

Spatial dichotomies in Indonesia's regional development

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CONTENTS

About NATSEM	i
Author note	iii
General caveat	iii
Abstract	iv
1 Introduction	1
2 Data and Methodology	2
2.1 Development indicators	2
2.2 Spatial Unit	3
2.3 Spatial Autocorrelation and Mapping	3
2.4 Weighting Matrix	5
3 Results	5
4 Conclusion	16
References	17

AUTHOR NOTE

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The microdata do not contain any information that enables identification of the individuals or families to which they refer.

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ABSTRACT

For many years there has been a debate about the extent to which large spatial gaps in development exist in Indonesia, especially between the eastern and western parts of the country. To contribute to this issue, this study examines the significance of Indonesia's spatial development distribution using regional GDP per capita and the Human Development Index as development indicators. Although the results from this study confirm that there are clusters of high and low developed areas within Indonesia, clusters of high regional GDP per capita are spreading in mining areas in both eastern and western Indonesia. Nevertheless, the distribution of the HDI confirms to some extent the existence of a spatial development gap in Indonesia

1 INTRODUCTION

Indonesia's regional development pattern is of great analytical and policy interest. The disparity in regional development has become the subject of many regional studies over the past decade (see for example, Nazara et al, 2001; Tadjoeddin et al, 2001; Akita and Alisjahbana, 2002; Milanovic, 2005). This is not only triggered by the fact that the disparity in regional development is much higher when compared to other developing countries (Shankar and Shah, 2003) but also because of the unique mixture of socio-economic and political conditions that Indonesia possesses.

Having one of the most spatially diverse resource endowments, population settlements, economic activity, ecology and ethnicity, regional disparity in Indonesia could easily spark a conflict that could potentially divide the nation (Tadjoeddin et al., 2001; Aspinall and Berger, 2001). One of the examples of this type of situation is the threat of separation from the mining provinces in Indonesia that led to the "Big Bang Decentralization", which has changed Indonesia from one of the most centralized countries in the world to one with relatively high levels of decentralization compared to other developing countries (World Bank, 2003).

The development gap among regions in Indonesia is alleged to be the main condition that has increased tensions over the years. This gap is often identified as the gap between the west and the east part of Indonesia or the gap between Java and Non Java (Suryadarma et al., 2006). The Indonesian Government has recognised this issue and responded by establishing a special government board, which consists of several ministries that are responsible for the development of Eastern Indonesia (Republic of Indonesia, 2000). Despite this, many argue that the issue of development inequality in Indonesia is not as simple as the difference between East and West or between Java and Non Java, as inequality between these large regions is not as great as the inequality that exists between smaller provinces or districts within the regions (Akita et al 2002; Hill et al 2008).

The "Big Bang Decentralization" has increased the need to conduct spatial analysis of development distribution at smaller geographic levels – most notably, districts (McCulloch and Sjahrir, 2008; McCulloch and Malesky, 2011). This is because in the decentralisation process, the central government delegated a significant amount of authority and governance to around 400 districts. These areas included education, agriculture, industry, trade and investment, and infrastructure (Alm et al. 2001). Therefore, this analysis of the spatial distribution of development in Indonesia would not only ascertain whether there is a substantial development gap between big regions but will also give some understanding about the inequality among smaller districts within these regions.

This analysis of patterns of spatial distribution of development among regions is also important in understanding Indonesia's regional growth and development at a district level. As acknowledged by McCulloch and Sjahrir (2008) and Akita et al. (2011), regional development analysis should also take into account the possible spatial effect or "neighbourhood effects" in conducting the analysis at a sub-national level, especially

at the district level, where there are fewer barriers restricting economic activities between regions (Anselin, 1988; LeSage, 1999; Rey, 2001; Egger and Pfaffermayr, 2006). These “neighbourhood effects” in Indonesia may not be as significant as they are elsewhere because it is the world’s largest archipelagic country. This means administrative regions in Indonesia often have natural barriers in the form of water boundaries that limit the interaction between two regions (Nijkamp et al., 1990).

The aim of this study is twofold. Firstly, to contribute to the debate around whether a development gap exists between the East and the West in Indonesia since decentralisation. Secondly, to examine spatial patterns of Indonesia’s recent development and the significance of these patterns within a spatial analysis framework, especially with the increasing availability of data at the district level. The analysis of such issues has been facilitated by the continuing development in Geographical Information Systems (GIS) (Goodchild et al., 2000). Whilst visual inspection of spatial data can provide evidence of basic relationships existing between areas in much the same way as descriptive statistics do, the inclusion of a test of statistical robustness is essential in identifying whether the relationships are significant. This would give some knowledge of whether neighbourhood effects have an important role in the development process while confirming the existence and location of concentrations of high or low development.

The remainder of the study is set out as follows. Section two discusses the data and methodology applied to analyse and assess the spatial development patterns. This includes the development indicators, spatial unit and the spatial weight matrix that reflects the conditions of each neighbouring region. The results are shown and discussed in section three while section four concludes the study.

2 DATA AND METHODOLOGY

2.1 DEVELOPMENT INDICATORS

The word “development” in this study refers to “economic development”, which is defined as the increase in the standard of living among people in an economy. Income plays a significant role in determining this economic development (Sen, 1983). Therefore, Gross Domestic Product (GDP) per capita, representing average income, is often used as a measure of the level of economic development in an economy. In Indonesia, regional GDP per capita has long been used as a measure of regional development (Akita and Lukman, 1995; Garcia and Soelistianingsih, 1998).

The other reason for using GDP as a proxy for a countries development is the availability of the data. Reliable data on regional GDP at a provincial level are readily available from the Regional Accounts of the Indonesian Central Statistics Office (BPS) since 1975, while the data at district level are available after 1993.

