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Analysis of The Spatial Distribution Pattern of The City of Bogor Legislative Election Results in 2009, 2014 and 2019 Using The Moran's Index and Local Indicator of Spatial Association (LISA) Methods

Analisis Pola Distribusi Spasial Hasil Pemilu Legislatif Dprd Kota Bogor Tahun 2009, 2014 dan 2019 Menggunakan Metode Index Moran dan Local Indicator Spatial of Association (LISA)

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ABSTRACT

This study aims to analyse and visualize the spatial distribution pattern of the results of the 2009, 2014, and 2019 Bogor City DPRD elections, using the Moran Index and the Local Indicators of the Spatial Planning Association (LISA). By looking at positive or negative spatial autocorrelation values and how strong the relationship or influence of vote acquisition in one region affects the outcome of vote acquisition in another location. This research was carried out using a weighting matrix, namely the Queen's Proximity Matrix to see the environmental areas that intersect between the sides and corners of the five constituency areas in Bogor City. The analysis using the Moran Index method resulted in spatial autocorrelation, where the political party as a whole obtained a negative Moran I value and a P-Value>0.05. This shows that there is no relationship between constituencies and random or ungrouped distribution patterns in various constituencies in Bogor City. This indicates that each party has a support base spread across various regions. Meanwhile, the LISA method produces spatial autocorrelation analysis to determine the area of the clustermap, where in 2009, 2014 and 2019 the results of the study showed 3 legislative election periods. The spatial distribution pattern of election political parties generally does not follow the High-High (H-H), High-Low (H-L) and Low-Low (L-L) clusters. Meanwhile, in the Low-High (L-H) cluster, there are Gerinda parties and PKS in 3 election periods. The results of the research can be used as recommendations in determining the priority areas of political parties in each constituency to carry out a victory strategy

Keywords: Legislative Elections; Political Parties; Moran Index, LISA

ABSTRAK

Penelitian ini bertujuan untuk menganalisis dan memvisualisasikan pola distribusi spasial hasil pemilu legislatif DPRD Kota Bogor pada tahun 2009, 2014, dan 2019, menggunakan metode Index Moran dan Local Indicator of Spatial Association (LISA). Dengan melihat nilai autokorelasi spasial positif atau negatif dan seberapa kuat hubungan atau pengaruh perolehan suara disuatu wilayah, yang mempengaruhi hasil perolehan suara dilokasi lainnya. Penelitian ini dilakukan dengan menggunakan matriks pembobot, yaitu Matrix Queen Contiguity untuk melihat wilayah ketetanggaan yang bersinggungan antara sisi dan sudut dari kelima wilayah daerah pemilihan di Kota Bogor. Analisis dengan metode Index Moran menghasilkan autokorelasi spasial, dimana secara keseluruhan partai politik mendapatkan nilai Morans'I negatif dan P-Value>0.05. Hal ini menunjukkan tidak adanya keterkaitan antar daerah pemilihan dengan pola sebaran yang acak atau tidak mengelompok di berbagai wilayah District Kota Bogor. Hal ini mengindikasikan bahwa setiap partai, memiliki basis dukungan yang menyebar di berbagai wilayah. Sedangkan pada metode LISA menghasilkan analisis autokorelasi spasial untuk menentukan clustermap area, dimana pada tahun 2009, 2014 dan 2019 hasil penelitian menunjukkan pada 3 periode pemilihan legislatif. Pola distribusi spasial partai politik pemilu secara umum tidak mengikuti kluster High-High (H-H), High-Low (H-L) dan Low-Low (L-L). Sedangkan pada kluster Low-High (L-H) terdapat partai Gerinda dan PKS pada 3 periode pemilihan. Hasil penelitian bisa dijadikan sebagai rekomendasi dalam penentuan wilayah prioritas partai politik di tiap daerah pemilihan untuk melakukan strategi pemenangan

Kata kunci: Pemilu Legislatif; Partai Politik; Index Moran, LISA

INTRODUCTION

The General Election Commission (KPU) is a state institution that organizes general elections in Indonesia that must implement information and communication technology management plans in accordance with government objectives. About the General Election Commission, which has the authority to manage information technology [(Khaerunisah, 2018). The Bogor City KPU held a general election for regional heads and legislative candidates in each constituency. Legislative General Election is the election of candidates for members of the House of Representatives, Provincial Legislative Assemblies and Regency/City Legislative Assemblies or who represent the people in constituencies organized by the KPU [(Election Constitution, 2016]. Candidates for members of the House of Representatives can get seats in the DPRD based on the most votes chosen, which are chosen through political parties that carry legislative candidates (KPU RI, 2024). The constituency in Bogor City is divided into 5 circular areas, namely the Bogor City Constituency 1 covering East Bogor and Central Bogor Regencies, the Bogor City Constituency 2 covering South Bogor Regency, the Bogor City Constituency 3 covering West Bogor Regency, the Bogor City Constituency 4 covering Tanah Sareal Regency and the Bogor City Constituency 5 covering North Bogor Regency (KPU RI, 2016).

Based on the recapitulation data of the 2009, 2014 and 2019 Bogor City KPU Regional Elections, the conditions at that time, the presentation of data displayed was only in the form of table data or a graph of the percentage of votes and the number of seats of political parties. So that the presentation of recapitulation data seems less informative in terms of spatial visualization, and the results of the recapitulation of votes obtained by political parties greatly affect the number of seats obtained by political parties in the electoral area. Meanwhile, the above problem requires a spatial analysis of the relationship or influence and how strongly the concentration of votes in an area affects the voting results in the surrounding location.

Some of the results of previous research on elections include research on the simultaneous election system, in this study explaining how to analyze the general election system as part of the success of the implementation of democratic parties in Indonesia (Dedi, 2019). This study discusses the spatial analysis of the results of the DPR-RI election and the acquisition of seats in the 2019 simultaneous general election in Tegal Regency using the LISA method, this study explains that the results of each party's vote acquisition are calculated using the Moran index calculation formula and the Local Indicators of Spatial Associations or LISA in this study looking at the distribution through spatial autocorrelation values (Kaasyifa, 2022). and another study on the spatial analysis of vote distribution and seat

acquisition of political parties in the 2009 elections in DKI Jakarta and West Java using the Moran and LISA Index methods, in this study identified the spatial association and vote distribution of the winning party in the 2009 Legislative Elections in the DKI Jakarta and West Java regions (Ardiansa, 2010).

Research on legislative elections using the Moran and LISA Index methods in Bogor City has not been conducted. Thus, based on the background and references of previous research, the researcher would like to discuss "Analysis of Spatial Distribution Patterns of the Results of the Bogor City DPRD Regional Elections in 2009, 2014 and 2019 Using the Moran Index Method and Local Spatial Indicators of Association (LISA)". The analysis method used in this study was assisted by Geoda software to generate clustering and find patterns of spatial relationships based on global and local regional associations.

PROBLEM STATEMENT

How to analyse and visualize the spatial pattern of the results of the recapitulation of political party elections in Bogor City for the 2009, 2014 and 2019 periods using the Moran Index and Local Index Spatial of Association (LISA) methods?

LITERATURE REVIEWS

Table 1: Literature reviews

No.	Author, Year	Journal Title	Research results	About
1.	Agus Dedi. 2019	Analysis of the Simultaneous General Election System	This study aims to analyze the general election system as part of the success of party implementation democracy in Indonesia.	Explaining the system in the 2019 election
2.	Faarijal Hammi Kaasyifa, 2022	Spatial Analysis of the Election Results of the DPR-RI in the Election The 2019 Simultaneous General in Tegal Regency uses *Moran Index* and *Local Indicators of Spatial Associations (LISA)*	The votes of each party were calculated using the Moran index calculation formula and the Local Indicator of Spatial Association or LISA to determine the distribution through spatial autocorrelation values.	Describe vote acquisition using the LISA method
3.	Dirga Ardiansa, 2010	Spatial analysis for sound distribution and Acquisition of Political Party Seats in Elections Legislative 2009 In the DKI Jakarta and West Java Regions	Spatial Analysis of Vote Distribution and Seat Acquisition of Political Parties in the 2009 Regional Elections in the DKI Jakarta and West Java Regions The purpose of this study is to identify the spatial association and vote distribution of the winning parties in the 2009 Legislative Elections in the	Explain how to calculate the number of votes in the 2009 Jakarta legislative election using the LISA method.

No.	Author, Year	Journal Title	Research results	About
			DKI Jakarta and West Java regions.	
4.	Mohammad Murthalaq Makes Fleet, 2019	Analysis of People's Political Participation in Elections 2019 General Legislative Election in Sigi Biromaru Regency Sigi Regency, Central Sulawesi Province	Showing the political participation of the community, starting from the scope of individuals, communities and groups, and national. In accordance with the general definition that political participation is the activity of a person or group of people to actively participate in political life.	Explaining the political partiality of the community.
5.	Alan Prahutama, 2014	Analysis of the Victory of the Governor Election (Pilgub) Central Java 2013 with Spatial Autocorrelation	Based on the analysis of local autocorrelation namely by Lieutenant Colonel Sukoharjo, Surakarta City, Klaten, Karanganyar are the which has an autocorrelation effect with other regions for the three pairs there is a relationship between the regions that are influenced by the surrounding areas.	Election of Governor In Central Java, autocorrelation analysis is used for the relevant regions.

METHODOLOGY

The research time starts from June 2023 with the research location at Ibnu Khaldun University Bogor. This research starts from data collection, data processing and data analysis as follows:

Data Collection

At this stage, the researcher carried out the process of collecting data collected from the Bogor City KPU institution in 2009, 2014 and 2019. The stages are carried out by sending a notification letter, in the form of a letter requesting data from recapitulation results in accordance with the year of the research data as a reference for research and in the appendix. As well as land images and administrative maps of Bogor City in 2022 obtained from the Geoportal Indonesia website.

