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Article

Strategies to enhance civic awareness for state defence in Indonesia: Measurement and benchmarking of the State Defence Index (SDI)

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Abstract: Countries employ various strategies to strengthen their soft power through education, public campaigns, mandatory service, and community involvement, essential for building a well-informed, prepared, and resilient citizenry. In Indonesia, the Civic Awareness for State Defence (CASD) program is designed to instil state defence awareness among citizens. This study introduces the Indonesia State Defence Index (SDI), a novel metric grounded in theoretical constructs such as national identity, nationalism, patriotism, and national pride. Differentiating from previous indices, our SDI employs advanced methodologies including Principal Component Analysis (PCA) and Structural Equation Modeling (SEM) to enhance measurement accuracy. Unlike earlier approaches that used traditional aggregation methods, our use of PCA ensures the reduction of dimensions for each state defence indicator, thereby guaranteeing that only the intended dimensions are measured. Utilising data from the State Defence Survey conducted by the Indonesian Ministry of Defence from 1 March to 26 June 2024, we aim to measure and benchmark SDI values across Indonesian regions, thereby elucidating the civic awareness profile in the context of state defence. The refined SDI provides critical insights for policymakers, highlighting regions that require focused interventions to bolster state defence preparedness.

Keywords: benchmarking; civic awareness; state defence; measurement; strategy; structural equation modeling (SEM); principal component analysis (PCA)

1. Introduction

Military power alone is not enough to confront the modern conflict of today. In the discourse of the global war on terror and upcoming conflicts, success is not a matter of imposing will but instead of influencing behavior in allies, adversaries, and society at large (Nye, 2017). Numerous countries have adopted different approaches of employing soft power as a modern defence strategy, which is evident in various contexts such as culture, education, humanitarian aid, sport, economy and tourism.

Soft power is a new political diplomacy and strategy field, especially in international relations (Froehlich, 2021). It is believed to be able to reduce or even annihilate threats and coercion (Nye, 2019), and can even have a strong influence as a deterrent (Banasik, 2021). In its implementation, soft power also enables the state to influence and direct citizens' behavior according to its national interests, through reward, punishment, persuasion and pressure (Nye, 2019).

Analysis of international relations and interpretation of the concept of power considers the element of power where military strength is seen not to lie in its

capacity, but rather in its ability to deter violence and put forward alternative means to promote its interests. This context then refers to defence diplomacy which also means not only in the context of international relations, for example, Singapore and the Vatican (Chong, 2010), but also strengthening local institutions to face the threat of local conflict, separatism, or terrorism, for example in Indonesia (Winger, 2017).

Countries have taken various means to strengthen their soft power as part of their defence and resilience strategy. Initiatives such as education and training, public campaigns, mandatory service and community involvement are believed to help build a well-informed, prepared, and resilient citizenry, a crucial element of a robust national defence strategy. Specifically in the case of Indonesia, the participation of citizens in state defence is a constitutional right and duty of every citizen through the embodiment of attitudes and behaviour inspired by the love of the nation (Ministry of Defence, 2015).

The Civic Awareness for the State Defence (CASD) is an Indonesian program designed to instil a sense of state defence and patriotism among citizens (UU, 2019). Its key objectives include (1) Developing Nationalism to cultivate a strong sense of pride and loyalty; (2) Strengthening National Identity to reinforce understanding and appreciation of culture, history, and values; (3) Fostering Civic Responsibility to encourage active and responsible participation in national development and civic duties; and (4) Building Defence Readiness by preparing citizens to contribute to state defence through various forms of civic engagement and readiness to support national stability. The program is implemented through government and private institutions (work environment), educational institutions, and community groups (non-work and non-educational environment). It aims to ensure that every citizen is aware of their role in maintaining national security and sovereignty, fostering a united and resilient nation.

Along with executing the program, the need to measure the perceived level of civic awareness becomes necessary to understand its effectiveness and to get an overview of the civic awareness profile in the context of state defence (Perpres, 2022). A measurement system has been developed in the form of Indeks Bela Negara, which can be referred to as Indonesia State Defence Index (SDI).

The SDI measurement refers to the basic theoretical concepts such as nationalism (Azzouz, 2021), national identity (Gelişli, 2014), patriotism (Mußotter, 2022), national pride (Mußotter, 2022), national politics (Permenhan, 2021), political psychology and their derivative concepts (Feldman and Johnston, 2014). To a more significant extent, this SDI value is expected to indicate potential conflict or instability in a specific region. Due to the delicate nature of this matter, the SDI values should therefore be measured precisely.

