



The Influence of Democratic Leadership on National Resilience in Indonesia: a Digital Spatial Analysis Approach

Maysuroh Lasmawati^{1*}, Achmad Farid Wajdi², Dangan Waluyo³

^{1,3}Program Studi Teknologi Penginderaan, Universitas Pertahanan Republik Indonesia

²Badan Riset dan Inovasi Nasional

Corresponding Author: Maysuroh Lasmawati

masyuroh.lasmawati@tp.idu.ac.id

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ABSTRACT

National stability depends on the integrity of leadership and public active participation in the national defense efforts. This research analyzes the influence of democratic leadership and the national security environment on the Indonesian national defense. It contributes to knowledge enrichment by providing new insights into democratic leadership studies, especially regarding the conceptual, methodological, and contextual aspects. Using a mixed-method approach, this research integrates quantitative survey data and geospatial analysis to assess the relationship between the variables. The research results show that democratic leadership and the national security environment can increase public participation in national defense initiatives. Remote sensing technology then can be optimized to monitor the participation rate, thus it can provide real-time and regional-based data to assist the decision-making process.

INTRODUCTION

As the third largest democratic country in the world, Indonesia has encountered complex challenges in maintaining its national sovereignty and security. National stability depends on the integrity of leadership and public active participation in the national defense efforts. These two factors can be increased and strengthened by implementing democratic values. However, based on a report conducted by the Ministry of Defense of the Republic of Indonesia (2024), there are only 60% of Indonesian citizens actively participated in the national defense efforts.

We need to know that sensing technology has been developed as a very useful tool to measure and monitor several aspects of society, including the participation rate in the national defense initiative. However, there is a discrepancy between the potential of sensing technology usage and its implementation within the Indonesian defense policy. The previous researches were also not sufficient in exploring the integration of sensing technology with integrity leadership to increase public participation in national defense efforts. Generally, these researches only focused on the theoretical approach or direct influence of leadership on the organization without engaging technology to analyze deeper.

This research then contributes to knowledge enrichment by providing new insights into the democratic leadership studies, especially regarding the conceptual, methodological, and contextual aspects. From a conceptual aspect, this research combines the democratic leadership analysis with digital sensing technology to measure the relationship between leadership integrity, competency, and empathy on the national defense by using spatial data to comprehend public engagement patterns. From the methodological aspect, this research uses a method which uses a quantitative survey and real-time spatial analysis based on sensing technology, thus it can offer more accurate data. From contextual aspect, this research focuses on Indonesia, given that the previous research only focused on developed countries. Therefore, this research aims to analyze the influence of democratic leadership and the national security environment on the Indonesian national defense by using a digital spatial analysis approach.

LITERATURE REVIEW

Visionary Leadership and Public Trust Theories

Visionary leadership is a leadership style focusing on long-term vision, in which a leader can inspire and motivate his/her followers to achieve common goals. A visionary leader plays an important role in the decision-making process of national security policy by formulating responsive strategies to overcome challenges (Diana, 2024). Meanwhile, public trust is a belief given by society to the government's ability to conduct its duties. The rate of public trust can influence public participation in national defense programs (Cook & Reidhead, 2022).

Based on the explanation above, this research proposes a hypothesis as follows:

H1: Leadership Integrity has a Significant Influence on Public Participation in National Defense Efforts.

Adaptive Leadership and Geospatial Theories

Adaptive leadership emphasizes the leader's ability to respond to dynamic changes and adjust strategies to overcome new challenges. This leadership style is very essential in the ever-changing context of national security (Soinine et al., 2023). Geospatial theory then emphasizes the importance of local-based strategy to understand public participation patterns.

Therefore, this research proposes the next hypothesis as follows:

H2: Democratic leadership has a significant influence on public participation in national defense efforts depending on the environment.

Social and Physical Sensing Theories

Social sensing is important to analyze public opinion, social trends, and public participation patterns by collecting data from social behavior, interaction, or activity through social media, surveys, or digital tools (Kindsiko & Vadi, 2023). Meanwhile, physical sensing is mainly used in technical, manufacturing, and transportation sectors by measuring physical parameters, such as temperature, pressure, humidity, and magnetic field (Kindsiko & Vadi, 2023). Social and physical sensing then can assist the usage of remote sensing technology in improving the effectiveness of national defense programs, especially in identifying participation patterns in several geographical areas.