There are some debates about the use of regional GDP per capita in Indonesia as a reliable measure of development. This debate largely centres on the mining industry, which while providing income to the central government and oil companies, this income

is accrued in regional GDP statistics (Akita and Lukman, 1995; Milanovic, 2005; Hill et al., 2008). This has become an important issue for Indonesia because many areas that have a high GDP per capita also have relatively low individual incomes (Tadjoeddin et al. 2001, Brodjonegoro and Martinez-Vazquez 2002). That is, the wealth from the output created within a region is not necessarily distributed within the same region, and using regional GDP may overstate the true wealth of a region and its inhabitants, especially where a large mining sector exists. Therefore, there should be another indicator that can be used to analyse the real distribution of regional development. The human development index (HDI) is an alternative development indicator that is available for Indonesia at the district level, which may overcome some of the shortcomings of the regional GDP measure. The BPS has published HDI data regularly since 2001. Creation of the index was initiated by the publication of the Indonesia Human Development Report in 2001 and 2004 by the UNDP project known as UNSFIR (United Nations Support Facility for Indonesian Recovery).

The HDI has been used to compare the development level of nations since 1990. It is based on three dimensions – life expectancy, education or literacy and standard of living or income – with each dimension given the same level of importance (i.e. equal weight). The index has been the subject of several criticisms, especially regarding the equal weighting (Kelly, 1991; Noorbakhsh, 1996) and the fact that most of the time the regions have a similar rank on the index and therefore, the index adds nothing new to the measurement of development (McGillivray, 1991). Having said this, it is still the most acceptable and widely used index of development, which provides a comparison not only of living standards, but critical survival and basic education in developing nations (Anand and Sen, 2000).

2.2 SPATIAL UNIT

Administrative divisions are the most common representation of an economic entity when studying regional economies within a country. This is mainly because data are recorded based on these divisions. Indonesia has several levels of administrative divisions. The first or highest administrative division is province followed by district level, which consist of Kabupaten (Municipality) and Kota (City). Kecamatan is the third administrative division while the fourth consists of Kelurahan and Desa. According to the Indonesian Department of Internal Affairs (2005), Indonesia had 33 provinces, 440 Districts (349 Municipalities and 91 Cities), 5,263 Kecamatans, 7,123 Kelurahans and 62,806 Desas in 2005.

There has been some fragmentation (i.e., boundary changes) of provinces and districts since decentralization took place. The number of districts has risen from 341 to around 490 from 1999-2008. To obtain a consistent database, the districts have been amalgamated to the 440 districts that existed in 2005. Most of these districts are located in the five main islands – 132 in Sumatra, 115 in Java, 62 in Kalimantan, 57 in Sulawesi and 29 in Papua.

2.3 SPATIAL AUTOCORRELATION AND MAPPING

Although the existence of spatial clustering of development in Indonesia is examined using spatial autocorrelation, it is also important to visualise the underlying spatial distribution for interpreting the results from the spatial clustering analysis. In visualising the spatial distribution of development among Indonesian districts, the natural breaks method has been used to classify the data. As the natural break classification distinguishes the class based on considerable gaps or 'breaks' in the data, this classification will give an early indication of possible concentrations of high or low development within an area.

The identification of significant spatial patterns will be done using Global and Local Moran's I-statistics. Global Moran's I uses the covariance of two district values to measure spatial relationships. The I-statistic will be higher if regions in closer proximity have a greater similarity measured through the development variable. On the other hand, if the covariance is positive for some neighbours and negative for others, the I-statistic will be low because these covariance's cancel each other out. The significance of the I-statistic is measured based on its comparison to the standard normal distribution. For a detailed description of the Global Moran calculation see Cliff and Ord (1973).

The Local statistic is important in identifying significant cluster of areas, as has been raised by Getis and Ord (1992). In further work, Anselin (1995) offered a method to decompose Global Moran's I-statistic to obtain a local variant that is embodied within the GeoDa software (Anselin 2004). This Local spatial Moran, known as Local indicators of spatial association (LISA), can be visualised on a spatial map that provides a spatial representation of four types of spatial clusters and outliers. A spatial cluster can either be high values of the development variables surrounded by similarly high values or the opposite scenario, or low values surrounded by low values. A spatial outlier on the other hand is indicative of areas that have high values, surrounded by areas that have low values or vice versa.

In this study the computation output from GeoDa is used. In this software, the significance of global and local spatial autocorrelation are measured based on pseudo significance levels using permutation testing. This testing compares the actual Moran statistic and the Moran statistic under randomised replication. The pseudo p-value is calculated from the ratio of higher or equal replicate statistics to the actual value (in the case of positive statistics) plus one over the number of replications plus one (Anselin, 2004). For our study we have used 9999 permutations and set the significance level to 0.05 for local spatial autocorrelation statistics.

The final element of the methodology is to modify the Moran's scatter plot, which enables the visualisation of how the Local Moran contributes to the Global Moran, to identify changes in the spatial concentration over time. The horizontal axis in the Moran's scatter plot shows the normalised value of the attribute of each area while the vertical axis shows the normalised spatially weighted value of the neighbouring areas. Each point in the scatter plot shows the extent of the local spatial autocorrelation while the fitted regression line shows the extent of global spatial correlation. To examine the changes over time, the standard GeoDa scatter plot of 2005 and 2008 is combined in a single Moran scatter plot. The years for each district are joined using an arrow that indicates the direction in which the change has occurred (i.e. the direction of the arrow

would indicate the change in the Local Moran value). This new plot has been termed the Moran arrow scatter plot (Chhetri et al. 2009; Vidyattama et al. 2010)

2.4 WEIGHTING MATRIX

An essential component of using spatial autocorrelation methods to measure spatial clustering is the specification of the spatial weighting matrix. This matrix discloses the way in which differing geographies are thought to interact, illustrating the distribution of spatial relationships. There are several criteria that are often used to determine whether areas are spatially related to each other. The criteria of a spatial relationship existing that is used in this study is that of a ‘shared boundary’ (contiguity), one of the most common criteria in determining spatial relationships.

The spatial weighting matrix for contiguity is represented as the binary condition of one if there is a common boundary and zero otherwise. Specifically, in this application, rook contiguity has been selected. This means that two regions are considered neighbours even if there is only one connecting point as their shared boundary, such as corner to corner. The spatial weighting matrix is produced by using GeoDa (for a more detailed discussion on contiguity matrixes in GeoDa see Anselin 2004, pp.106-16).