This research aims to develop a measurement method for SDI to measure and benchmark the SDI values among regions in Indonesia. To accomplish the objective, we investigate (1) the conceptual framework of SDI, (2) the dimensions and the parameters (indicators) for each dimension of SDI, (3) the calculation of SDI as an overall composite index for civic awareness in state defence, and (4) portray the civic awareness (SDI) profile of regions in Indonesia.

To the best of our knowledge, other indices often rely on separated or limited theoretical frameworks and measurement techniques, such as national identity

perception in university student in Turkey (Gelişli, 2014), national identity and pride in European countries (Dimitrova-Grajzl et al., 2016), nationalism and patriotism measurement in East and West Germany (Mußotter, 2022) as well as in China (Huang et al., 2023). Our research introduces the Indonesia National State Defence Index (SDI)—an innovative metric that integrates comprehensive theoretical constructs such as national identity, nationalism, patriotism, and national pride.

The proposed SDI measurement stands out by utilizing advanced analytical methodologies, including Principal Component Analysis (PCA) and Structural Equation Modeling (SEM), to achieve a more nuanced and precise measurement of civic awareness and state defence readiness. This approach contrasts with previous SDI measurement (Direktorat Bela Negara, 2021), which utilized SEM-PLS but relied on traditional aggregation methods without PCA. The PCA approach in our research ensures the reduction of dimensions for each state defence indicator, guaranteeing that only the intended dimensions are measured.

Many academic publications have used SEM in social sciences, business, management, accounting, psychology, and specifically in modelling complex concepts such as nationalism and/or patriotism and their derivative concepts. Related 207 publications from Scopus database searched in June 2024 with terms such as SEM AND nationalism/patriotism/national identity/national pride, revealed themes that were dominated by consumer ethnocentrism, purchase intention, consumer behaviour, and acculturation, but lacking in themes related to state defence.

This research also employs an advanced mixed-method approach using PLS-SEM qualitative and quantitative methods and PCA, to develop and measure the State Defence Index (SDI), using the observation data obtained from the State Defence Online Survey conducted by the Indonesian Ministry of Defence from 1 March to 26 June 2024.

2. Literature review

Nationalism idealizes one's country (Mußotter, 2022), viewing it as the highest authority and a sense of superiority. It is often criticized for driving conflict but also seen as a force for independence and integration, effectively protecting national interests and serving as a unifying force (Amir, 2007; Zimmer, 2002). Patriotism, defined as "attachment to the homeland" (Osborne et al., 2017) emphasizes loyalty, democratic and humanity principles (Satherley et al., 2019), and unity without superiority or anti-immigration views.

The term "nation" involves mental construction and the formation of national identity, shaped by shared values and collective perceptions. Citizens increasingly imagined themselves with an "imagined" nationhood (Isajiw, 1992) and national identity characterized by a historic territory considered as homeland, shared history, culture and values, legal rights and duties, and shared economy and territorial mobility (Schulte Nordholt, 2001). Furthermore, national pride is the sense of awareness citizens experience when they accomplish goals that reflect their national identity. This encompasses both patriotism and nationalism, and is often used to gauge levels of the two of them (Van Osch et al., 2018).

The above theories are the main principles for the constructs in the

measurement method for Indonesia State Defence Index (Direktorat Bela Negara, 2021). Instead of directly adopting those concepts as its primary constructs, the Indonesia State Defence concept integrates them into five basic elements namely: (1) love of the homeland, (2) nation awareness, (3) belief in the national ideology, (4) willingness to make sacrifices for the nation, and (5) having the basic capacity to defend the nation (UU, 2019).

Each of five elements of Indonesia SDI is measured using five indicators portraying the related construct to form the basic or element-based SDI. The overall SDI is measured using this element-based SDI and other related social indices such as Indonesia Democracy Index and Human Development Index (Direktorat Bela Negara, 2021).

As some underlying concepts such as national identity, nationalism and patriotism are interrelated with one another, analysis of ISSP data from 34 countries shows that in some countries some variables that were intended to measure one construct also measure the other (Davidov, 2009). In the context of Indonesia, these are transpired in the SDI concept such that some variables of patriotism are included in all five basic elements, while some variables of nationalism are in the first three elements. Structural Equation Modeling (SEM) is a statistical approach to multivariate data analysis techniques that combine among others multiple regression, factor analysis and path analysis. SEM enables researchers to model and estimate complex relationships among multiple dependent and independent variables simultaneously, while still taking account of the systematic and random errors. It is then capable of measuring complex concepts that are typically unobservable and measured indirectly by multiple indicators. Two main approaches to SEM are Covariance Based (CB) SEM and Partial Least Square (PLS) SEM. While CB-SEM is typically used for confirmatory analysis, and PLS-SEM is preferred for exploratory analysis or prediction, both can be used complementary to each other (Dash and Paul, 2021).