Thus, this research proposes the final hypothesis as follows:

H3: Remote sensing technology can be optimized as measuring and monitoring tools in public participation in national defense initiatives.

Based on the causal relationship between dependent variables and independent variable, this research then provides a conceptual framework below:

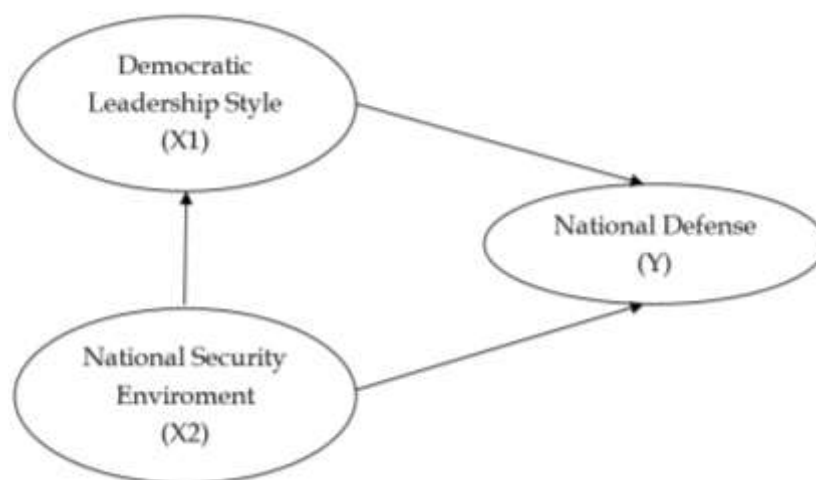


Figure 1. Conceptual Framework

METHODOLOGY

This research used a predictive social quantitative approach by focusing on the use of standard statistics on spatial data and integration of Machine Learning (ML)—such as Random Forest and Gradient Boosting Machines (GBM)—and Deep Learning (DL) models to deliver a deeper prediction. These models were applied to identify the main variables that influence national defense and predict the distribution of national defense rates based on spatial data. Model validation is then conducted through a matrix such as R-squared, mean absolute error (MAE), and root mean squared error (RMSE) by using a cross-validation approach to examine the performance of the prediction model. The population in this research includes Indonesian citizens (18-55 years old), government officers, national army and police officers, public prominent figures, and local society members who engaged or had interests in the national security, defense, and democracy issues. This research then used purposive sampling techniques in selecting the data from the 2024 National Defense Initiative report conducted by the Indonesian Defense Ministry. In the data analysis processes, there were three main steps carried out by the researchers, namely descriptive statistics, inferential/causal statistics, and visualization based on artificial intelligence technologies.

RESEARCH RESULT

The analysis of the relationship between integrity leadership and national defense can be seen in the regression result below.

Table 1. Regression Result for the Leadership Types (Moral and Integrity)

Category: Moral dan Integritas

OLS Regression Results						
Dep. Variable:	IBN	R-squared:	0.580			
Model:	OLS	Adj. R-squared:	0.489			
Method:	Least Squares	F-statistic:	6.431			
Date:	Fri, 03 Jan 2025	Prob (F-statistic):	0.000240			
Time:	00:48:02	Log-Likelihood:	17.674			
No. Observations:	35	AIC:	-21.35			
Df Residuals:	28	BIC:	-10.46			
Df Model:	6					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	-0.0946	0.153	-0.620	0.541	-0.407	0.218
C1	-0.2579	0.136	-1.891	0.069	-0.537	0.022
C3	0.4790	0.194	2.474	0.020	0.082	0.876
C5	0.1664	0.166	1.004	0.324	-0.173	0.506
idi	0.3603	0.136	2.641	0.013	0.081	0.640
ipm	0.3820	0.192	1.993	0.056	-0.011	0.775
gini	0.0965	0.130	0.741	0.465	-0.170	0.363
Omnibus:	2.423	Durbin-Watson:	1.935			
Prob(Omnibus):	0.298	Jarque-Bera (JB):	1.395			
Skew:	-0.007	Prob(JB):	0.498			
Kurtosis:	3.978	Cond. No.	18.7			

