 0.0267 | 0.0309 | 0.0326 | 0.0361 | 0.0118 | 0.0145 |
| ENVIRONMENTAL | Forest area (%) | 0.1783 | 0.1783 | 0.7439 | 0.7439 | 0.5760 | 0.5760 | 1.8443 | 1.8443 | 0.3816 | 0.3816 | 0.3831 | 0.3831 | 0.0000 | 0.0000 | 0.4809 | 0.4809 | 0.3814 | 0.3814 | 0.0417 | 0.0417 | 0.5491 | 0.5491 |
| | Wet forest and swamp (%) | 0.0012 | 0.0012 | 0.0000 | 0.0000 | 0.0015 | 0.0015 | 0.0079 | 0.0079 | 0.0063 | 0.0063 | 0.0017 | 0.0017 | 0.0000 | 0.0000 | 0.0184 | 0.0184 | N/A | N/A | 0.0050 | 0.0050 | 0.0042 | 0.0042 |
| | Non critical land (%) | 0.0941 | 0.0941 | 0.4490 | 0.4490 | 0.2451 | 0.2451 | 0.1919 | 0.1919 | 0.2711 | 0.2711 | 0.3099 | 0.3099 | 0.5970 | 0.5970 | 0.1789 | 0.1789 | 0.1766 | 0.1766 | 0.0223 | 0.0223 | 0.3400 | 0.3400 |
| | Critical land (%) | 0.4022 | 0.4022 | 0.0288 | 0.0288 | 0.2270 | 0.2270 | 0.0839 | 0.0839 | 0.1302 | 0.1302 | 0.0522 | 0.0522 | 0.0102 | 0.0102 | 0.0694 | 0.0694 | 0.1696 | 0.1696 | 0.2456 | 0.2456 | 0.0715 | 0.0715 |
| | Area with slope >40⁰ (%) | 0.3646 | 0.3646 | 0.5722 | 0.5722 | 0.3049 | 0.3049 | 1.1274 | 1.1274 | 0.1909 | 0.1909 | 0.5192 | 0.5192 | 0.0000 | 0.0000 | 0.3927 | 0.3927 | 0.2307 | 0.2307 | 0.1270 | 0.1270 | 0.4267 | 0.4267 |
| | Karst area (%) | 0.2200 | 0.2200 | 0.4429 | 0.4429 | 0.0049 | 0.0049 | 0.4639 | 0.4639 | 0.0900 | 0.0900 | 0.4022 | 0.4022 | 0.0000 | 0.2346 | 0.5710 | 0.5710 | 0.1000 | 0.1000 | 0.0000 | 0.0000 | 0.2851 | 0.2851 |
| | Disaster area (%) | 0.0000 | 0.271 | 0.0000 | 0.0542 | 0.0131 | 0.0131 | 0.0349 | 0.0349 | 0.0563 | 0.0563 | 0.06 | 0.06 | 0.0000 | 0.1019 | 0.1153 | 0.1153 | 0.0519 | 0.0519 | 0.3899 | 0.3899 | 0.1178 | 0.1178 |
| | Waste per day (%) | 0.3599 | 0.8 | 0.756 | 0.96 | 0.752 | 0.79 | 0.655 | 0.45 | 0.473 | 0.9000 | 0.894 | 0.770 | 0.0000 | 0.0000 | 0.327 | 0.273 | 0.1169 | 0.2410 | 0.5457 | 0.618 | 0.7119 | 0.7119 |
| SOCIAL | Family breakdown | 0.00736 | 0.01032 | 0.0076 | 0.0038 | 0.0113 | 0.0114 | 0.0005 | 0.0000 | 0.0072 | 0.0095 | 0.0246 | 0.0216 | 0.000 | 0.0000 | 0.0196 | 0.0409 | N/A | 0.0078 | 0.0102 | 0.0118 | 0.00952 | 0.01147 |
| | Family planning | 0.13071 | 0.12322 | 0.13858 | 0.13300 | 0.15580 | 0.15059 | 0.05904 | 0.00000 | 0.08253 | 0.12872 | 0.14432 | 0.00000 | 0.00000 | 0.00000 | 0.10985 | 0.00000 | 0.14701 | 0.17722 | 0.12010 | 0.11653 | 0.09800 | 0.08422 |
| | Society Empowerment Organization | 0.0001 | 0.0001 | 0.0003 | 0.0003 | 0.0001 | 0.0001 | 0.0004 | 0.0004 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0006 | 0.0006 | 0.0002 | 0.0002 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| | Crime rate | 0.0044 | 0.0041 | 0.0022 | 0.0014 | 0.0039 | 0.0037 | 0.0024 | 0.0026 | 0.0018 | 0.0017 | 0.0022 | 0.0019 | 0.0000 | 0.0000 | 0.0016 | 0.0019 | 0.0014 | 0.0016 | 0.0041 | 0.0040 | 0.0025 | 0.0023 |
| | Traffic accident rate | 0.0004 | 0.0002 | 0.0006 | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0002 | 0.0002 | 0.0003 | 0.0000 | 0.0000 | 0.0003 | 0.0002 | 0.0004 | 0.0003 | 0.0003 | 0.0002 | 0.0003 | 0.0002 |
| | Productive age population | 0.4878 | 0.4592 | 0.4532 | 0.4609 | 0.4738 | 0.4831 | 0.6179 | 0.4766 | 0.4547 | 0.4279 | 0.4385 | 0.4250 | 0.5523 | 0.5311 | 0.4575 | 0.4633 | 0.4329 | 0.4495 | 0.4383 | 0.4483 | 0.3874 | 0.3784 |