PCA is a statistical technique used to reduce the dimensionality of the data and identify the most important components that explain the majority of the variation in the data (Jolliffe and Cadima, 2016). The dimension reduction feature of PCA can enhance SEM approach by simplifying the model, reducing noise and data redundancy, and decreasing computational load of SEM algorithms especially in processing large datasets. PCA can also be used in data pre-processing, to remove multicollinearity among observed variables by producing orthogonal (uncorrelated) components. This can improve the estimation of SEM parameters that can lead to better fitting models (Kline, 2015). Furthermore, by ensuring that the components (factors) are meaningful and represent the underlying dimensions of the data, PCA can help in validating the constructs in SEM and enhancing the measurement model (Hair et al., 2019a).

3. Methodology

This research employs an advanced mixed-method approach (Kurtaliqi et al., 2024), which involves the development of the State Defence Index (SDI) through a series of structured steps as outlined by OECD (2008), and further refined by

Mazziotta and Pareto (2016).

a) Defining the conceptual framework.

It is fundamental to be able to clearly describe civic awareness of state defence in terms of the constructs and the corresponding measurable indicators, to help comprehend the big picture, communicate with others and facilitate further analysis. The State Defence Index (SDI) is composed of the basic or element-based SDI (SDIe) and the non-element-based SDI (SDIn).

b) Data preparation and standardisation.

Data preparation involves data acquisition, cleansing and transformation to ensure suitability of acquired data to previously defined variables, data relevance, and quality. The data were meticulously cleaned by addressing missing values through appropriate imputation methods and treating outliers using statistical techniques such as Grubb's Test (Urvoy and Autrusseau, 2014).

c) Multivariate analysis.

Multivariate analysis enables researchers to understand the relationships between variables, identify patterns, and make inferences about the underlying structure of the data (Hair et al., 2019a). The SDIe is predicted using PLS-SEM technique with PCA as a weighting scheme. The analysis is carried out using SmartPLS software (Ringle et al., 2024) and involved several key steps. First, an initial model that represents the relationships between the variables is developed. The model consists of a measurement model, which describes the relationship between constructs/latent variables and their corresponding indicators, and a structural model, which describes the relationship between constructs. Then, the model is estimated to generate the loadings and path coefficients that describe these relationships. After that, the measurement model is assessed to ensure it is reliable and valid, focusing on internal consistency and how well the model captures the concepts it's meant to measure, by checking factors like Cronbach's alpha, composite reliability, and average variance extracted (AVE) (Hair et al., 2019b).

Next, the structural model is evaluated to see how well it could predict outcomes, using metrics like R-squared values. Based on these evaluations, the model is refined to improve its reliability, validity, and predictive power. Additionally, we used the Predicted Orientation Segmentation (POS) method (Arenas-Gaitán et al., 2020) to divide the dataset into groups based on predicted orientations. The final SDIe formula is then created as a linear combination of the different factors, with the coefficients calculated using a statistical method called polynomial regression.

d) Calculation of Index.

SDI is calculated as a weighted sum of the SDIe scores and SDIn scores using coefficient of determination (R2) and (1-R2) as the weights (Direktorat Bela Negara, 2021). Calculation of SDIe consists of calculation of each element construct's scores and calculation of SDIe scores. To apply the SDIe formula to new data (test data), we prepare the data by performing dimensionality reduction on each indicator using the PCA approach to align with the PCA approach used in PLS-SEM. Each construct's score is calculated by multiplying the significant eigenvectors by their respective indicators and aggregating the results. Finally, the SDIe value is calculated by combining the values of the element constructs using the specified

formula. The SDIe individual values are then aggregated into SDIe regional (province) and national values. The distribution of samples across all regions will be analyzed and the under-sampled regions will be marked for special consideration during further analysis. The established social indices such as human development index and index of democracy (Direktorat Bela Negara, 2021) are used to calculate the SDIn, which in turn is used to calculate the overall SDI values.

e) Validation.

The SDI values are then compared to the predictions made by officials having expertise in CASD (experts), namely commanders of military districts, regional police officials, regional government officials and academics. A series of focus group discussions to assess the state defence awareness in each region are organised by MoD in several major cities such as Bandung, Semarang, Surakarta, Yogyakarta, Balikpapan, Asahan, and Denpasar, using experts' fields observations and classification scheme as shown in **Table 1** (Direktorat Bela Negara, 2021). The calculated SDI values and experts' predictions are statistically compared using ANOVA and Brown Forsythe tests. The analysis will assess the similarity in mean and variance between the two SDI measurements.