Given the unique Indonesian archipelagic condition, using contiguity for the spatial matrix will result in several districts without any neighbouring region. This is because contiguity does not include boundaries defined by sea. Overall there are 23 districts identified as having no neighbour. There are other spatial weight matrices that have been used to overcome this problem. The spatial weight matrix based on a distance decay parameter is one example, and it can be combined with the length of the boundary that the two regions share to get a more precise spatial relationship between two regions (Cliff and Ord, 1981). Another example is Ying (2003) who uses a binary weight matrix based on several distance bands to replace the contiguity relationship and flag when two regions are spatially related. As the contiguity rule has only produced 23 “neighbourless” districts, or around 5 per cent of the total number of districts, the impact is considered not significant.

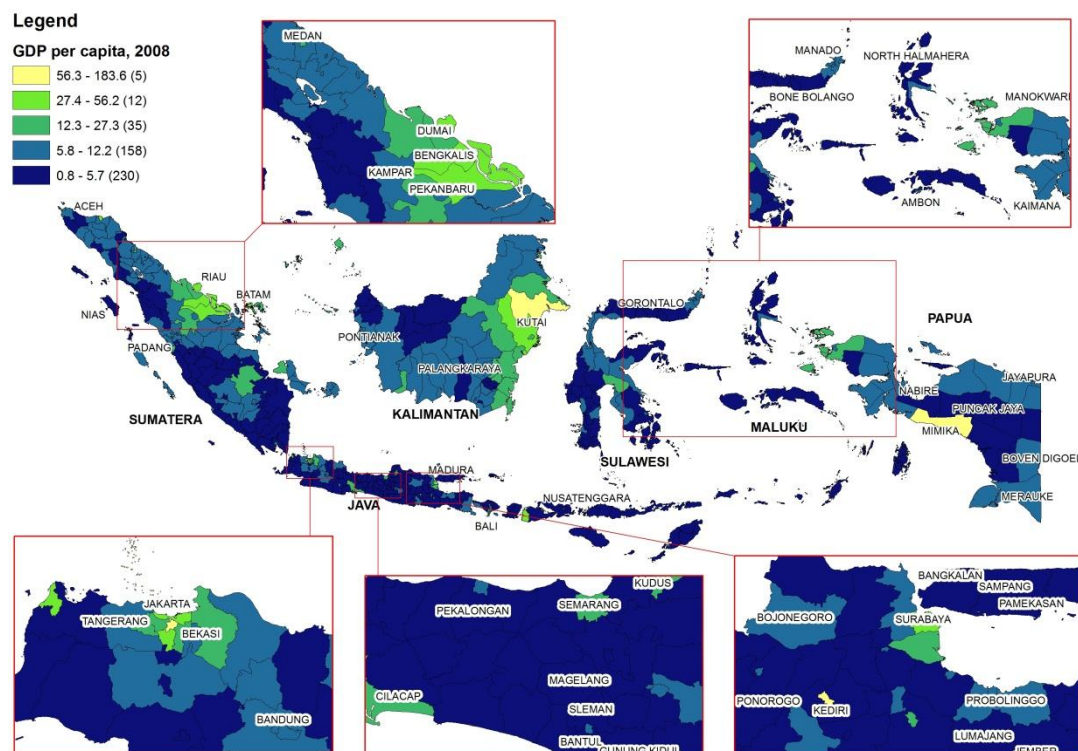
3 RESULTS

The map of Regional GDP per capita using natural breaks (Figure 1) identifies districts with high GDP per capita using a lighter colour, becoming darker as GDP per capita reduces. The classification shows a prominent gap between the districts with the highest regional GDP per capita and the remaining districts, with only five districts belonging to the highest class – Central Jakarta, Mimika in Papua, Kediri in East Java and two districts in East Kalimantan – East Kutai and Bontang (Figure 1). While Central Jakarta is the centre of Indonesian government and business activity and Kediri is well known

for the export of its art and craft, the other three districts – Mimika, Bontang, and East Kutai – are mining areas.

The dominance of mining and its impact on per capita regional GDP is also evident in another well-known mining area – Riau. Although Riau does not have any districts that belong to the highest classification of regional GDP per capita, there are many districts that lie within the second and third highest classifications. While these patterns reflect the decline of Riau’s mining sector over the past three decades (Hill et al 2008), the fact that more than half of the districts are in the lowest group show how regional GDP per capita is highly influenced by these large mining districts, including those in Riau. Another interesting feature, highlighted in Figure 1, is that several of the larger cities (such as Semarang and Surabaya) have relatively high regional GDP per capita, yet this wealth does not appear to spread to neighbouring districts.