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

The table above shows that moral and integrity leaders have a significant relationship with national defense (IBN) with an R-squared value of 0.580, indicating that 58% variation in IBN can be explained by this model. From the leadership variable, variable C3 (emphasizing morals and ethics) has a significant influence with a p-value of 0.020 and a positive coefficient of 0.479. This shows that moral and ethical values are very crucial in enhancing national defense. Meanwhile, variable C1 (integrity and free from corruption, collusion, and nepotism or KKN) is almost significant with a p-value of 0.069. This result indicates the important role of integrity, although its effect is less powerful statistically. Furthermore, the Indonesia Democracy Index (IDI) has a significant influence with a p-value of 0.013 and a positive coefficient of 0.360, indicating that a good democracy contributes positively to the national defense. The other variables, such as the Human Development Index (IPM) and Gini, are not significant in this model.

Table 2. Regression Result for the Leadership Types (Participation and Empathy)

Category: Partisipasi dan Empati						
OLS Regression Results						
=====						
Dep. Variable:	IBN		R-squared:	0.522		
Model:	OLS		Adj. R-squared:	0.420		
Method:	Least Squares		F-statistic:	5.095		
Date:	Fri, 03 Jan 2025		Prob (F-statistic):	0.00120		
Time:	00:48:02		Log-Likelihood:	15.429		
No. Observations:	35		AIC:	-16.86		
Df Residuals:	28		BIC:	-5.970		
Df Model:	6					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

const	-0.0764	0.261	-0.292	0.772	-0.612	0.459
C4	0.1928	0.374	0.515	0.610	-0.573	0.959
C6	0.2064	0.248	0.833	0.412	-0.301	0.714
C8	0.0515	0.417	0.123	0.903	-0.803	0.906
idi	0.4181	0.154	2.721	0.011	0.103	0.733
ipm	0.1711	0.182	0.941	0.355	-0.202	0.544
gini	0.0561	0.137	0.410	0.685	-0.224	0.336
=====						
Omnibus:	4.729	Durbin-Watson:	1.851			
Prob(Omnibus):	0.094	Jarque-Bera (JB):	3.469			
Skew:	-0.489	Prob(JB):	0.176			
Kurtosis:	4.193	Cond. No.	40.4			
=====						

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Table 2 then shows that regression results for participation and empathy elements have an R-squared value of 0.522. It means that 52.5% of variations in the national defense can be explained by independent variables. All variables in the leadership category (C4, C6, and C8) have a p-value more than 0.05, indicating that participation and empathy aspects might indirectly have a significant influence on national defense. Meanwhile, IDI shows a marginal significance with a p-value of 0.012, meaning that democratic condition

contributes positively to national defense. The IPM and Gini variables then proved to be not significant, indicating that perhaps they have a weaker influence in this model. Although the model shows a moderate relationship, participation and empathy elements might be more effective if combined with other factors that are relevant to increase national defense.

Table 3. Regression Result for the Leadership Types (Participation and Empathy)

Category: Partisipasi dan Empati

OLS Regression Results

Dep. Variable:	IBN	R-squared:	0.522
Model:	OLS	Adj. R-squared:	0.420
Method:	Least Squares	F-statistic:	5.095
Date:	Fri, 03 Jan 2025	Prob (F-statistic):	0.00120
Time:	00:48:02	Log-Likelihood:	15.429
No. Observations:	35	AIC:	-16.86
Df Residuals:	28	BIC:	-5.970
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	-0.0764	0.261	-0.292	0.772	-0.612	0.459
C4	0.1928	0.374	0.515	0.610	-0.573	0.959
C6	0.2064	0.248	0.833	0.412	-0.301	0.714
C8	0.0515	0.417	0.123	0.903	-0.803	0.906
idi	0.4181	0.154	2.721	0.011	0.103	0.733
ipm	0.1711	0.182	0.941	0.355	-0.202	0.544
gini	0.0561	0.137	0.410	0.685	-0.224	0.336

Omnibus:	4.729	Durbin-Watson:	1.851
Prob(Omnibus):	0.094	Jarque-Bera (JB):	3.469
Skew:	-0.489	Prob(JB):	0.176
Kurtosis:	4.193	Cond. No.	40.4

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Moreover, the regression result for competency and vision elements from Table 3 shows an R-squared value of 0.547, which means 54.7% of variations in the national defense can be explained by independent variables. Unfortunately, there is only an IDI variable that gives a significant influence with a p-value of 0.006, indicating that a democratic environment has a positive impact on national defense.