Table 1. Classification of the state defence index.

1–100 scale	1–5 scale	Qualitative Scale	Predicted Implication/Consequence
< 40	< 2	Very Low	Disintegration, Separatism, Riot, Conflict
40–59	2.0–2.9	Low	Riot, Conflict, Massive Demo
60–79	3.0–3.49	High Enough	Demo, Stability under control
80–89	3.5–3.99	High	Stability under control
≥ 90	≥ 4.0	Very High/Very Good	Stability under control

4. Results and discussion

4.1. Conceptual framework of state defence index (SDI)

SDI tries to measure civic awareness on their role in maintaining national security and sovereignty which is expressed as 5 elements of State Defence (Permenhan, 2019). The first element, love of the homeland, captures the emotional connection individuals feel towards their nation. The second element, nation awareness, assesses individuals' knowledge and understanding of their rights and responsibilities as citizens. This includes knowledge of the constitution, political system, and civic duties. The third element, belief in the national ideology, examines the extent to which individuals identify with and support the core values and principles that underpin their nation. National ideologies of Indonesia encompass values like religiosity, humanity, national unity, democracy, and social justice. The fourth element, willingness to sacrifice for the nation, assesses an individual's readiness to contribute to the nation's well-being, even at a personal cost. This could involve sacrificing time, money, or even comfort for the sake of the country. Finally, the fifth element, basic capability to defend the nation, evaluates an individual's preparedness to physically protect the nation from external threats.

As shown in the **Figure 1** below, SDI is composed of element-based SDI index

(SDIe) and non-element-based SDI index (SDIn). SDIn is added to improve the measurement accuracy due to the realisation that civic awareness of state defence is determined not only by its 5 (five) elements but also influenced by other factors. These factors, which are considered hidden data and not included in the conceptual model of SDI, are selected from existing national social indices such as Human Development Index and Index of Democracy. They explain the variance of the dependent variable (the SDI) which cannot be explained by the independent variables (the 5 elements).

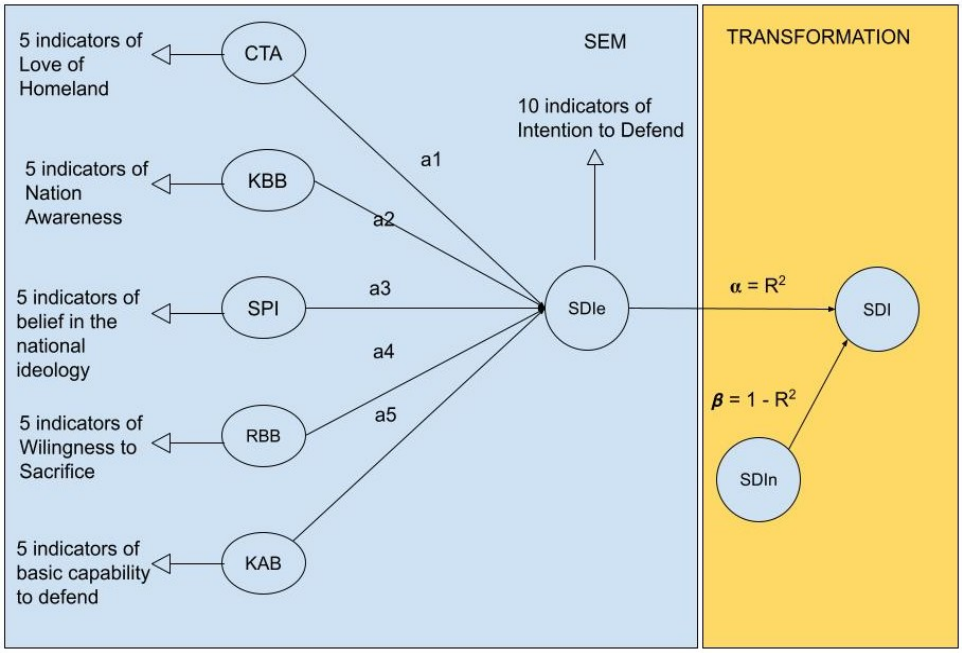

Figure 1. Conceptual model of SDI measurement.

4.2. Selection of indicators

The 5 elements as well as the index are unobservable or latent variables. These latent variables are measured by the corresponding observable indicators as shown in the **Table 2** below.

Table 2. Latent variables and observable indicators of the elements of SDI.