Figure 1 Distribution of regional GDP per capita (million rupiah/year), 2008



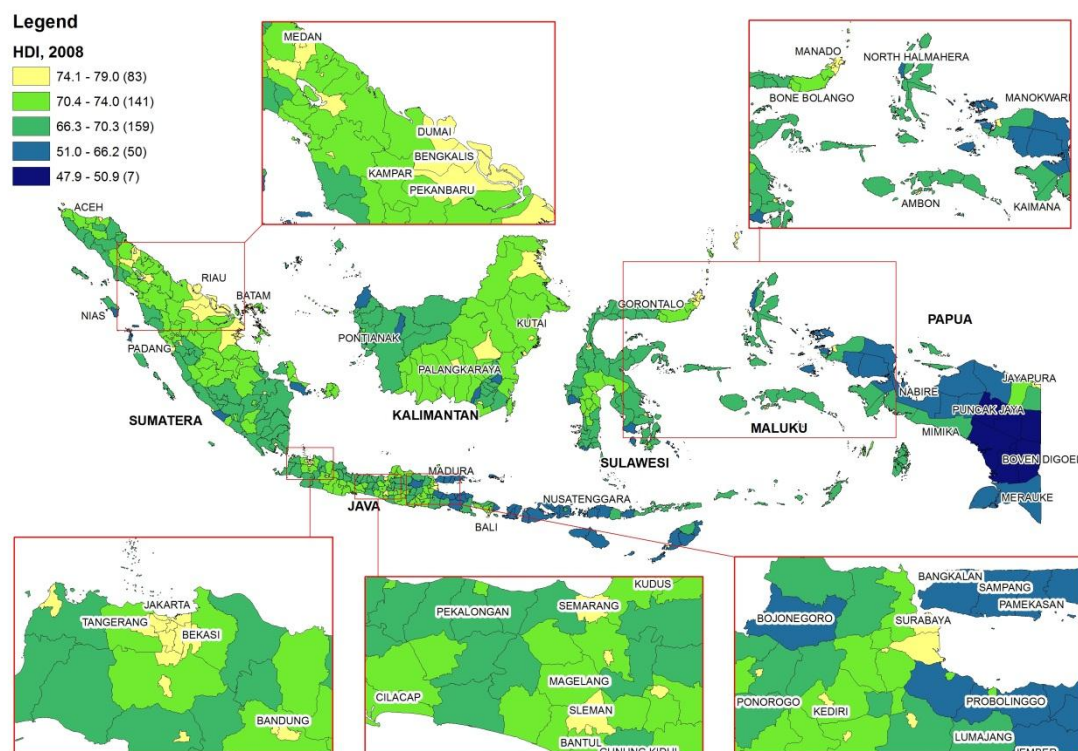
Note: The distribution is classified based on the relative widest gap or natural break classification in ArcMap

The Human Development Index (HDI) provides a somewhat different picture of the distribution of regional development in Indonesia. An immediate noticeable difference compared to the distribution of regional GDP per capita is that there is a much higher proportion (83 out of 440 districts) of districts that lie within the highest HDI group,

compared with only five in the regional GDP per capita distribution (Figure 2). This indicates that there are fewer gaps between the districts with the highest level of human development with the rest of the country, which supports the issue McGillivray (1991) has with the index. However, Figure 2 does indicate that there exists a considerable gap between the seven districts with the lowest HDI values and all other districts, with all of these districts located in Papua.

These results raise the issue of the development imbalance between eastern and western Indonesia. Taking the line between Kalimantan and Sulawesi as the boundary between the east and west, most of the regions in eastern Indonesia lie within the three lowest HDI classifications (between 47.9 and 50.9). Jayapura (the capital city of Papua), Ambon (the capital city of Maluku) and Manado and its surrounding districts are the only areas that lie within the highest HDI classification. On the other hand, the entire district in the lowest HDI classification is in Papua. Furthermore, there is a high proportion of districts in Papua in the second lowest HDI class. Besides Papua, there is another area of districts in the second lowest HDI classifications that are sprinkled from East Java to the east throughout the Nusatenggara Islands.

Figure 2 Distribution of Human Development Index, 2008



Note: The distribution is classified based on the relative widest gap or natural break classification in ArcMap

Western Indonesia typically has higher levels of HDI outcomes, with more than 20 per cent of districts within the highest HDI classification, and more than half belonging to the two highest classes. These statistics are dominated by well known Indonesian cities and economic hotspots such as Jakarta, Bandung, Surabaya, Medan, Yogyakarta (Sleman and Bantul), Padang, Banda Aceh and Pekanbaru, which all have high HDI levels. No clear divisive pattern of high and low development outcomes, as measured by the HDI, exists between Java and non-Java regions; with districts within Java (especially those in the most Eastern part of the Province) also demonstrating low HDI levels.

The I-statistics (global spatial autocorrelation) are presented in Table 1. These show the statistical relationship between the patterns of spatial development. These results show that the HDI has a higher level of spatial autocorrelation globally compared to regional GDP per capita. Therefore, there is a higher probability of spatial clusters of development locally when measured by the HDI. This reiterates the results from the HDI map using natural breaks, as the districts with a low HDI are mostly in the east of Indonesia and the east of Java, clustered around each other. On the other hand, high regional GDP per capita related to the mining districts are located far away from each other.

Table 1 Global spatial autocorrelation of development, 2005-2008

	Regional GDP per capita		HDI	
	2005	2008	2005	2008
All				
I-statistic	0.218	0.375	0.597	0.620
p-value	0.002	0.001	0.001	0.001
Sumatera				
I-statistic	0.363	0.351	0.228	0.259
p-value	0.002	0.001	0.002	0.001
Java				
I-statistic	0.297	0.316	0.568	0.575
p-value	0.002	0.005	0.001	0.001
Other Islands				
I-statistic	0.196	0.405	0.630	0.653
p-value	0.013	0.002	0.001	0.001

Table 1 also presents the I-statistics of districts in the two biggest islands in terms of population size – Java and Sumatera as well as all other districts on the other islands. As mentioned above, these I-statistics indicate the level of spatial autocorrelation, or the concentration of development. The higher the statistics, the more concentrated, or the more continuous the sequence of development levels are. The table shows that in 2005, Sumatera had slightly higher I-statistics and hence, a higher concentration of regional GDP per capita compared to Java and other islands. This has changed in 2008 as the I-