Data Processing

At this stage, the researcher carried out a data processing process using Microsoft Excel 2019 software, ArcGis 10.8 and Geoda with the data that has been obtained will be classified manually based on the number of DPTs, political party votes and the number of seats using Microsoft Excel 2019. Then, after the data is classified, the data is entered into the Arcgis software through a spatial connection table, then it is seen in the attribute table whether the data matches the selection area. Once the data is correct, it is then exported for processing with Geoda software. Finally, run the Geoda software, by entering the exported data and then proceeding with spatial analysis.

Data Analysis

At this stage, the research carried out a data analysis process using the Moran Index method and LISA using Geoda software in the following way:

1. Spatial weighting: Selects the Variable ID and Queen Proximity data. Queen Contiguity is a weighting that intersects between sides and corners.
2. Spatial autocorrelation: This analysis is an automatic calculation of data on the number of valid votes and the acquisition of political parties in Bogor City globally or locally.
3. Morans Bivariat'I: This analysis looks at whether there is a spatial autocorrelation between the variables of total votes and political party votes, based on constituencies determined by Moran's scatterplot quadrant.
4. LISA Bivariate: This analysis looks at whether there is a spatial autocorrelation between the variables of total votes and political party votes, based on constituencies determined by the spatial cluster map.
5. Area determination: This analysis is seen from the determination of cold spot areas and hotspot areas, where cold spot areas are areas that get positive values such as high-high and low-low, while hotspots are areas that get negative values such as low-high and high-low. Then after that the data generates a map layout.

FINDINGS AND DISCUSSION

Data Collection

The results of data collection are in the form of secondary data, namely the data collected in this study in the form of data from the Bogor City KPU institution in the form of permanent voter lists (DPT) and the results of the recapitulation of legislative elections in 2009, 2014 and 2019 in Bogor City. Judging from the overall data, the Bogor City DPT has increased in each period. So that from the results of the data, it can be seen that the participation of the community in choosing candidates for Legislative members. These results, analysed by looking at how strong the influence of a region's votes are with other regions, using the 2022 Bogor City administrative map to determine the electoral district (Dapil).

Legislative Election Results by Constituency

At this stage, the researcher processed data on the results of the legislative election obtained from the Bogor City KPU. The data used in this study in the last 3 election periods, which were held in 2009, 2014 and 2019 were the results of the election distribution. The following are the results of the votes obtained for seats and political parties in each constituency as shown in Table 2.

Table 2: Seat Allocation and Number of DPTs in 2009, 2014 and 2019

District	Electoral Districts (Dapil)	Seat Allocation			Number of Voters (DPT)		
		2009	2014	2019	2009	2014	2019
East Bogor	Dapil 1	10	11	10	64.410	69.120	69.180
Central Bogor	Dapil 1	10	11	10	74.230	76.319	73.237
Bogor Selatan	Dapil 2	8	8	9	116.463	125.910	132.806
West Bogor	Dapil 3	8	10	10	136.416	149.404	157.987
Tanah Sareal	Dapil 4	10	8	11	122.783	128.470	140.113
North Bogor	Dapil 5	9	8	10	104.638	116.901	120.976
Total		45	45	50	618.940	666,124	694,299

Based on Table 2, the administrative area of West Bogor (Dapil 3) is the constituency with the highest number (DPT) with 136,416 people in 2009, 149,404 people in 2014 and 157,987 people in

2019. Meanwhile, in other administrative areas, East Bogor (Dapil 1) is the constituency with the lowest number (DPT) with 64,410 people in 2009, 69,120 people in 2014 and 69,180 people in 2019. This indicates that in each legislative election period in the administrative area (DPT) the number recorded has increased quite significantly.

Legislative Election Results by Political Party

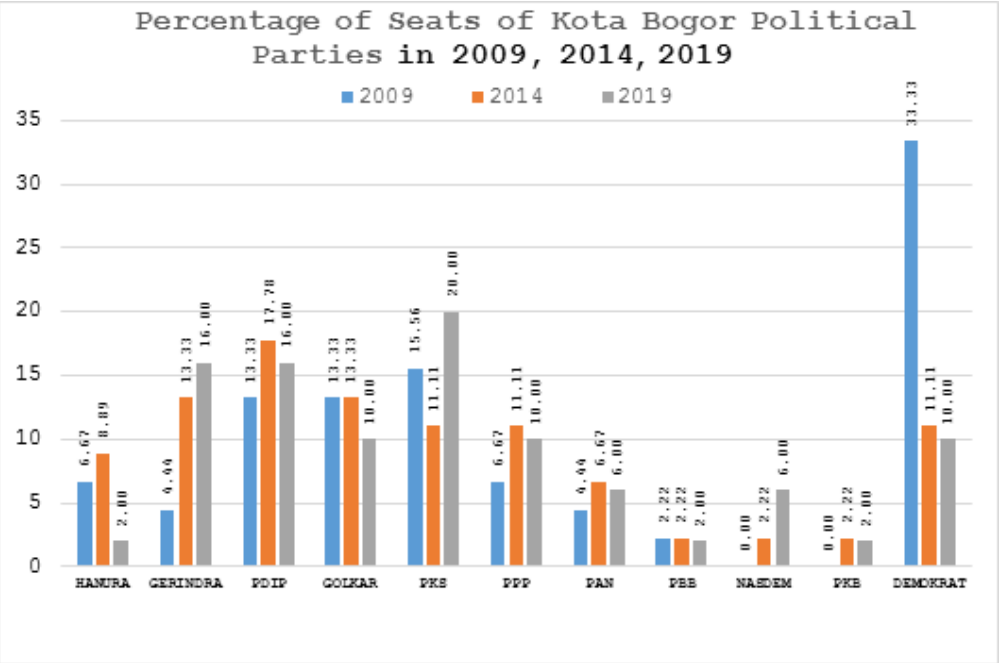
The process described refers to the process, observation of each constituency which is divided into 5 parts out of a total of 6 sub-districts in Bogor City. Based on the administrative area of Bogor City, the results of the percentage of legislative votes in Bogor City for the 2009, 2014 and 2019 periods. Experiencing several changes in the number of votes in each different political party.

Table 3: Percentage of Votes and Seats of Political Parties in 2009, 2014 2019

Political Party	Vote Count			Chair			Sound presentation		
	2009	2014	2019	2009	2014	2019	2009	2014	2019
Hanura	11.063	24.916	3.956	3	4	1	3,24%	5,69%	2,46%
Gerindra	7.340	56.686	23.835	2	6	8	2,15%	12,95%	14,83%
PDI-P	44.615	92.673	28.135	6	8	8	13,07%	21,17%	17,51%
Golkar	52.263	71.246	18.892	6	6	5	15,31%	16,27%	11,76%
PKS	62.698	56.732	40.433	7	5	10	18,37%	12,96%	25,16%
PPP	14.210	47.325	16.149	3	5	5	4,16%	10,81%	10,05%
GENTLEMAN	9.977	19.458	6.585	2	3	3	2,92%	4,44%	4,10%
PBB	8.949	8.209	2.513	1	1	1	2,62%	1,87%	1,56%
Nasdem	0	8.611	1.789	0	1	1	0%	1,97%	1,12%
PKB	0	4.899	7.399	0	1	3	0%	1,12%	4,60%
Democrat	130.278	47.083	11.013	15	5	5	38,16%	10,75%	6,85%
Total	**341.393**	**437.838**	**160.709**	**45**	**45**	**50**	**100%**	**100%**	**100%**

Table 3 show the results of the vote calculation and the number of legislative seats in Bogor City for the period of 2009, 2014 and 2019. The impact occurred on each political party, some increased and decreased significantly in the acquisition of votes and legislative seats. While the number of DPTs in each rotation period from 2009, 2014, and 2019 has always increased, this does not go smoothly with the number of voters going up and down every period. Figure 1 shows the percentage graph of political parties in Bogor City in 2009, 2014 and 2019.

Figure 1: Percentage of Seats of Political Parties in 2009, 2014 and 2019



The results of the percentage calculation of the number of seats of political parties in Bogor City for the period of 2009, 2014 and 2019, the legislative election in Bogor City was attended by 11 political party participants. Where in the 2009 and 2014 period the number of seats was 45 seats and the addition occurred in the 2019 period as many as 50 seats. Based on data from the recapitulation of the number of seats in 2009, the Democratic Party got the highest percentage of 33.33% or a total of 15 seats, while the Nasdem and PKB parties did not get the percentage because they had not participated in the preparation. In 2014, the PDIP party got the highest percentage of 17.78% or 8 seats, while the Nasdem and PKB parties only got 2.22% or 1 seat. In 2019, the PKS party got the highest percentage of 20% or 10 seats, while the Hanura and PKB parties only got 2% or 1 seat. It indicates how strong voter participation is in choosing political parties, the dominant ones have a vote base and have the largest number of seats.

Data Processing and Analysis

At this stage, spatial data processing and analysis was carried out in the form of data on the results of the Bogor City legislative elections in 2009, 2014 and 2019. In processing and analysing data, Geoda software is used to make classifications based on constituencies with *mattrix contiguity* to see the area of concern, *Arcgis* to display a spatial analysis of the vote calculation of political parties that have been in the cluster area, which has previously been analysed in the Geoda software.

Mattrix Contiguity

The weighting matrix in this spatial analysis is to show the neighbourhood area, using the *Queen Contiguity* matrix (side-corner intersection) by looking at the weighting matrix of the five constituency areas in Bogor City as seen in Table 4.