No	Latent Variables	Observed Indicators (dimension)
1	Love of the homeland (CTA)	1) Protect the National Unity 2) Preference to use National Language 3) Preference to domestic product 4) Pride as a citizen 5) Protection of National Resources
2	Nation awareness (KBB)	1) Unity in Diversity 2) Importance of Citizenship 3) Equality before the law 4) Involvement in Democratic Process 5) Preference to cooperative endeavor
3	Belief in “Pancasila” as the national ideology (SPI)	1) Commitment to religious tolerance 2) Implementation of National Ideology 3) Trust in National Ideology 4) Anti-corruption as Implementation of Social Justice 5) Early instillation of National Ideology

Table 2. (*Continued*).

No	Latent Variables	Observed Indicators (dimension)
4	Willingness to sacrifice for the nation (RBB)	1) Desire to contribute 2) Defence Against Foreign Threats 3) Volunteerism 4) Strive for excellence 5) Willingness to contribute privately owned resources
5	Basic capability to defend the nation (KAB)	1) Support the military against foreign invasion 2) Self-discipline 3) Importance of education 4) Physically and mentally healthy to defend the country 5) Contribute skills and capabilities to defend the nation
6	Civic awareness of State Defence (SDIe)	1) Extend of love for the homeland 2) Concern and responsibility to participate in state defence 3) Intention to participate in state defence against foreign attack 4) Intention to participate in reconciling conflicts 5) Intention to take part in state defence activities 6) Importance of state defence 7) Belief in state defence activities as self-discipline and character building 8) Confidence to take part in state defence activities 9) Support for family members' participation in state defence activities 10) Belief that state defence activities strengthen the sense of national unity

4.3. Data preparation

The IBN online surveys conducted by MoD from March 2024 until the end of 2024 (Ministry of Defence, 2024a) to gauge the perception of State Defence of the Indonesian people which is reflected in the determination, attitudes, behaviour and actions of citizens in maintaining state sovereignty, territorial integrity and the safety of the nation. The respondents were categorised based on various demographic variables to capture a comprehensive view of the community. The survey uses Likert scale to measure the variables of the citizen perception and intention according to five elements of state defence as seen in **Table 2**. This study used an ad-interim dataset of 18.807 respondents collected from 1 March to 26 June 2024 for SDIe modelling and calculation. For the SDIn calculation, the statistical data namely Indonesia Democratic Index or IDI (Indonesia Central Bureau of Statistic, 2023b) and Human Development Index or HDI (Indonesia Central Bureau of Statistic, 2023a) are used.

Another dataset was also acquired from the Officials Perception of State Defence Awareness Survey (Ministry of Defence, 2024b), performed by MoD in June 2024. The 135 respondents are commanders of military districts, regional police officials and regional government officials, which have insights and expertise in the CASD program in Indonesia.

Both datasets were meticulously cleaned by addressing missing values through appropriate imputation methods and treating outliers using statistical techniques such as Grubb's Test (Urvoy and Autrusseau, 2014). This thorough cleaning process ensures the reliability and accuracy of the Dataset for subsequent analysis, providing a solid foundation for drawing reliable conclusions.

4.4. Multivariate analysis

4.4.1. The SEM model

The initial model consists of measurement models (outer models) and a structural model (inner model) constructed based on the conceptual model in **Figure 1**. The measurement models describe the relationship between the latent variables and their respective indicators. The structural model describes the relationship between exogenous latent variables (the 5 elements shown in **Table 1**) and the endogenous latent variable (SDIe). The measurement models are reflective (as shown by the direction of the arrows from the latent variables to their indicators), meaning that the indicators are caused by the latent variable. In other words, each latent variable is measured by the corresponding indicators.

4.4.2. Model estimation and evaluation

This process iteratively produces outer models' loadings and inner model's path coefficients between latent variables. Since the model is fitted using PLS SEM with PCA weighting scheme, the outer model loadings are estimated using PCA and the inner model path coefficients are estimated using PLS-SEM in Smart PLS. Comparing several alternative models in terms of reliability, validity, and predictive power, the final model is presented in **Figure 2**. Several constructs' indicators are removed for optimal construct's reliability and validity. Quadratic effects are added for KBB and SPI to overcome multicollinearity between constructs.