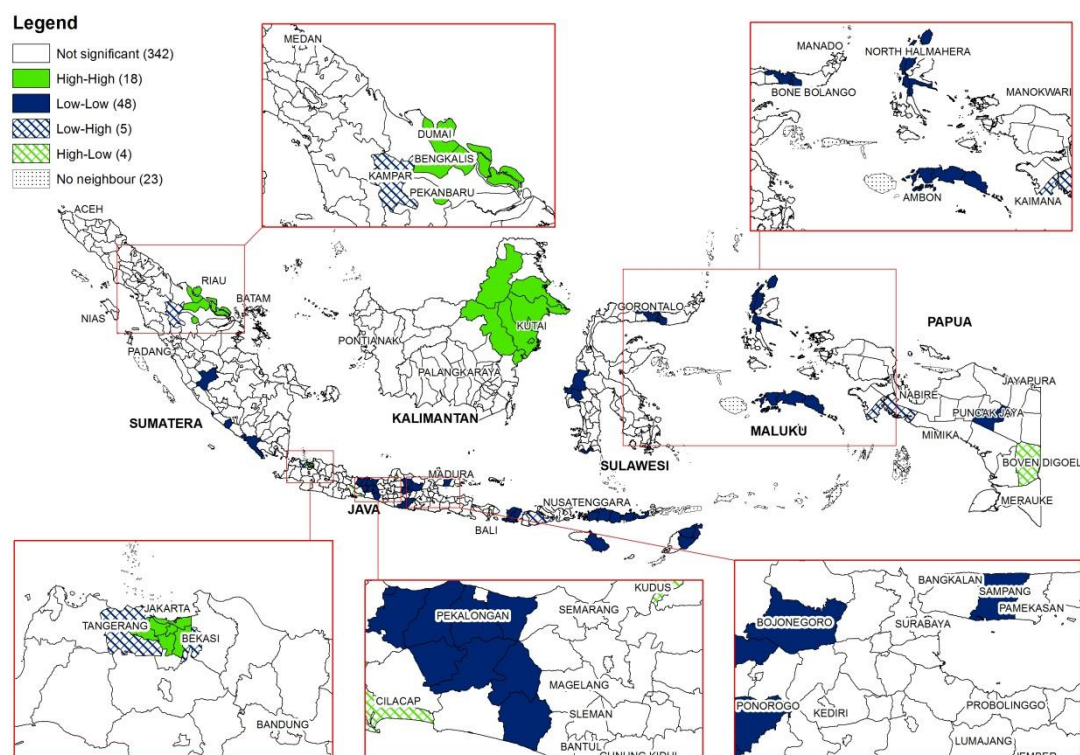
statistics of districts on other islands increased considerably from 0.196 to 0.405. This made the districts on other islands show the highest concentration of relatively low or high development.

As will be discussed later, the increase shows that the concentration of regional GDP per capita on the other islands is actually very high and the low I-statistic is caused by one area with very high GDP per capita in a low GDP per capita area. Therefore, the decrease in the GDP of this area immediately reveals the true extent of the GDP per capita concentration. This is supported by the global autocorrelation estimate based on the HDI. In this estimate, the districts on other islands also had the highest I-statistics or the highest development concentration, not only in 2008 but also in 2005.

Using the local version of Moran's I-statistic, significant development clusters are identified. Figure 3 shows there is a concentration of areas of high regional GDP per capita around two mining areas – in Riau and Kutai. There are several reasons that can be offered to explain this concentration apart from obvious labour market spill-over effects into surrounding areas. These reasons include firstly, evidence that the distribution of minerals within an area is not concentrated in just one of these districts, but dispersed among several districts within close proximity to each other and forming a significant area of development. Secondly, the opening of a palm oil plantation in areas surrounding those dominated by the mining sector is likely to be influencing the formation of a high GDP per capita cluster. The latter could be considered a quasi-trickledown effect, as it is highly likely that the existence of the plantation is related to the existing infrastructure such as road networks that have been built by mining companies.

Apart from the two mining areas, Figure 3 also identifies the capital city Jakarta as another concentrated area of high regional GDP per capita. This is not a surprising result since Jakarta is not only the capital city of Indonesia, but also the city where the most business and economic activities are conducted in Indonesia. At the edge of Jakarta, there are two areas that have significantly lower regional GDP per capita compared to Jakarta as their neighbour – Tangerang and Bekasi. This is an interesting result given that the economic activity in Jakarta is expected to affect economic activity in Tangerang and Bekasi, and the data show that the regional GDP per capita of these areas is still reasonably high (in the second and third classification of GDP per capita, respectively).