Table 4: Matrix of Regional Neighboring Polluters in Bogor City

Constituencies	Neighboring Areas
East and Central Bogor (1st District)	1. Bogor Selatan 2. West Bogor 3. Land of Salty 4. North Bogor
South Bogor (Dapil 2)	1. East-Central Bogor 2. West Bogor
West Bogor (Dapil 3)	1. East-Central Bogor 2. Bogor Selatan 3. Land of Salty
Tanah Sareal (Dapil 4)	1. East-Central Bogor 2. West Bogor 3. North Bogor
North Bogor (Dapil 5)	1. East-Central Bogor 2. Land of Sand

Analysis of the Spatial Distribution Pattern of the 2009 Legislative Election

The process described refers to the step of spatial analysis to test the association or relationship between the overall variables of political party vote results in the context of Bogor City constituency data in 2009. Spatial Association Test Using *Index Moran* and *LISA* to measure the general level of spatial association between the variables of vote results obtained in an electoral area.

Global Spatial Association (*Moran Index*)

The analysis of the Moran Index method is used to identify spatial patterns. This provides information about how strongly the spatial pattern influences the relationship between constituencies. Then compare the results using the distribution of votes from the 2009 legislative election to the votes of political parties, based on administrative maps. The following are the results of the testing of the

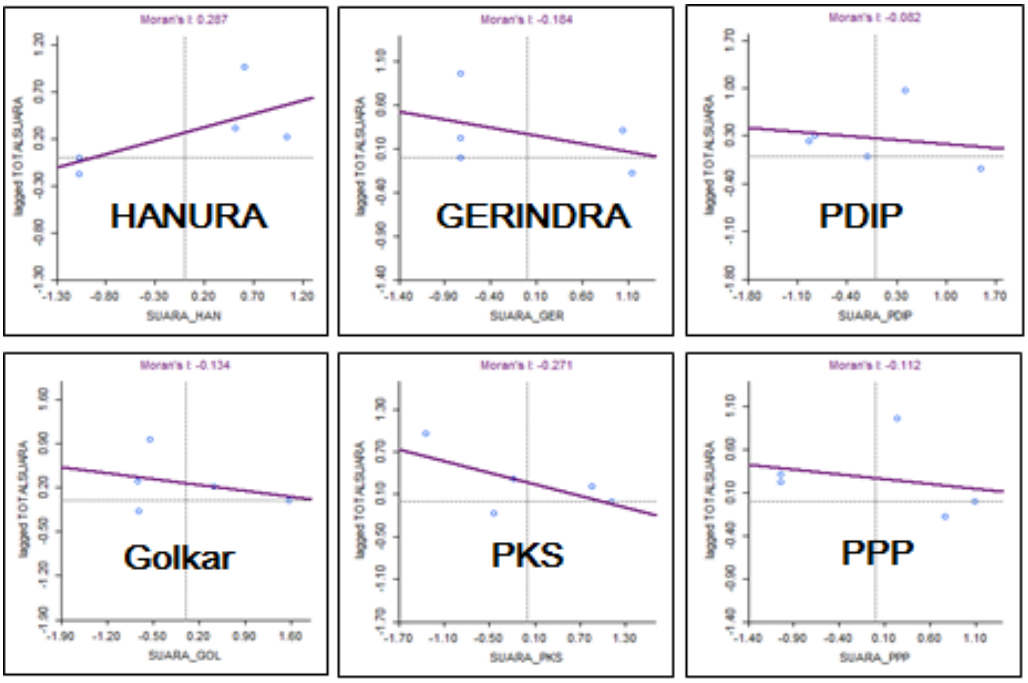
spatial association of the Moran Index in the legislative election of the Bogor City region in the 2009 period. It can be seen in Table 5.

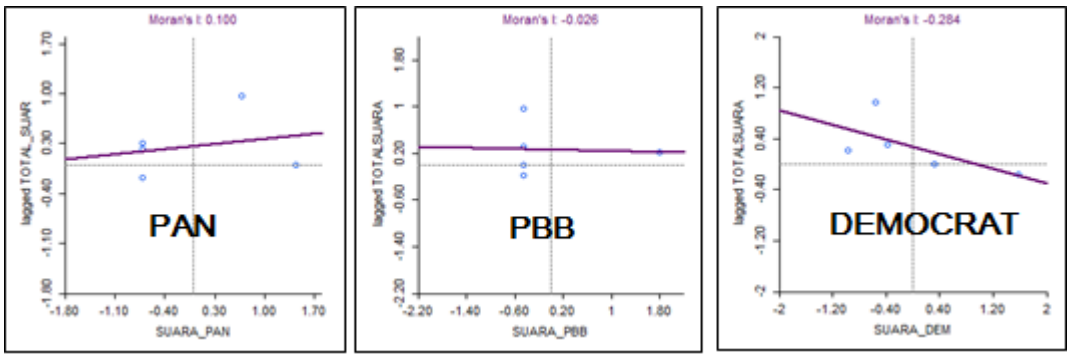
Table 5: Moran Index Analysis in 2009

Region	Political Party	Moran's I (Global)	*E*[I]	P-Value	Distribution Pattern
Bogor City 5 Districts (Dapil 1, Dapil 2, Dapil 3, Dapil 4, Dapil 5)	Hanura	0.287	-0.25	0.0	*Clustered*
	Gerindra	-0.184	-0.25	0.138	*Random*
	PDI-P	-0.082	-0.25	0.073	*Random*
	Golkar	-0.134	-0.25	0.016*	*Random*
	PKS	-0.271	-0.25	0.206	*Random*
	PPP	-0.112	-0.25	0.001*	*Random*
	GENTLEMAN	0.100	-0.25	0.821	*Clustered*
	PBB	-0.026	-0.25	0.396	*Random*
	Democrat	-0.284	-0.25	0.273	*Random*

Based on table 5 of the analysis of the Moran Index of Political Parties in 2009**,** there was a negative or positive spatial autocorrelation with a significant value (*P-Value<0.05).* The Golkar Party and PPP showed negative values and significant *pvalues*, meaning that they had a relationship between constituencies with a random distribution pattern in various constituencies in Bogor City. As well as the Gerindra party, PDIP, PKS, PBB and Democrats showed negative values and insignificant *pvalues*, meaning that they did not have a relationship between constituencies with random distribution patterns in various constituencies in Bogor City. The PAN Party shows positive values and insignificant *pvalues*, meaning that it does not have a relationship between constituencies with the distribution pattern that groups in various constituencies of Bogor City. Meanwhile, the Hanura party does not have a spatial association relationship because it gets a zero score. Based on these results, the majority of parties showed a pattern of vote distribution that did not cluster with several parties that had a significant high level in the distribution pattern. This can indicate that in the legislative elections of the year In addition, the results of the Moran Index analysis depict the Moran scatterplot graph in Figure 2.

Figure 1: Analysis of Moran Scatterplot of Political Parties in 2009





In Figure 2 shows the pattern of the relationship between the votes obtained by political parties in the legislative election in Bogor City in 2009, the electoral district in Quadrant I (upper right) shows that the area that received high vote results was surrounded by the area that received high vote results as well. The constituencies in Quadrant II (top left) show that the areas that received low vote results were surrounded by areas that received high vote results as well. The constituencies in Quadrant III (bottom left) show that the areas that received low vote results were surrounded by areas that received low votes as well. The constituencies in Quadrant IV (bottom right) show that the areas that received high votes were surrounded by areas that received low votes as well. The results of the analysis show that the trend line (purple line) descending downwards is negative, which shows that there is a negative relationship between the votes of political parties in an area and the votes in the surrounding areas. There are 7 political parties, namely, the Gerindra party, PDIP, Golkar, PKS, PPP, PBB and Democrats. Meanwhile, the upward trend line is positive, which shows that there is a positive relationship between the votes of political parties in an area and the votes in the surrounding areas. There are 2 political parties, namely, the Hanura party and the PAN. This means that the characteristics of each political party have diverse neighbourhood associations in obtaining the voter vote base.

Local Index Spatial of Association (LISA)

Analysis *Local Index of Association (LISA)* is used to measure the general level of spatial association between variables obtained from legislative elections in an electoral area. There are several parameters in the analysis *Local Indicator Spatial of Association* (*LISA*) among them *Z-Score, Std. Deviation,* and *Z-li*. *Std. Deviation* Measure the value of the variation *index moran* among the units that are breastfed in the surrounding area (*neighbouring* area) a Dapil. *Z-li* Measure local associations or how the results of legislative elections in a constituency correlate with votes in the surrounding area. This provides an overview of how the spatial pattern of vote acquisition in the surrounding area affects the constituency concerned. *P-Value* shows the probability value of the value *LISA*. The following are the results of the analysis *LISA* period 2009 in Table 6.