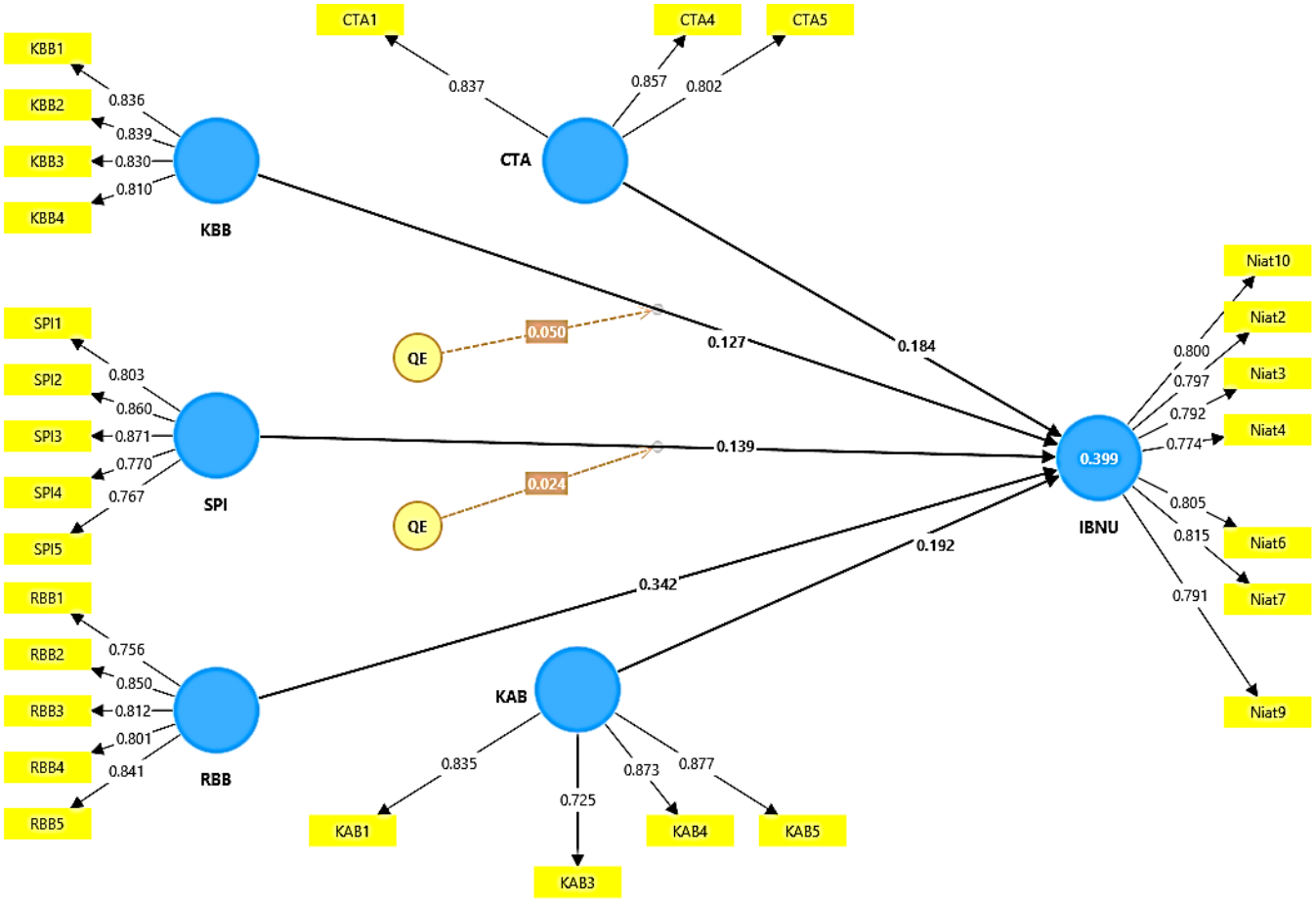

Figure 2. Final model.

The final model has good indicators' reliability since its outer loadings are all above 0.708. It indicates that each latent construct explains more than 50 percent of

the indicator's variance. **Table 3** presents assessment results of construct reliability and validity. It indicates that the model has good internal consistency reliability (the Cronbach's alpha values are all above 0.7) and good composite reliability (rho_C and rho_A values are all above 0.7) (Jolliffe and Cadima, 2016). The Average Variance Extracted (AVE) values above 0.5 indicates convergent validity for all constructs.

Table 3. Construct reliability and validity.

Constructs	Cronbach's alpha	Composite reliability (rho_A)	Composite reliability (rho_C)	Average variance extracted (AVE)
CTA	0.778	0.779	0.871	0.692
IBNU	0.904	0.904	0.924	0.634
KAB	0.847	0.855	0.898	0.689
KBB	0.848	0.848	0.898	0.687
RBB	0.871	0.873	0.907	0.661
SPI	0.873	0.876	0.908	0.665

The discriminant validity testing using Fornell-Larcker method shows that the correlation between the indicators within constructs are larger than those between different constructs. This means the model has good discriminant validity, i.e., there is no redundant construct in the model.