Figure 3 Cluster map of regional GDP per capita based on LISA, 2008

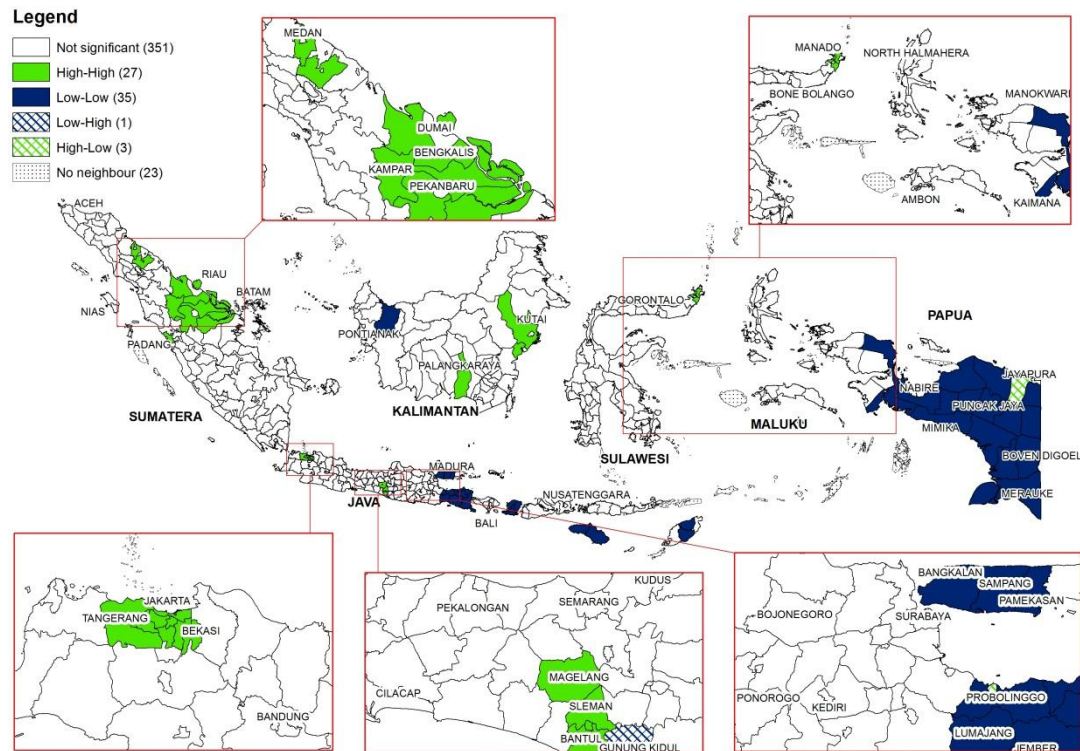


One of the hot topics in Indonesian regional development is the gap between eastern and western Indonesia, or between Java and Non Java. The results shown in Figure 3 neither support nor reject this proposition. LISA analysis for regional GDP per capita identifies a significant concentration of areas (East Nusa Tenggara, Maluku and Gorontalo), with low regional GDP per capita. Papua also shows a clustering of low GDP per capita areas, however these are only concentrated in Puncak Jaya. This result is due to the mining output of Mimika and medium GDP per capita ranking of Sorong in the West of Manokwari, which reduces the significance of the clustering. These results support the conjecture that a development gap between the east and west does exist. However, a concentration of high regional GDP per capita in the western part of Indonesia or in Java has not been revealed from these local area spatial autocorrelation statistics. Instead, clusters of low regional GDP per capita are identified in central Java (surrounding Pekalongan) and East Java (Bojonegoro, Ponorogo and Madura).

The application of LISA to the HDI confirms the analysis of the HDI distribution shown using a natural break classification. A large cluster of districts with low HDI values is identified in Papua with Jayapura an outlier, having significantly higher HDI than its neighbour (Figure 4). Figure 4 also identifies significant clusters in East Java, West Kalimantan and parts of Nusa Tenggara. Looking at the map using natural breaks, more districts in Nusa Tenggara should be included in the cluster of low HDI districts. This could be an effect of using contiguity as the neighbouring factor in an archipelagic country such as Indonesia. This contributes to the debate of the appropriate spatial

weight matrix to be used in archipelagic conditions, and more work needs to be done in this area.

Figure 4 LISA Cluster map of Human Development Index, 2008



As expected from the map using natural breaks, there are more clusters of high HDI identified in the western part of Indonesia. Despite the low Global I-statistics in Sumatera, districts in and around Medan, Riau and Padang are included in the high HDI cluster (Figure 4). In Java, the clusters of high HDI are located in Jakarta and its surrounding areas – Tangerang and Bekasi – as well as in Yogyakarta with Gunung Kidul as an outlier, having significantly lower HDI than its neighbours. There are some areas east and south of Kalimantan that can be considered a cluster of high HDI, while Manado is the only cluster of high HDI identified in the eastern part of Indonesia. There are some interesting differences between the high HDI cluster that we see around Jakarta and the high regional GDP per capita cluster. The surrounding districts that are included in high HDI cluster, such as Tangerang or Bekasi, are also identified as having significantly lower regional GDP per capita. This could be due to a commuting pattern of people with a high HDI to the central area of Jakarta. As discussed previously, this could also possibly be because the GDP per capita of Jakarta is much higher and these surrounding areas are potentially not benefiting as much from the economic activity in Jakarta as the wealth is not being shared.

As mentioned in the GDP results discussion, the clustering of low HDI areas in Papua and high HDI areas in parts of Sumatera and Java again raise the discussion of the existence of a development gap between west and east Indonesia. Although the low HDI

cluster does not cover the entire eastern part of Indonesia, one could argue that the use of contiguity has reduced the significance of other low HDI areas in eastern Indonesia. This is because there are some archipelagic districts that are not regarded as having any neighbouring districts in the contiguity specification. This may indicate that the use of contiguity as the spatial matrix weight specification has caused under-estimation of the significance of possible clusters. The districts of Nusatenggara Islands are the perfect example of this as the low HDI district in that location is not recognised as having a significant cluster. Nevertheless, the significant low HDI cluster in the eastern part of Java may reduce the possibility of this theory, as Java is always considered as in the western part of Indonesia. This finding also has an impact on the discussion of the development gap between Java and Non Java.

The arrow diagrams analyse how recent trends may affect development clusters. As discussed in Section 2.3, the arrows in these diagrams show the changes of position in the Moran's scatter plot. They show the change in the position of a district's development level and the development level of its surrounding areas relative to the national average. Figure 5 shows that the cluster of high development (defined by GDP per capita) in Sumatera is still dominated by the Riau area. Despite decades of declining mining in the area, the regional GDP per capita of Riau districts is still considerably higher than other areas in Sumatera. Moreover, recent trends between 2005 and 2008 show that there was faster growth in several of these districts, such as in Bengkalis and Siak. This trend did not, however, affect the neighbouring districts such as Pekanbaru and Dumai. The other cluster of high development - Medan city - also experienced higher growth than average. This pattern was not followed by the neighbouring areas.

In Java most of the significant patterns are dominated by Jakarta and the surrounding areas. Central Jakarta not only had the highest regional GDP per capita, but also the highest growth between 2005 and 2008. This is followed by the neighbouring area within Jakarta as well as the cities of Bekasi and Tangerang. The more rural area of Tangerang and Bekasi did have similar growth during the same period but was not really catching up with Jakarta. Kediri is the only area with high and increasing regional GDP per capita over time, however this growth is localised within the city and the neighbouring areas growth was below average.

The story for the other islands is concentrated in the fall of Mimika's regional GDP per capita. This alone can explain the considerable increase in the Global I-statistics in the Other Islands region. Mimika was clearly an outlier in the Papua region, with neighbours such as Nabire and Puncak Jaya clearly below the average. Figure 5 also shows the high development cluster area - East Kalimantan, experienced above average growth in the period between 2005 and 2008, especially East Kutai and Bontang.