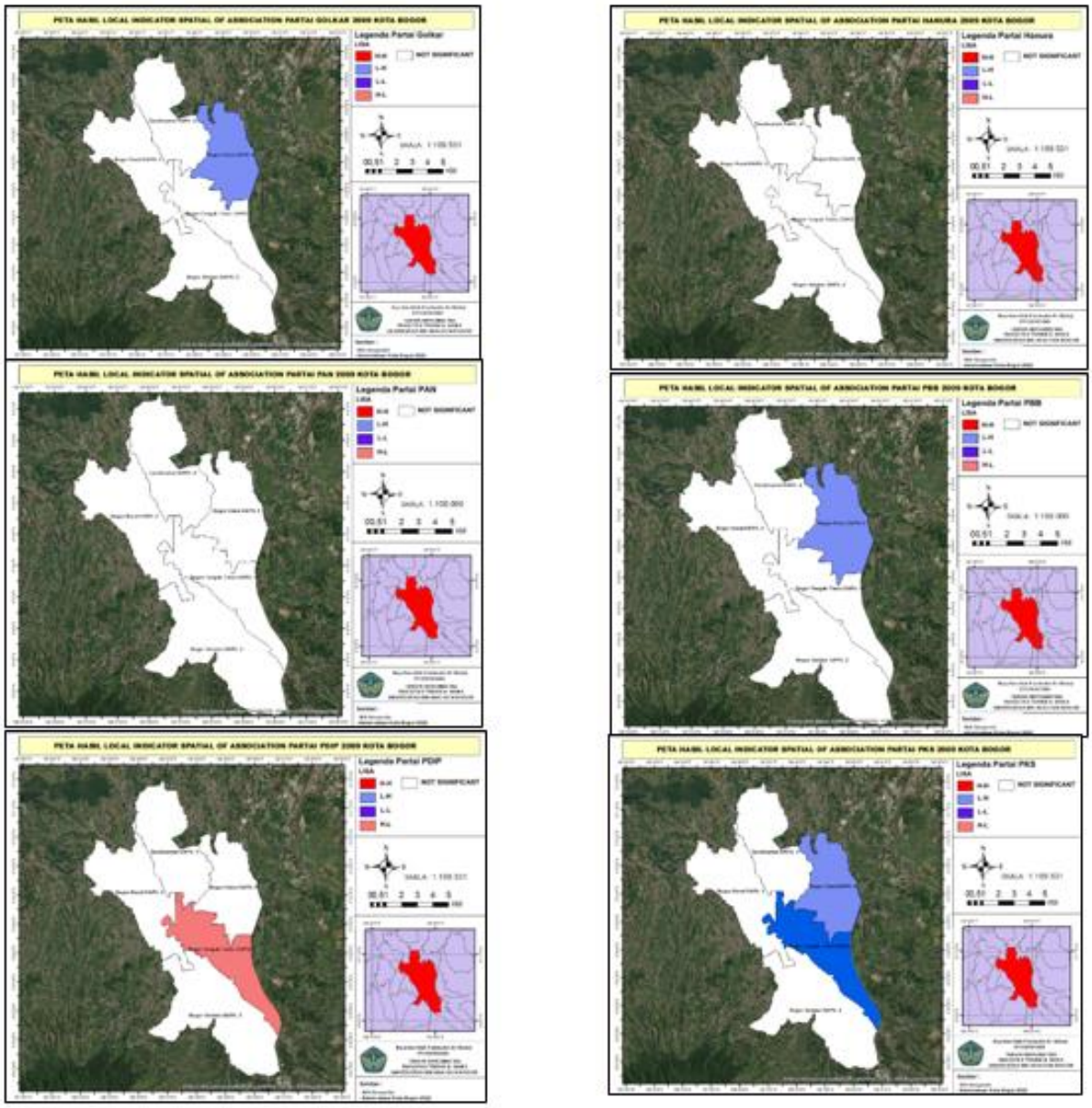
Table 6: LISA Analysis in 2009

Territory	Political Party	Area	(Z) *Score*	Std. Deviation	(Z) li	High/Low	P-Value
Bogor City	Gerindra	Dapil 1	1.143	-0.169	-0.194	High/Low	0.001
		Dapil 5	-0.729	0.220	-0.161	Low/High	0.001
	PDI-P	Dapil 1	1.487	-0.619	-0.252	High/Low	0.001
	Golkar	Dapil 5	-0.552	0.964	-0.532	Low/High	0.001
	PKS	Dapil 1	-0.441	-0.169	0.074	Low/Low	0.011
		Dapil 5	-1.343	0.964	-1.295	Low/High	0.001
	PPP	Dapil 1	0.760	-0.169	-0.129	High/Low	0.001
	PBB	Dapil 5	-0.447	0.964	-0.431	Low/High	0.001
	Democrat	Dapil 1	1.584	-0.169	-0.269	High/Low	0.001
		Dapil 5	-0.554	0.964	-0.534	Low/High	0.001

Based on the results in Table 6 of the analysis of the Local Index of Spatial Association (LISA), we can see how the pattern of political party votes in each constituency (Dapil) in the 2009 legislative

election in Bogor City. LISA analysis helps identify spatial clusters and outliers in the sound acquisition data. In the analysis, the party in the (High-High) area does not exist. Parties in the area (Low-High) include the same Gerindra, Golkar, PKS, PBB, and Democrats in the 5th constituency. The party in the area (Low-Low) is the PKS party in constituency 1. Parties in the area (High-Low) include the Gerindra party, PDIP and PPP and the same Democrats are in the 1st constituency. The following are the results of the cluster map of spatial analysis of the results of the 2009 legislative elections, in Figure 3.

Figure 3: Clustermap of Political Parties in 2009



The clustermap of the results map in Figure 3 presents the results of the analysis using the *Local Indicator of Spatial Association* (*LISA)* method for the acquisition of votes for political parties in the 2009 Bogor City legislative election. Using the *bivariate local moran's I,* from the results of the analysis test in 2009, it shows that there are no political parties in quadrant I (*High-High*). In quadrant II (*Low-High*) there are 5 political parties, namely the Gerindra party, Golkar PKS, PPP and Democrats. In quadrant III (*Low-Low*) there is 1 political party, namely the PKS party. In quadrant IV (*High-Low*) there are 4 political parties, namely the Gerindra party, PDIP, PPP and Democrats.

Table 7: Clustermap of Political Party Relations in 2009

Year	Political Party	Relationship	Colour	Quadrant
2009	-	*High-High*	Dark Red	Quadrant I
	1. Gerindra 2. Golkar 3. SME 4. PPP 5. Democrat	Low-High	Light Blue	Quadrant II
	1. SME	*Low-Low*	Dark Blue	Quadrant III
	1. Gerindra 2. PDIP 3. Gerindra 4. PDIP	*High-Low*	Pink	Quadrant IV

Analysis of the Spatial Distribution Pattern of the 2014 Legislative Election

The process described refers to the steps of spatial analysis to test the association or relationship between the overall variables of political party vote results in the context of Bogor City election data in 2014. Spatial Association Test Using *Index Moran* and *LISA* to measure the general level of spatial association between the variables of vote results obtained in an electoral area.

Global Spatial Association (Index Moran)

The analysis of the *Moran Index* method is used to identify spatial patterns. This provides information about how strongly the spatial pattern influences the relationship between constituencies. Then compare the results using the distribution of votes from the 2014 legislative election and administrative maps. The following are the results of the testing of the *Moran Index spatial association* in the legislative election of the Bogor City region in the 2014 period. Can be seen in Table 8.

Table 8: Moran Index Analysis in 2014

Region	Political Party	Moran's I (Global)	*E*[I]	P-Value	Distribution Pattern
Bogor City 5 Districts (Dapil 1, Dapil 2, Dapil 3, Dapil 4, Dapil 5)	Hanura	0.091	-0.25	0.008*	*Clustered*
	Gerindra	-0.313	-0.25	0.081	*Random*
	PDI-P	-0.167	-0.25	0.067	*Random*
	Golkar	-0.038	-0.25	0.123	*Random*
	PKS	-0.345	-0.25	0.114	*Random*
	PPP	0.041	-0.25	0.003*	*Clustered*
	GENTLEMAN	-0.327	-0.25	0.886	*Random*
	PBB	-0.022	-0.25	0.001*	*Random*
	Nasdem	0.405	-0.25	0.001*	*Clustered*
	PKB	-0.015	-0.25	0.000*	*Random*
	Democrat	-0.295	-0.25	0.030*	*Random*

Based on Table 8 of the analysis of the *Moran Index* of Political Parties in 2014**,** there is a negative or positive spatial autocorrelation with a significant value (*P-Value<0.05).* The United Nations, PKB and Democrat parties showed negative values and significant *pvalues*, meaning that they have a relationship between constituencies with random distribution patterns in various constituencies in Bogor City. As well as the Gerindra party, PDIP, Golkar, PKS and PAN showed negative values and insignificant *pvalues*, meaning that they did not have a relationship between constituencies with random distribution patterns in various constituencies in Bogor City. Meanwhile, the Hanura, PPP and Nasdem parties show positive values and significant *pvalue*, meaning that they have a relationship between constituencies with a distribution pattern that groups in various constituencies of Bogor City. Based on these results, the majority of parties showed a pattern of vote distribution that did not cluster with several

parties that had a significant high level in the distribution pattern. This may indicate that in the 2014 legislative elections, no party had the dominance of the vote pockets in one constituency, but rather more widespread support in various regions. In addition, the results of the *Moran Index* analysis illustrate the *moran scatterplot* graph in Figure 4.