To identify the limitations of this modelling approach and enhance its predictive accuracy, we implemented the Predicted Orientation Segmentation (POS) method as described by Arenas-Gaitán et al. (2020). This approach involves segmenting the dataset into distinct groups based on predicted orientations. Through this method as presented in **Table 4**, the model demonstrated an average weighted *R*-square of 0.517 (n = 18,807) across two segments. Segment 1 showed an *R*-square of 0.22 (n = 1926), while Segment 2 exhibited a significantly higher *R*-square of 0.701 (n = 16,881). For this purpose, we selected a suitable sample and used the Segment 2 sample as the basis for calculating the formula from the modelling results.

Table 4. Predicted orientation segmentation (POS) result.

	Original sample *R*-squares	Weighted average *R*-squares	Segment 1	Segment 2
IBNU	0.399	0.517	0.220	0.701
n	18,807	18,807	1926	16,881

The implementation of the Predicted Orientation Segmentation (POS) method highlights significant variation in the model's predictive power across different segments. The overall average weighted *R*-square of 0.517 indicates a moderate level of predictive accuracy when considering the entire dataset. However, the disparity between Segment 1 and Segment 2's *R*-square values suggests that the model performs substantially better for certain groups. Segment 1, with an *R*-square of 0.22, represents a group where the model's predictions are less accurate, indicating that a smaller proportion of variance in the dependent variable is explained by the model for this segment. In contrast, Segment 2, with an *R*-square of 0.701, suggests a high level of predictive accuracy, meaning a significant portion of the variance in the

dependent variable is explained by the model. This substantial difference implies that the factors influencing the dependent variable might vary considerably across segments, providing an opportunity to refine the model further by incorporating segment-specific variables or adjusting the modelling approach for different groups to improve overall predictive accuracy. Examining the *F*-square (effect size) values, it can be inferred that the quadratic effect of SPI has the smallest effect size (0.002) and largest *p* value (0.148). Therefore, removing the quadratic effect of SPI will not have a significant effect since its *p*-value (0.148) is well above the 5% threshold. Therefore, the final model will only have a quadratic effect of KBB as described by the following formula:

$$\text{SDIe} = a \times \text{CTA} + b1 \times \text{KBB} + b2 \times \text{KBB2} + c \times \text{SPI} + d \times \text{RBB} + e \times \text{KAB} \quad (1)$$

where the coefficients (*a*, *b*1, *b*2, *c*, *d*, and *e*) for the SDIe formula are calculated using multivariate polynomial regression. The final formula is as follows, with addition of the intercept value (a constant) in a regression model representing the mean value of the response variable when all of the predictor variables in the model are equal to zero.

$$\text{SDIe} = 0.158 \times \text{CTA} + 0.043 \times \text{KBB} + 0.006 \times \text{KBB2} + 0.09 \times \text{SPI} + 0.334 \times \text{RBB} + 0.195 \times \text{KAB} + 0.566 \quad (2)$$

4.5. SDI calculation and analysis

4.5.1. SDIe calculation

In order to compute the SDIe using Equation (2), the scores for each construct (CTA, KBB, SPI, RBB, KAB) are first determined using PCA's eigenvectors and eigenvalues as shown by the Equations (3) and (4) below. Each construct's score is calculated by multiplying the dominant proportion of variance (corresponding to eigenvalue >1) and the weighted sum of the corresponding indicators' values. The weight for each indicator is calculated by normalising the sum of significant eigenvector elements (>0.4) across PCs corresponding to the indicator.

$$C_j = V_j \times \sum_{i=1}^{n} W_{ji} \times ind_{ji} \quad (3)$$

$$W_{ji} = \text{Norm}\left[\sum_{k=1}^{n} v_{jik}; v_{jik} > 0.4\right] \quad (4)$$

where C_j is score of *j*-th construct of SDIe, V_j is dominant proportion of variance of *j*-th construct, w_{ji} is the weight of *i*-th indicator of *j*-th construct, ind_{ji} is the value of *i*-th indicator of *j*-th construct, and v_{jik} is the *i*-th element of *k*-th eigenvector of the *j*-th construct.

The result of SDIe calculation utilising data collected from 1 March to 26 June 2024 is presented in **Figure 3**. The bar chart illustrates the element-based State Defence Index (SDIe) of 25 of 35 provinces of Indonesia, with a red dashed line indicating the overall average SDIe value of 3.50. As shown in **Figure 3**, 12 out of 24 (50%) data bars associated with province's SDIe values are colour coded in red, which means they have 20 or less respondents. As the survey is still on-going, their SDIe values are expected to change significantly once the respondent count exceeds the minimum sample threshold of 385 respondents (Memon et al., 2020).