Figure 5 Moran arrow scatter plot of regional GDP per capita, 2005-2008

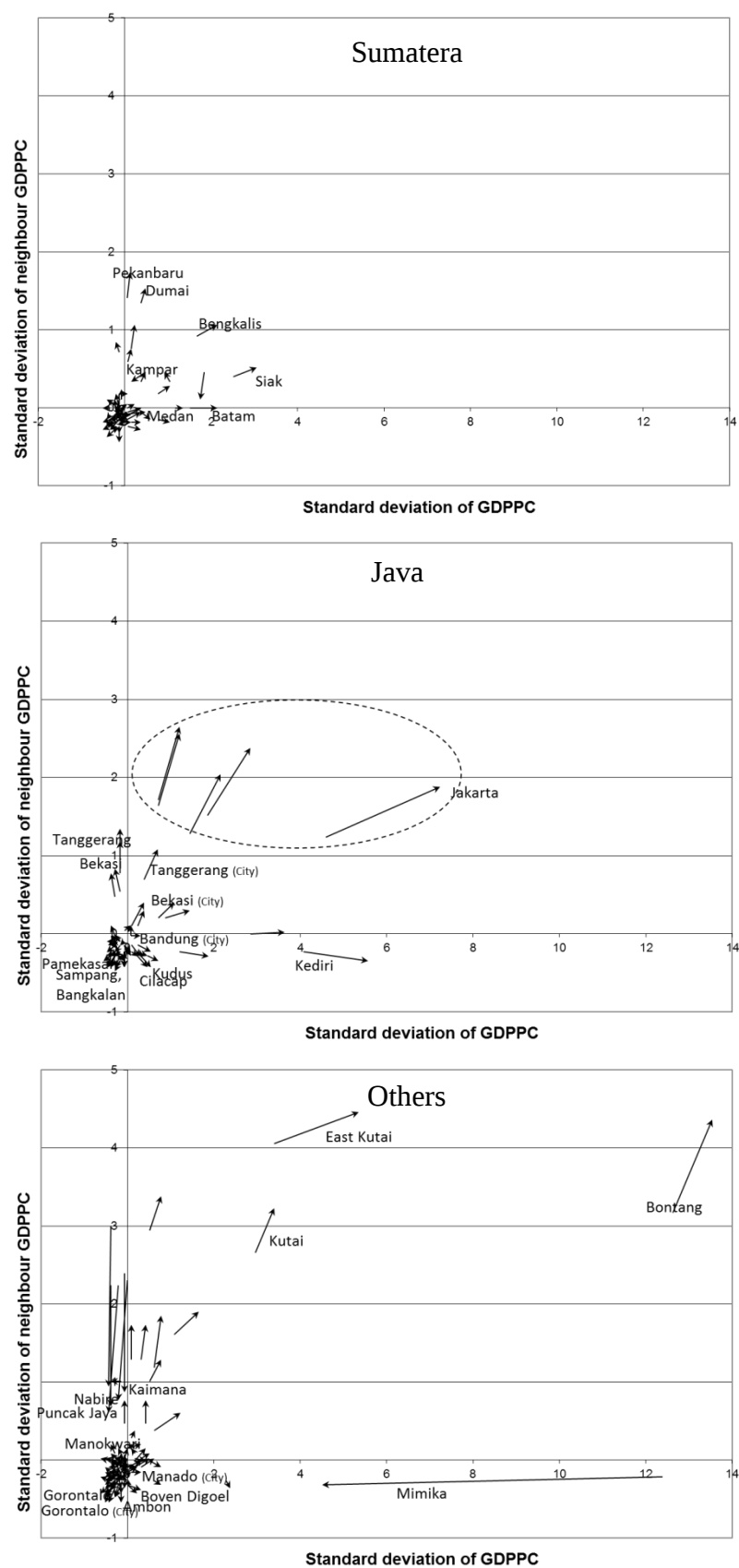
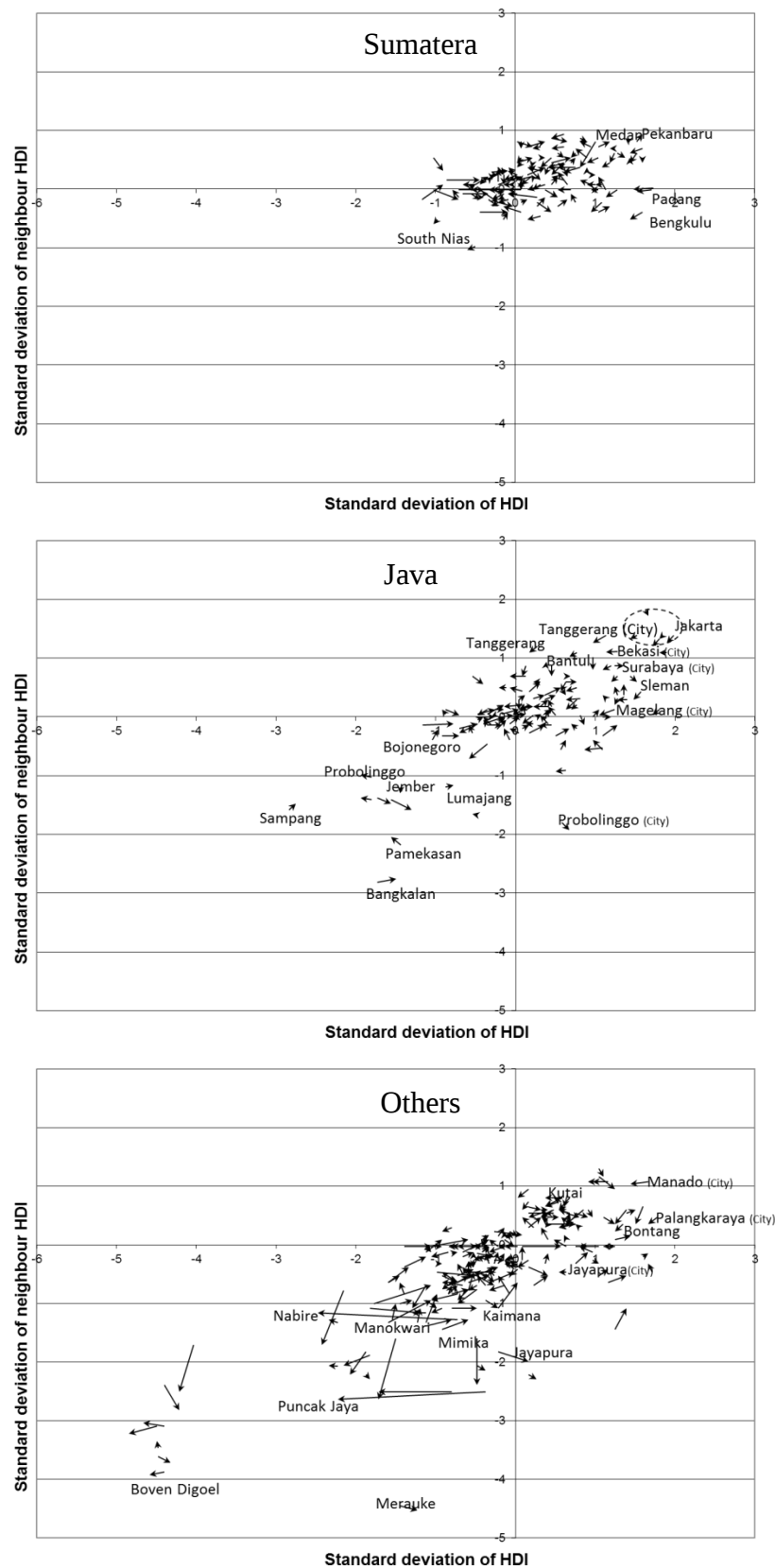