Figure 4: Moran's Analysis of Political Parties' Scatterplots in 2014

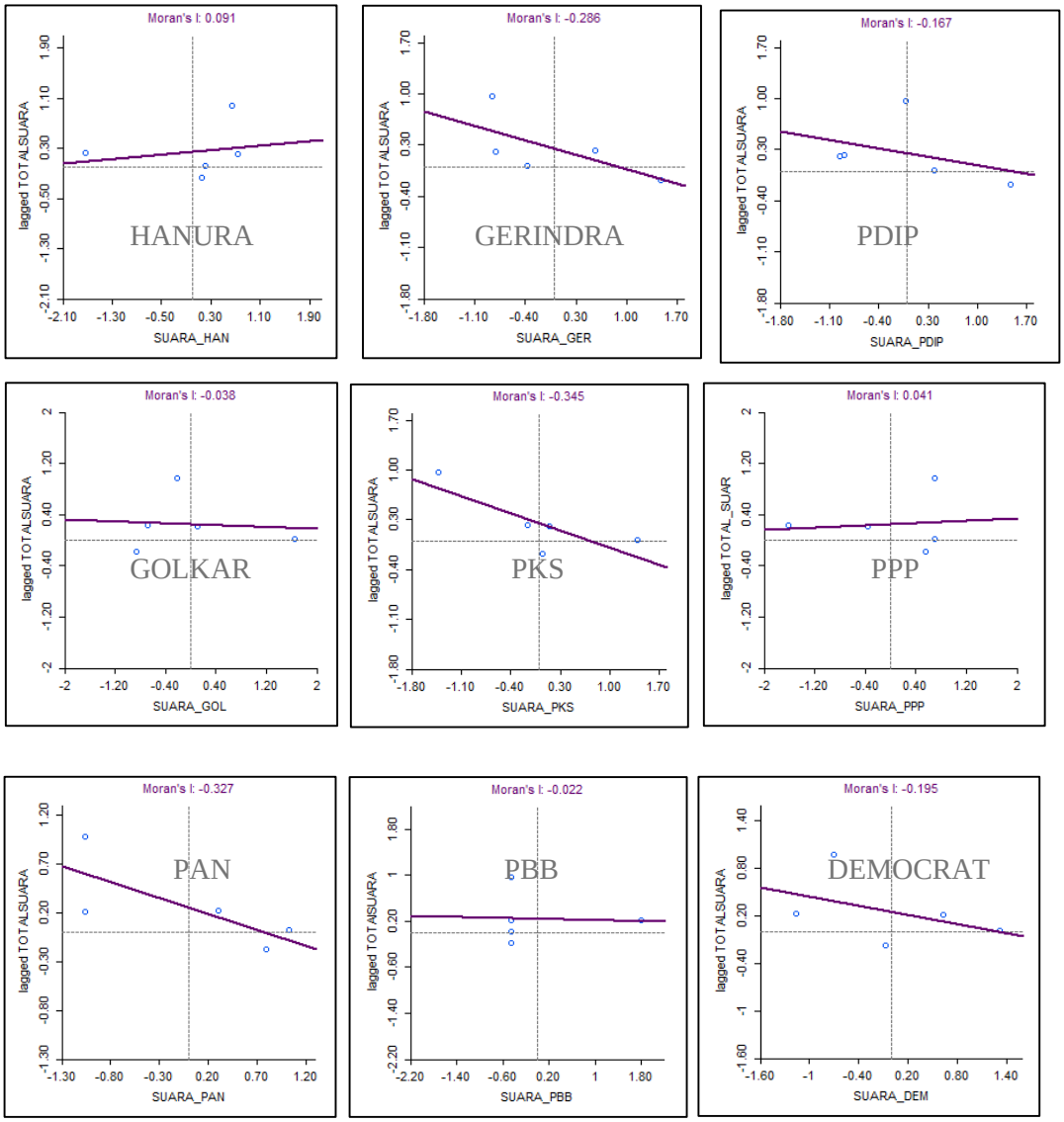


Figure 4 shows the pattern of the relationship between the votes obtained by political parties in the legislative election in Bogor City in 2009, the electoral district in Quadrant I (upper right) shows that the areas that received high votes were surrounded by areas that received high votes as well. The constituencies in Quadrant II (top left) show that the areas that received low vote results were surrounded by areas that received high vote results as well. The constituencies in Quadrant III (bottom left) show that the areas that received low vote results were surrounded by areas that received low votes as well. The constituencies in Quadrant IV (bottom right) show that the areas that received high votes were surrounded by areas that received low votes as well. The results of the analysis show that the trend line (purple line) descending downwards is negative, which shows that there is a negative relationship between the votes of political parties in an area and the votes in the surrounding areas. There are 8 political parties, namely, the Gerindra party, PDIP, Golkar, PKS, PAN, PBB, PKB and Democrats. Meanwhile, the upward trend line is positive, which shows that there is a positive relationship between the votes of political parties in an area and the votes in the surrounding areas. There are 2 political

parties, namely, the Hanura party and the PAN. This means that the characteristics of each political party have diverse neighbourhood associations in obtaining the voter vote base.

Local Index Spatial of Association (LISA)

Analysis *Local Index of Association (LISA)* is used to measure the general level of spatial association between variables obtained from legislative elections in an electoral area. There are several parameters in the analysis *Local Indicator Spatial of Association* (*LISA*) among them *Z-Score, Std. Deviasi, Z-li*. *Std. Deviation* Measure the value of the variation *Moran Index* among the units that are breastfed in the surrounding area (*neighbouring* area) a Dapil. *Z-li* Measure local associations or how the results of legislative elections in a constituency correlate with votes in the surrounding area. This provides an overview of how the spatial pattern of vote acquisition in the surrounding area affects the constituency concerned. *P-Value* shows the probability value of the value *LISA*. The following are the results of the analysis *LISA* 2014 period in Table 9.