This research then used the Uniform Manifold Approx and Projection (UMAP) to visualize the province clustering patterns based on the IDI, IPM, and Gini Coefficient indicators. The clustering patterns reflected the characteristic similarity rate between provinces, with several provinces creating a group that is close to each other (such as provinces 22, 27, and 33). This group shows the similarity in human development, democracy, and income inequality. Due to this similarity, a collective policy then can be implemented effectively. However, some provinces are isolated from each other (such as province 2), indicating that they have very different characteristics from other provinces. This condition can be highlighted because it reflects the existence of unique challenges that need to be solved by formulating a more specific policy.

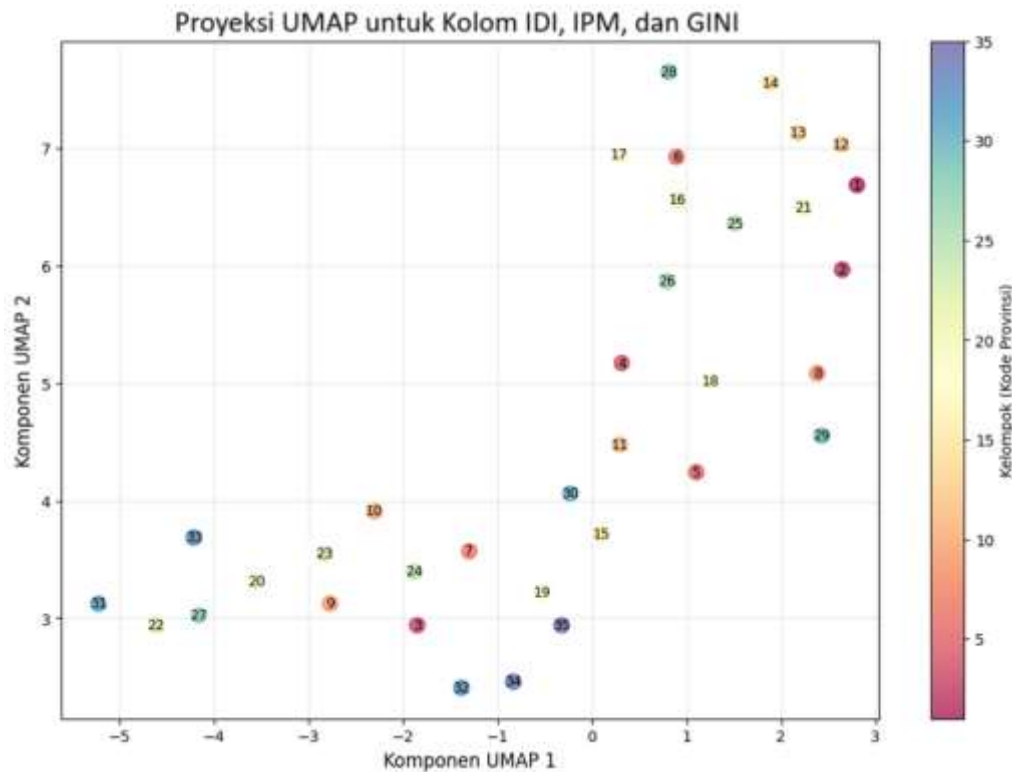


Figure 2. Analysis of IDI, IPM, and Gini

The relationship between the environment and national defense then can be seen through the table below.