Figure 6 shows changes over time in the HDI. These results indicate relatively low Global I-statistics. Except for a high development cluster in Sumatera, the difference between the HDI's in this area is not significantly different to the rest of Sumatera. Moreover, there are cities or urban districts with high HDI values that are surrounded by low HDI districts such as Padang, Bengkulu and Banda Aceh. The clustered results for Sumatera, shown in Figure 6, demonstrate that there are no extremely low HDI districts and there is an indication that the districts with relatively lower HDI are catching up with other areas, while the HDI in cities and urban areas, (especially those that are surrounded by relatively low HDI districts) is not as high as the average development.

In Java, Figure 6 shows that the main differences in development patterns are between the areas surrounding Jakarta - including Tangerang and Bekasi, with those in the most eastern part of the Island and Madura. There is little difference in HDI development in the Jakarta high development cluster area, while there is some improvement from Madura districts such as Sampang and Bangkalan.

A concerning story of low and worsening HDI outcomes can be seen in the Other Islands results shown in Figure 6. Districts in the eastern part of Papua are less developed than other areas in Papua, as well as the rest of Indonesia. Furthermore, there is no sign that these districts are catching up in terms of development (as shown by the HDI) in other districts. In addition, the drop in regional GDP per capita in Mimika seems to have had a negative effect on the neighbouring areas HDI values, such as Puncak Jaya and Nabire.

Figure 6 Moran arrow scatter plot of HDI, 2005-2008



4 CONCLUSIONS

Given the importance of issues of inequality in Indonesia's regional development, this study aims to provide more evidence as to whether there is a clear development gap between certain regions in Indonesia. In doing so, the study has sought to ascertain whether the distribution of development in Indonesia has a statistically significant pattern. To do so, the Global and Local Moran's I-statistics are applied to infer the significance of the spatial distribution of regional development in Indonesia, visualised first through mapping the indicators using a natural break classification.

Two widely accepted indicators of development have been used to measure the level of development at district level in Indonesia. Analysis of development outcomes at a district level is becoming increasingly important as most of the governing authority has been decentralised to this level. GDP per capita, which serves as a proxy of per capita income, is one of the most widely used development indicators, especially when comparing cross-country development, while the HDI has emerged as an alternative indicator and is endorsed by the United Nations. Each of these indicators have limitations in gaining accurate and true measurement of the living standards of people within a community.

The results show both regional GDP per capita and the HDI have significant positive spatial correlation at a district level. This means that the high development districts tend to be located near other high development areas, while low development districts are typically located near other low development districts. As a consequence, the use of a spatial adjustment method is likely to be needed in analysing the regional distribution of development in Indonesia. Although both significant, the I-statistics of regional GDP per capita is considerably lower compared to those for the HDI. One reason for this is that highly developed areas (defined by GDP per capita) are often related to mining areas, and although these districts could form a cluster, areas outside these clusters often have much lower regional GDP per capita.

Having concentrated mining areas means the gap between western and eastern parts of Indonesia or between Java and Non Java is less obvious in terms of regional GDP per capita. The existence of the high regional GDP per capita in Jakarta has been balanced by major mining areas in Riau, East Kalimantan and Papua. The latter two also balance the east versus west issue to some extent. Furthermore, clusters of low regional GDP per capita are also shown to exist in Java. The development gap is more obvious in terms of the HDI, especially between east and west parts of Indonesia, as most districts in Papua have much lower HDI outcomes compared to the rest of Indonesia.

The temporal analysis illustrates that the clusters of both regional GDP per capita and the HDI are unlikely to change in the near future. This is because although concentrated in a small number of districts, the growth in the clusters of high GDP per capita growth are higher than average. In terms of the HDI, the cluster of low HDI districts in Papua is unlikely to be able to catch up with the rest of the country, and in many districts progress is shown to be falling. Furthermore, the reduced regional GDP per capita in Mimika seems to have had a negative effect on its neighbouring districts.

There are several implications of this study. The first is regarding government policy. This study shows that to deal with the regional disparity issue, the Indonesian government should focus more on improving HDI rather than concentrating on improving the regional economic growth, especially in Papua and the island strip from East Java to the east. This is not a trivial issue as the HDI has four components and further analysis needs to be done to know whether the government needs to concentrate on one particular component of HDI or all four components simultaneously.

Another issue is that improving the HDI will involve dealing with cultural and ethnicity issues because those locations are relatively remote.

Another implication of this study is that it indicates that the contiguity criteria for the spatial weight matrix is not really suitable to conduct spatial analyses in an archipelago country such as Indonesia. Although the number of districts affected is not significant, these districts are relatively close to each other and as a consequence make the impact more significant. More study should attempt to find the most suitable spatial matrix to be used in a spatial study for archipelagic countries, and it may well be that the specification should be different from one archipelagic country to another.

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