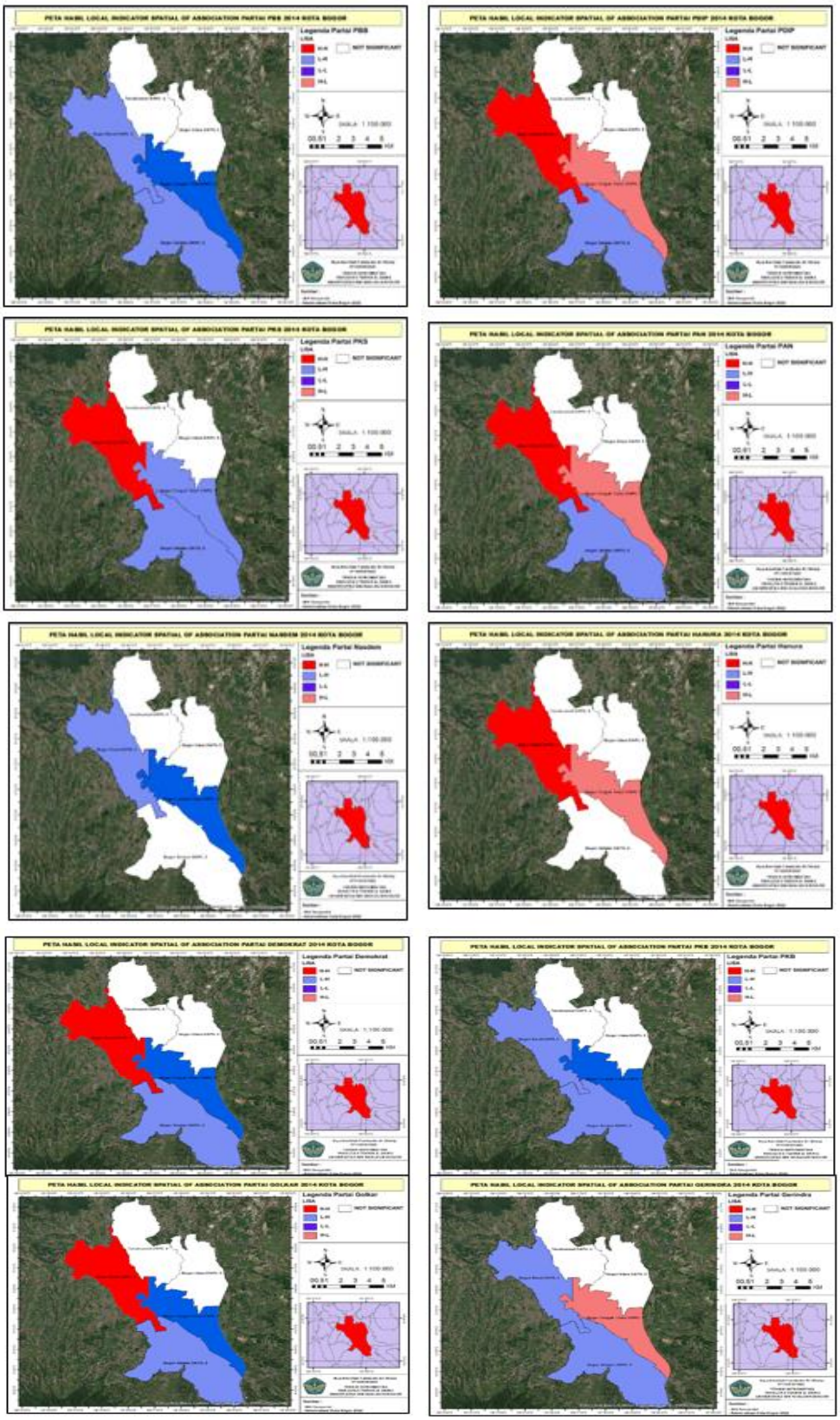
Table 9: LISA Analysis in 2014

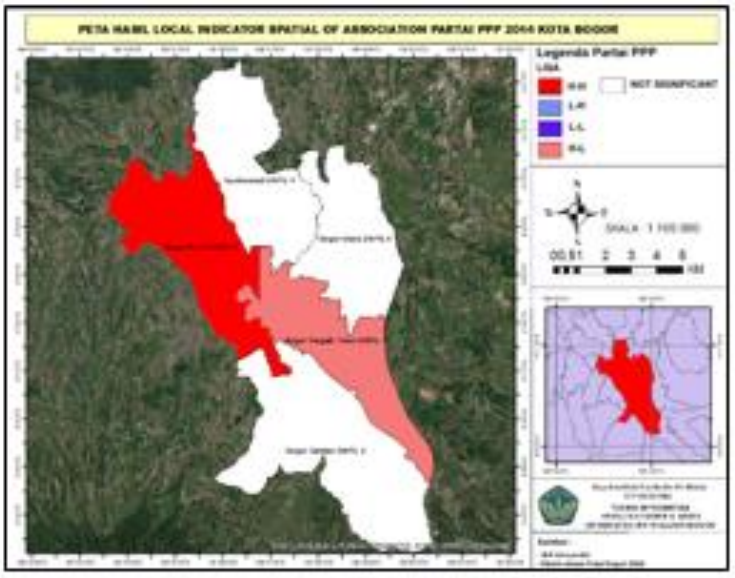
Territory	Political Party	Area	(Z) *Score*	Std. Deviation	(Z) li	High/Low	P-Value
Bogor City	Hanura	Dapil 1	0.155	-0.174	-0.027	High/Low	0.001
		Dapil 3	0.198	0.019	0.003	High/High	0.029
	Gerindra	Dapil 1	1.474	-0.174	-0.256	High/Low	0.001
		Dapil 2	-0.853	0.976	-0.832	Low/High	0.001
		Dapil 3	-0.372	0.019	-0.007	Low/High	0.001
	PDI-P	Dapil 1	1.469	-0.174	-0.225	High/Low	0.001
		Dapil 2	-0.017	0.976	-0.017	Low/High	0.001
		Dapil 3	0.385	0.019	0.007	High/High	0.029
	Golkar	Dapil 1	-0.865	-0.174	0.150	Low/Low	0.001
		Dapil 2	-0.210	0.976	-0.204	Low/High	0.001
		Dapil 3	1.651	0.019	0.031	High/High	0.029
	PKS	Dapil 1	0.055	-0.174	-0.009	Low/High	0.001
		Dapil 2	-1.428	0.976	-1.394	Low/High	0.001
		Dapil 3	1.382	0.019	0.026	High/High	0.029
	GENTLEMAN	Dapil 1	0.787	-0.174	-0.137	High/Low	0.001
		Dapil 2	-1.057	0.976	-1.032	Low/High	0.001
		Dapil 3	1.025	0.019	0.019	High/High	0.029
	PBB	Dapil 1	-0.447	-0.174	0.077	Low/Low	0.001
		Dapil 2	-0.447	0.976	-0.436	Low/High	0.001
		Dapil 3	-0.447	0.019	-0.008	Low/High	0.001
	Nasdem	Dapil 1	-0.447	-0.174	0.077	Low/Low	0.001
		Dapil 3	-0.447	0.019	-0.008	Low/High	0.001
	PKB	Dapil 1	-0.174	-0.447	-0.077	Low/Low	0.001
		Dapil 2	0.976	-0.447	-0.436	Low/High	0.001
		Dapil 3	0.019	-0.447	-0.008	Low/high	0.001
	Democrat	Dapil 1	-0.075	-0.174	0.013	Low/Low	0.001
		Dapil 2	-0.706	0.976	-0.689	Low/High	0.001
		Dapil 3	1.321	0.019	0.025	High/High	0.029

Based on the results in Table 9, the Local Index of Spatial Association (LISA) analysis, we can see how the pattern of political party votes in each constituency (Dapil) in the 2014 legislative election in Bogor City. LISA analysis helps identify spatial clusters and outliers in the sound acquisition data. In the analysis, the parties in the area (High-High) include the Hanura party, PDIP, Golkar, PKS and PAN which are in the same constituency 3. Parties in the area (Low-High) include the Gerindra party (constituency 2 and 3), PDIP (constituency 2), Golkar (constituency 2), PKS (constituency 1 and 2), PAN (constituency 2), PBB constituency (2 and 3), Nasdem (constituency 3), PKB (constituency 2 and 3) and Democrats (constituency 2). Parties in the area (Low-Low) include the same Golkar party, PBB,

Nasdem, PKB and Democrats in constituency 1. Parties in the area (High-Low) include the same Hanura, Gerindra, PDIP and PAN parties in the 1st constituency. The following are the results of the clustermap spatial analysis of the results of the 2014 legislative elections, in Figure 5.

Figure 5: Clustermap of Political Parties in 2014





The clustermap of the results map in Figure 5 presents the results of the analysis using the *Local Indicator of Spatial Association* (*LISA)* method for the acquisition of votes for political parties in the 2014 Bogor City legislative election. Using *Moran's local bivariate I,* the results of the analysis test in 2014 showed that there were 7 political parties in quadrant I (*High-High*), namely the Hanura party, PDIP, Golkar, PKS, PPP, PAN and Democrats. In quadrant II (*Low-High*) there are 9 political parties, namely the Gerindra party, PDIP, Golkar PKS, PAN, PBB, PKB, Nasdem and Democrats. In quadrant III (*Low-Low*) there are 5 political parties, namely the Golkar party, the United Nations, the Democrats, PKB and Nasdem. In quadrant IV (*High-Low*) there are 5 political parties, namely the Hanura party, Gerindra, PDIP, PPP and PAN.

Table 10: Clustermap of Political Party Relations in 2014

Year	Political Party	Relationship	Colour	Quadrant
2014	1. Hanura 2. PDIP 3. Golkar 4. PKS 5. PPP 6. PAN 7. Democrat	*High-High*	Dark Red	Quadrant I
	1. Gerindra 2. PDIP 3. Golkar 4. SMEs 5. PAN 6. United Nations 7. Democrat 8. PKB 9. Nasdem	Low-High	Light Blue	Quadrant II
	1. Golkar 2. United Nations 3. Democrat	*Low-Low*	Dark Blue	Quadrant III
	4. PKB 5. Nasdem	*Low-Low*	Dark Blue	Quadrant III

1. Hanura 2. Gerindra 3. PDIP 4. PPP 5. PAN	*High-Low*	Pink	Quadrant IV	

Analysis of the Spatial Distribution Pattern of the 2019 Legislative Election

The process described refers to the steps of spatial analysis to test the association or relationship between the overall variables of political party vote results in the context of Bogor City election data in 2014. The Spatial Association Test uses the *Moran Index* and *LISA* to measure the general level of spatial association between the variables of vote results in an electoral area.

Global Spatial Association (Index Moran)

The analysis of the *Moran Index method* is to identify spatial patterns. This provides information about how strongly the spatial pattern influences the relationship between constituencies. Then compare the results using the distribution of votes from the 2019 legislative election and administrative maps. The following are the results of the testing of the *Moran Index spatial association* in the legislative election of the Bogor City region in the 2019 period. It can be seen in Table 11.

Table 11: Moran Index Analysis in 2019

Territory	Political Party	Moran's I (Global)	*E*[I]	P-Value	Distribution Pattern
Bogor City	Hanura	-0.146	-0.25	0.008*	*Random*
	Gerindra	-0.005	-0.25	0.002*	*Random*
	PDI-P	-0.053	-0.25	0.012*	*Random*
Territory	**Political Party**	**Moran's I (Global)**	***E*[I]**	**P-Value**	**Distribution Pattern**
5 Districts (Dapil 1, Dapil 2, Dapil 3, Dapil 4, Dapil 5)	Golkar	0.138	-0.25	0.048*	*Clustered*
	PKS	-0.127	-0.25	0.026*	*Random*
	PPP	0.030	-0.25	0.000*	*Clustered*
	GENTLEMAN	0.029	-0.25	0.928	*Clustered*
	PBB	0.247	-0.25	0.000*	*Clustered*
	Nasdem	-0.092	-0.25	0.926	*Random*
	PKB	0.048	-0.25	0.002*	*Clustered*
	Democrat	-0.089	-0.25	0.753	*Random*

Based on Table 11 of the results of the *Moran Index* analysis of political parties in 2019**,** there is a negative or positive spatial autocorrelation with a significant value (*P-Value<0.05).* The Hanura Party, Gerindra, PDIP and PKS show negative values and significant *pvalue*, meaning that they have a relationship between constituencies with random distribution patterns in various constituencies in Bogor City. And the Nasdem and Democratic parties showed negative values and insignificant *pvalues*, meaning that they did not have a relationship between constituencies with random distribution patterns in various constituencies in Bogor City. Meanwhile, the Golkar party, PPP, PBB and PKB show positive values and significant *pvalue*, meaning that they have a relationship between constituencies with a distribution pattern that groups in various constituencies in Bogor City. Based on these results, the majority of parties showed a pattern of vote distribution that did not cluster with several parties that had a significant high level in the distribution pattern. This can indicate that in the 2019 legislative election, no party has the dominance of the vote pockets in one constituency, but rather more widespread support in various regions. In addition, the results of the *Moran Index* analysis illustrate the *moran scatterplot* graph in Figure 6.