Table 4. Regression Result of the Environment and National Defense

OLS Regression Results						
=====						
Dep. Variable:	IBN		R-squared:	0.420		
Model:	OLS		Adj. R-squared:	0.364		
Method:	Least Squares		F-statistic:	7.497		
Date:	Fri, 03 Jan 2025		Prob (F-statistic):	0.000653		
Time:	12:59:55		Log-Likelihood:	50.862		
No. Observations:	35		AIC:	-93.72		
Df Residuals:	31		BIC:	-87.50		
Df Model:	3					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

const	2.5387	0.225	11.270	0.000	2.079	2.998
idi	0.1486	0.050	2.976	0.006	0.047	0.250
ipm	0.1154	0.074	1.566	0.127	-0.035	0.266
GINI	-0.2166	0.236	-0.916	0.367	-0.699	0.266
=====						
Omnibus:	2.674	Durbin-Watson:			1.788	
Prob(Omnibus):	0.263	Jarque-Bera (JB):			1.669	
Skew:	-0.055	Prob(JB):			0.434	
Kurtosis:	4.064	Cond. No.			128.	
=====						

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Table 4 shows that the IDI variable has a significant influence on national defense (IBN) with a coefficient value of 0.1486 and a significant rate of 0.006. This indicates that a higher rate of democracy in a province will increase national defense awareness or contribution to the national defense. However, although the IPM variable has a positive influence on the IBN, it is not statistically significant with a significance value of 0.05. The Gini variable also does not have a significant influence and has a negative coefficient value. Therefore, these conditions need further intervention from the leader to build social solidarity and strong trust from the public.

Remote sensing technology then can be optimized to measure and monitor public participation in the national defense initiatives in a real-time and regional-based. This technology has the advantage of collecting richer data than traditional methods. Some technologies such as the Internet of Things (IoT), physical sensors, and geolocation data can record public activities in national defense programs, including their participation in training, community activity, or engagement in defense simulation. Spatial data then can be visualized on a digital map that can show the distribution of participation in a more detailed picture. Remote sensing technology has also been used to analyze the Safety Gradient Index (SGI) to picture the difference in National Defense Index (IBN) intensity between provinces in Indonesia (see Figure 3).

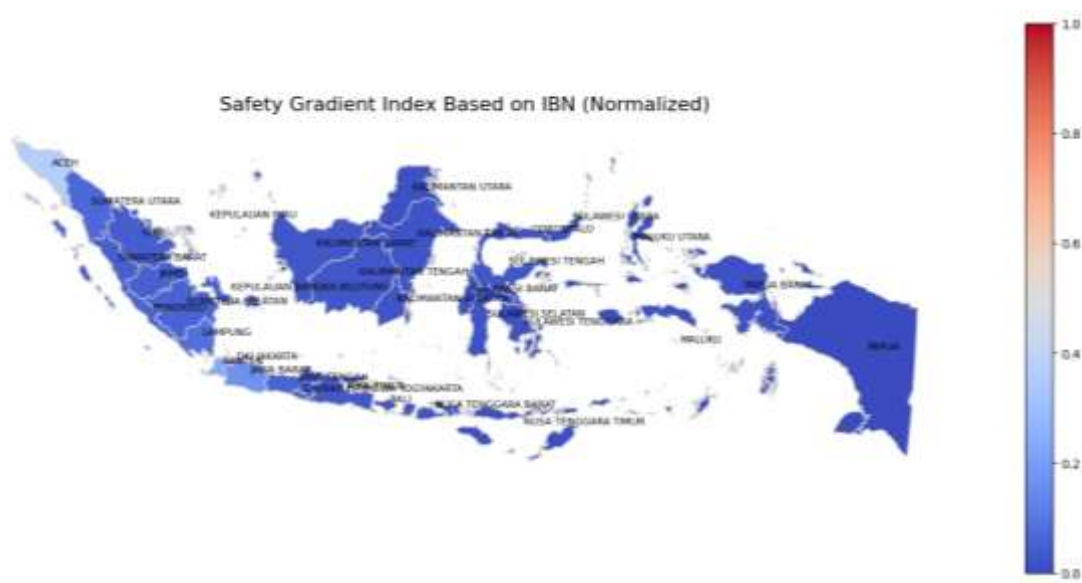


Figure 3. Province Defense Safety Index

Moreover, remote sensing technology can provide a real-time measurement of public participation rate (see Figure 2). This offers a significant advantage in monitoring the change in participation patterns, especially in the regions that are facing geographical and social challenges. The integration of remote sensing data with a cloud-based information system then provides assistance for the government in making decisions faster and based on data.