Figure 2*:* Moran's Analysis of Political Party Scatterplots in 2019

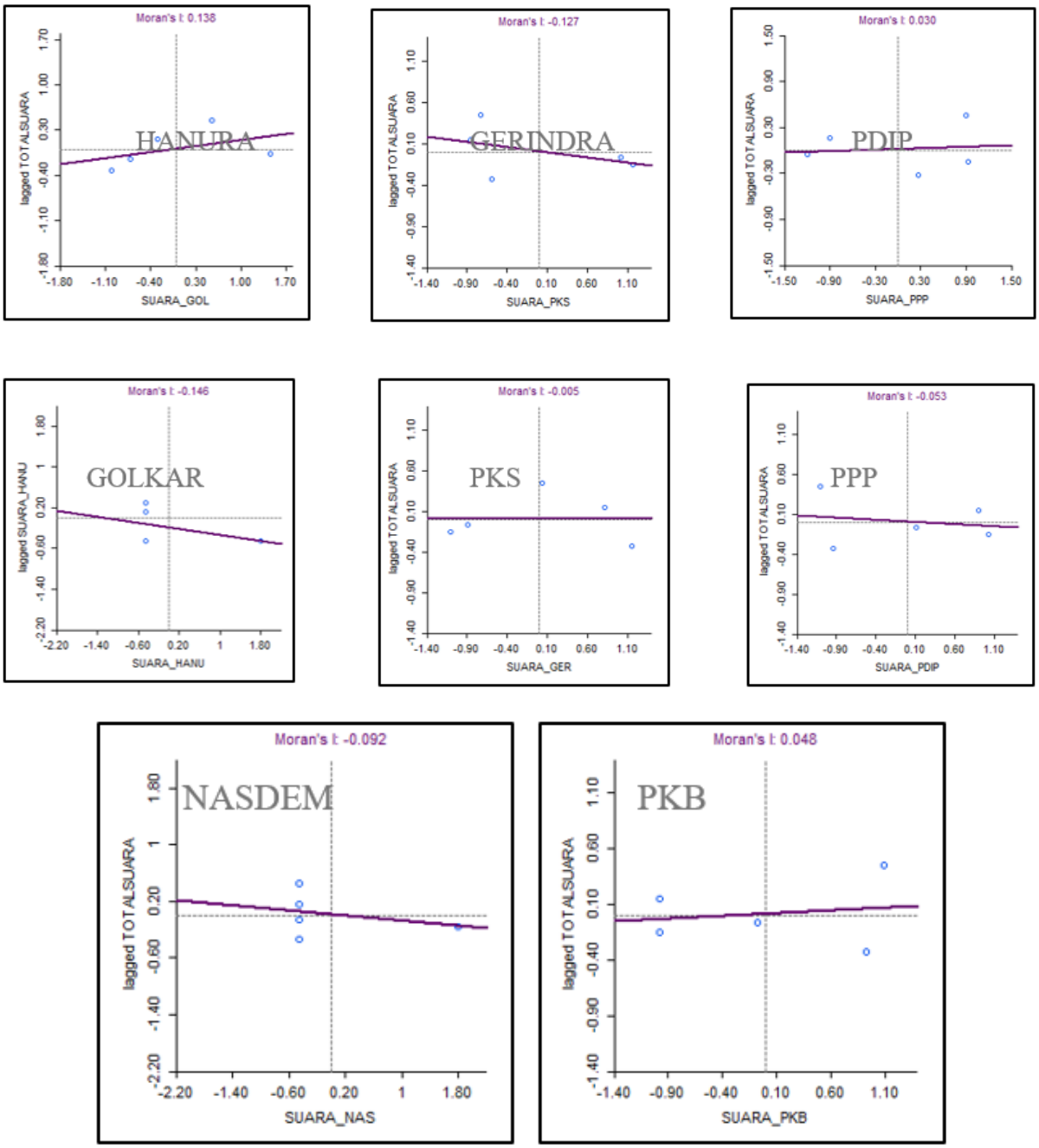


Figure 6 shows the pattern of the relationship between the votes obtained by political parties in the legislative election in Bogor City in 2019, the electoral district in Quadrant I (upper right) shows that the area that received high vote results was surrounded by the area that received high vote results as well. The constituencies in Quadrant II (top left) show that the areas that received low vote results were surrounded by areas that received high vote results as well. The constituencies in Quadrant III (bottom left) show that the areas that received low vote results were surrounded by areas that received low votes as well. The constituencies in Quadrant IV (bottom right) show that the areas that received high votes were surrounded by areas that received low votes as well. The results of the analysis show that the trend line (purple line) descending downwards is negative, which shows that there is a negative relationship between the votes of political parties in an area and the votes in the surrounding areas. There are 5 political parties, namely, Hanura party, Gerindra, PKS, Democrats and Nasdem While the upward trend line is positive, which shows that there is a positive relationship between the votes of political

parties in an area and the votes in the surrounding areas. There are 6 political parties, namely, the Gerindra party, Golkar, PDIP, PAN, PBB, and PKB. This means that the characteristics of each political party have diverse neighbourhood associations in obtaining the voter vote base.

Local Index Spatial of Association (LISA)

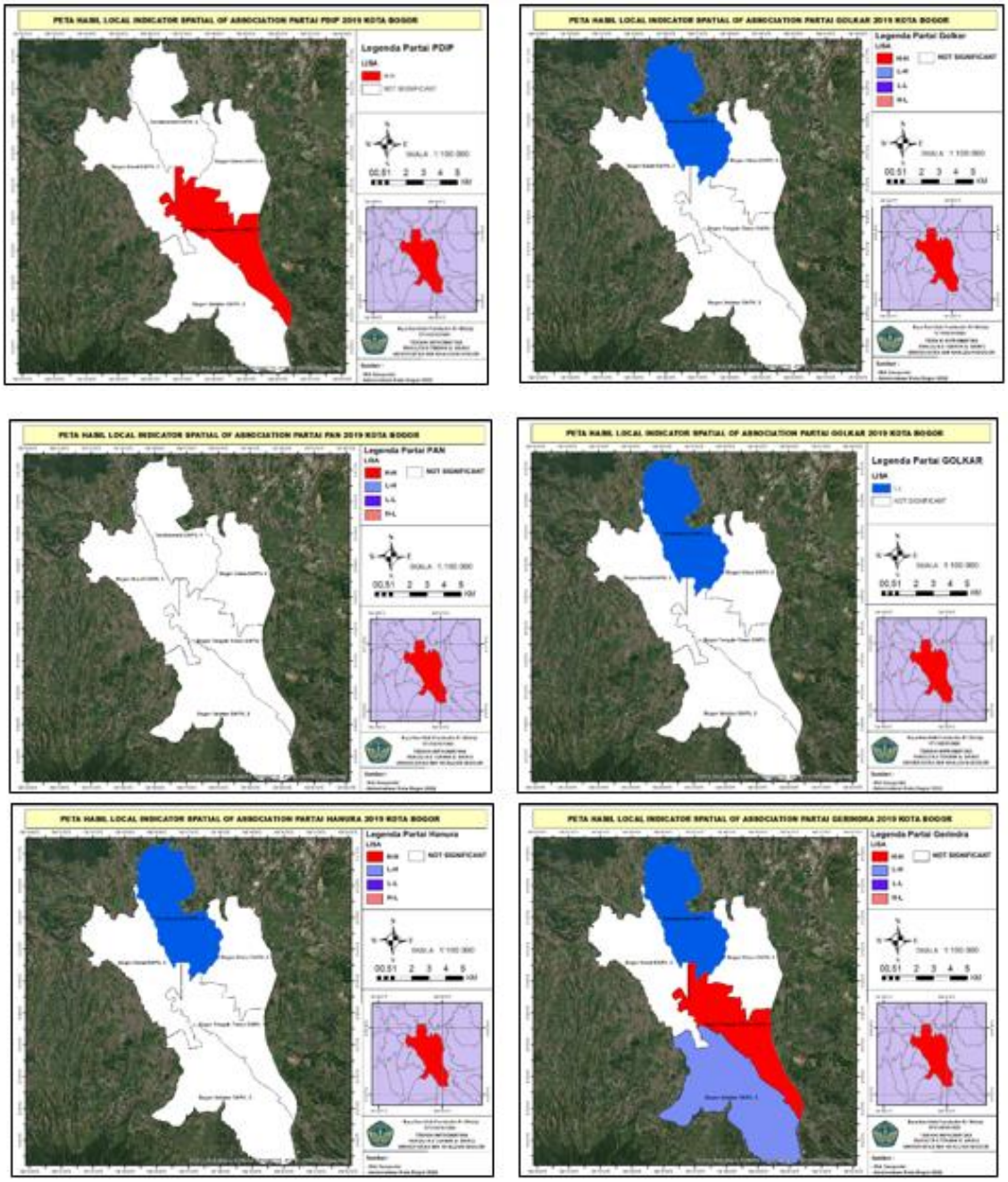
The *Local Index of Association (LISA)* analysis is used to measure the general level of spatial association between variables obtained from legislative elections in an electoral area. There are several parameters in the analysis of *Local Indicator Spatial of Association* (*LISA)* including *Z-Score, Std. Deviation, Z-li*. *Std. Deviation* measures the value of the variation in the Moran Index among units that are chested in the neighbouring areas of a Dapil. *Z-li* measures local associations or how the results of legislative elections in a constituency correlate with votes in the surrounding area. This provides an overview of how the spatial pattern of vote acquisition in the surrounding area affects the constituency concerned. *P-Value* indicates the probability value of *the LISA value*. The following are the results of the *LISA* Analysis for the 2019 period in Table 12.

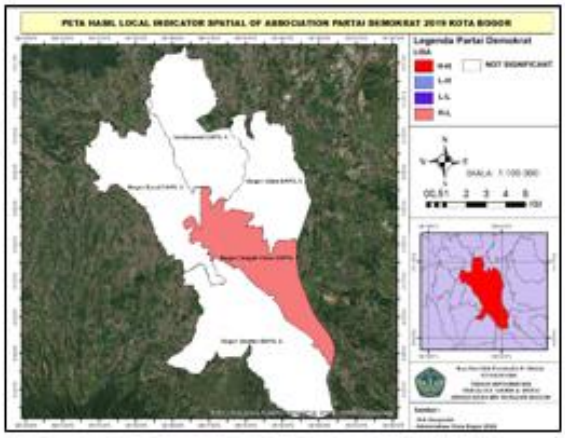
Table 12: LISA Political Party Analysis 2019

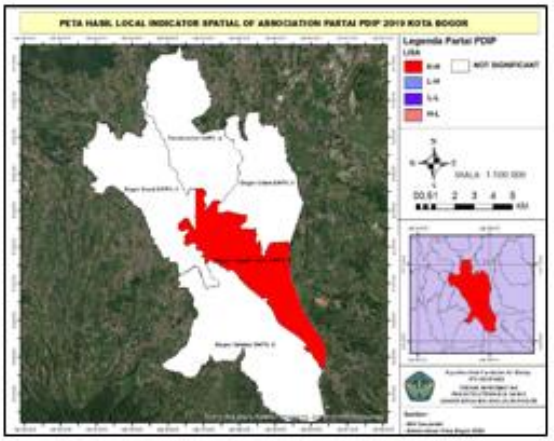
Territory	Political Party	Area	(Z) *Score*	Std. Deviation	(Z) li	High/Low	P-Value
Bogor City	Hanura	Dapil 4	-0.447	-0.148	0.066	Low/Low	0.001
	Gerindra	Dapil 1	0.810	0.156	0.126	High/Low	0.001
		Dapil 2	1.152	-0.327	-0.377	Low/High	0.001
		Dapil 4	-1.099	-0.148	0.163	Low/Low	0.001
	PDIP	Dapil 1	0.904	0.156	0.141	High/High	0.034
	Golkar	Dapil 4	-0.706	-0.148	0.105	Low/Low	0.001
	PKS	Dapil 1	-0.859	0.156	-0.134	Low/High	0.001
	PPP	Dapil 2	0.266	-0.327	-0.087	High/Low	0.001
Territory	**Political Party**	**Area**	**(Z) *Score***	**Std. Deviation**	**(Z) li**	**High/Low**	**P-Value**
	PBB	Dapil 4	-0.447	-0.327	0.146	Low/Low	0.001
	PKB	Dapil 2	-0.934	-0.327	-0.350	High/Low	0.001
		Dapil 4	-0.980	-0.148	0.145	Low/Low	0.001