DISCUSSION

The Influence of Leadership Integrity on Public Participation in National Defense Initiatives

The research result shows that a region that has a high-integrity leader has a higher participation rate in national defense initiatives. A leader who has consistent democratic principles and moral integrity can increase public awareness and participation. Ethical leadership characterized by integrity is very important in building trust between the government and its citizens (Hariyati, 2024). This trust will create an effective government and increase public participation in national defense initiatives (Valgarðsson et al., 2024). According to Habyarimana et al. (2023), high-integrity leadership can build a more effective bureaucracy in the region, such as Uganda. It also can build trust in regional and international cooperation in the national security and defense sectors (Cottiero, 2023).

The Influence of Democratic Leadership on Public Participation in the Different Regions

This research has found the disparity in public participation depends on geographical characteristics. A region with better access to information and communication technology (ICT) tends to have a higher participation rate. This is because the ICT can create e-participation which is easier and less expensive (Lee-Geiller, 2024), improve social participation (Vazquez et al., 2023), boost economic growth and participation (Liu et al., 2024), reduce social alienation (Qadikolaei et al., 2022), increase the public participation in election process (Basile, 2023), and increase public engagement, especially the elders and disabilities (Zhan et al., 2023). Furthermore, democratic leadership characterized by the use of an inclusive communication approach, has a significant effect in enhancing public participation in the marginal region (Austin et al., 2021; Sistrunk et al., 2024).

The use of Remote Sensing Technology to Measure Public Participation

Based on the research result, the implementation of remote sensing technology can monitor public participation with higher accuracy through spatial and temporal data, thus the decision-making will be more accurate. It also ensures that the collected data is more comprehensive and can be further analyzed (Ling et al., 2010). Remote sensing technology can increase public participation in the national defense because it can provide more detailed information (Figueiredo et al., 2022), highlight the potential of community participation in various regions (Sommerville et al., 2015), underline the role of spatial insight in decision-making and public engagement (Mobo & Munir, 2024), and improve public understanding on the temporal-spatial characteristics (Chunming et al., 2013).

The Environmental Factors in Supporting National Defense

This research has found the relationship between the environment and leadership, indicating that social-economic indicators, such as IDI, IPM, and Gini, influence the effectiveness of leadership style in building public participation. A leader who can integrate social-economic development policy with democratic values then can mobilize the public in the national defense efforts. This type of leadership has been proven to increase public participation in the decision-making process in Kenya (Njiiri et al., 2024). It also can mobilize public resources and engagement in development projects in several Indonesian villages (Nuridina et al., 2024). Directive, supportive, and participative leadership also has increased public engagement in Sabah, Malaysia (Lajuni et al., 2022).

CONCLUSIONS AND RECOMMENDATIONS

The public participation rate in the national defense initiatives can be increased by democratic leadership which focuses on morality, integrity, competency, and empathy. It is also influenced significantly by environmental factors, such as the Indonesian Democracy Index (IDI), Human Development Index (IPM), and Gini Coefficient. Geographical differences then affect the public participation patterns in the national defense, thus adaptive leadership is needed to be implemented in the region with low accessibility. In monitoring public participation, remote sensing technology has been proven as an effective tool because it can provide real-time and regional-based data. This technology offers an opportunity for the decision-makers to understand the public engagement patterns so that it can assist the data-based decision-making process.

This research then provides three main recommendations for the decision-makers. First, the government needs to increase the quality of democracy by strengthening democratic institutions and cultures based on public ethics, integrity, and transparency values. Second, improving the quality of life of the community, particularly in the education and health sectors. Third, although the influence of the Gini Coefficient on democratic leadership is relatively weak, economic inequality needs to be reduced to maintain social stability.

ADVANCED RESEARCH

This research has several limitations, namely (1) most of the data is collected by survey, so there is a bias possibility because each respondent has a subjective perception; (2) the analysis result might not involve all populations because the availability of spatial and temporal data in several regions is uneven; and (3) the explanation of social relation and local culture dynamics is limited because this research more focused on the spatial analysis and regression model.

Therefore, future research can be conducted to overcome those limitations. The use of longitudinal data can provide more dynamic pictures regarding the transformation of national defense participation. A qualitative approach also can be carried out to understand the social dynamics and cultural context that influence the relationship between leadership style, the environment, and public participation. By using big data from social media or platform digital, future research also can analyze public participation in real-time and holistically. By

focusing on a particular region, such as a conflict region or low development rate region, future research can provide more effective policy recommendations.

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