Based on the results in Table 12 of the Local Index of Spatial Association (LISA) analysis, we can see how the pattern of political party votes in each constituency (Dapil) in the 2019 legislative election in Bogor City. LISA analysis helps identify spatial clusters and outliers in the sound acquisition data. In this analysis, the party in the area (High-High) is the PDIP party in constituency 1. Parties in the area (Low-High) include the Gerindra party (2nd constituency) and PKS (1st constituency). Parties in the area (Low-Low) include the same Hanura, Gerindra, Gokar, PBB, PKB parties in the 4th constituency. Parties in the area (High-Low) include the Gerindra party (constituency 1), PPP (constituency 2) and PKB (constituency 2). The following are the results of the clustermap spatial analysis of the results of the 2019 legislative elections, in Figure 7.

Figure 7: Clustermap of Political Parties in 2014




PETA HASIL LOCAL INDICATOR SPATIAL OF ASSOCIATION PARTAI DEMOKRAT 2019 KOTA BOGOR
Legenda Partai Demokrat
NOT SIGNIFICANT


PETA HASIL LOCAL INDICATOR SPATIAL OF ASSOCIATION PARTAI PDIP 2019 KOTA BOGOR
Legenda Partai PDIP
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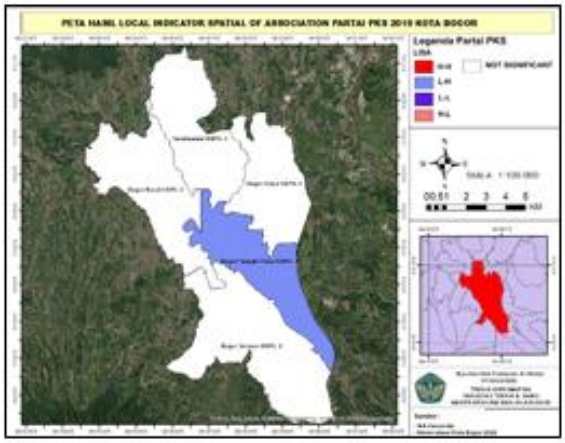
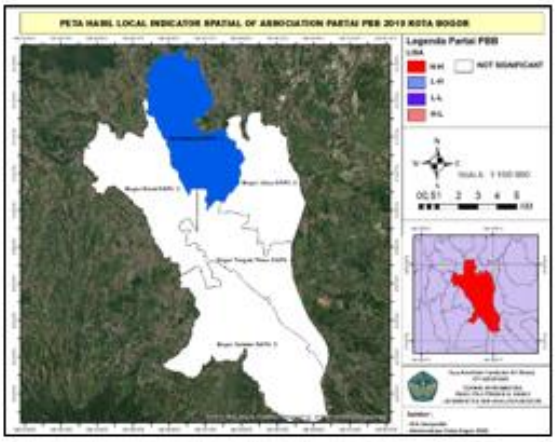

PETA HASIL LOCAL INDICATOR SPATIAL OF ASSOCIATION PARTAI PKS 2019 KOTA BOGOR
Legenda Partai PKS
NOT SIGNIFICANT


PETA HASIL LOCAL INDICATOR SPATIAL OF ASSOCIATION PARTAI PBB 2019 KOTA BOGOR
Legenda Partai PBB
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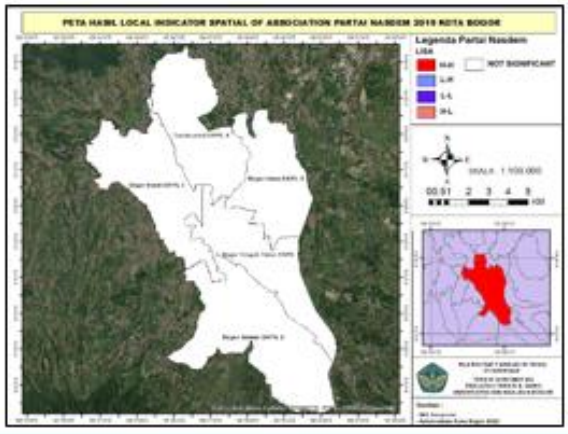
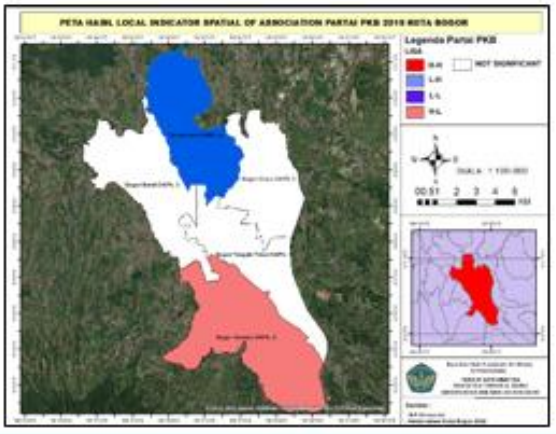
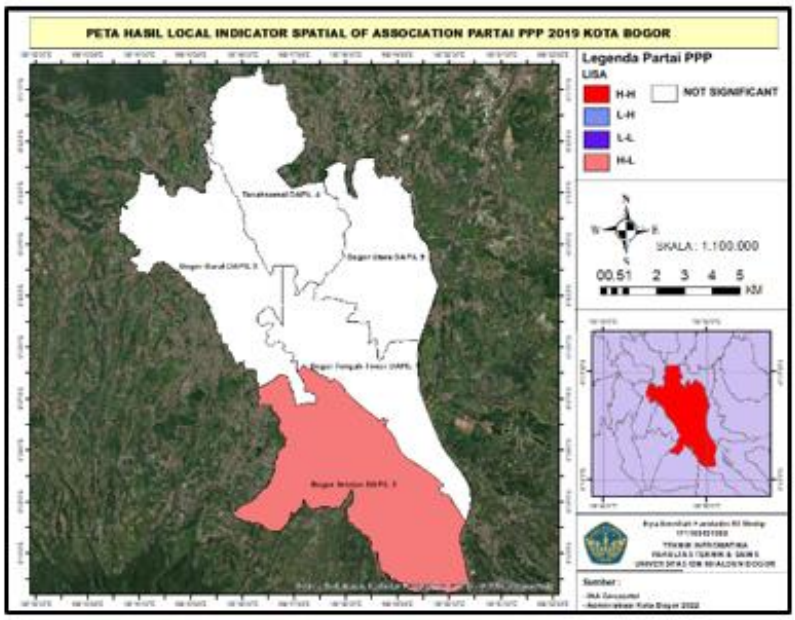

PETA HASIL LOCAL INDICATOR SPATIAL OF ASSOCIATION PARTAI NASDEM 2019 KOTA BOGOR
Legenda Partai Nasdem
NOT SIGNIFICANT


PETA HASIL LOCAL INDICATOR SPATIAL OF ASSOCIATION PARTAI PKB 2019 KOTA BOGOR
Legenda Partai PKB
NOT SIGNIFICANT



The result map *clustermap* in Figure 7 presents the results of the analysis using the *Local Indicator of Spatial Association* (*LISA) method* for the acquisition of votes for political parties in the 2019 Bogor City legislative election. Using *Moran's Bivariate Local I,* the results of the analysis test in 2019 show that there are 2 political parties in quadrant I (*High-High*) political parties, namely the Gerindra party and PDIP. Quadrant II (*Low-High*) there are 2 political parties, namely the Gerindra party and PKS. Quadrant III (*Low-Low*) has 5 political parties, namely the Hanura party, Gerindra, Golkar, PBB and PKB. Quadrant IV (*High-Low*) there are 3 political parties, namely the PPP, Democrats and PKB parties.

Table 13: Clustermap of Political Party Relations in 2019

Year	Political Party	Relationship	Colour	Quadrant
2019	1. Gerindra	*High-High*	Dark Red	Quadrant I
	1. Gerindra 2. SME	Low-High	Light Blue	Quadrant II
	1. Gerindra 2. Hanura 3. Golkar 4. PKB 5. United Nations	*Low-Low*	Dark Blue	Quadrant III
	1. PPP 2. Democrat 3. PKB	*High-Low*	Pink	Quadrant IV

CONCLUSION

This study concludes the results of the analysis of the Moran Index and the Local Spatial Indicators of Association in the 2009, 2014 and 2019 Legislative Elections, showing that overall the average political party received a negative Moran I score and P-Value>0.05. This shows that there is no relationship between constituencies and random or ungrouped distribution patterns in various constituencies in Bogor City. This indicates that each party has a support base spread across various regions. Meanwhile, the LISA method generates spatial autocorrelation analysis to determine the area

of the cluster map. The results of the study show that in 3 legislative election periods, the spatial distribution pattern of election political parties generally does not follow the High-High (H-H), High-Low (H-L) and Low-Low (L-L) clusters. Meanwhile, in the Low-High (L-H) cluster, there are Gerinda parties and PKS in 3 election periods. The results of the research can be used as recommendations in determining the priority areas of political parties in each constituency to carry out a winning strategy.

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