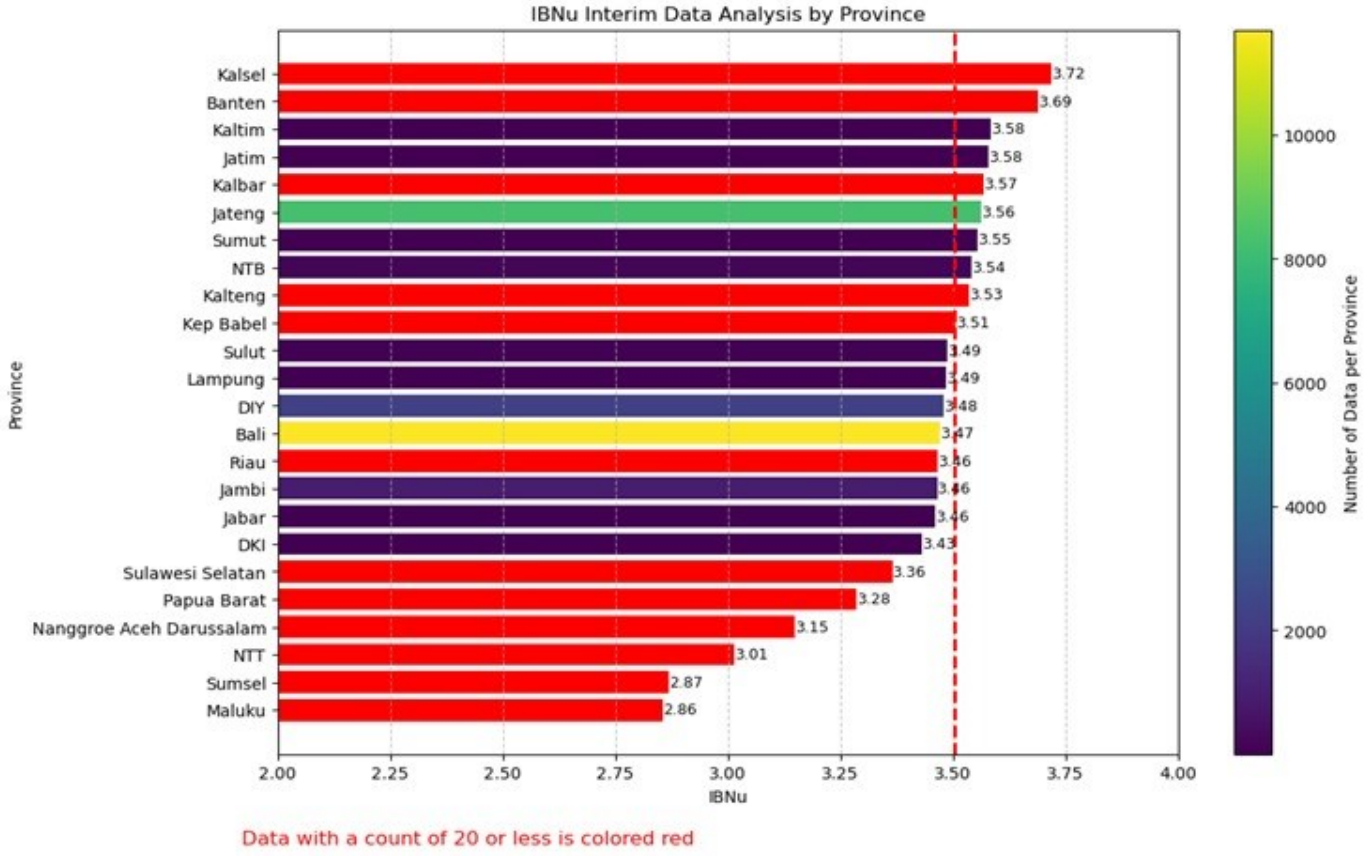

Figure 3. SDIe values by province.

4.5.2. SDIn dan SDI calculation

The non-element based-SDIn values are calculated as a geometric mean of the IDI and HDI, in this case of the year 2023. The SDI values are calculated using the following formula, with optimum predictive accuracy (0.701) acquired by the POS method as the coefficient of determination *R*-squared.

$$SDI = 0.701 \times SDIe + 0.299 \times SDIn \quad (5)$$

The SDI values are presented in **Figure 4**, where the mean imputation method is applied for the missing values in the SDIe of the provinces that are not represented in the survey dataset.

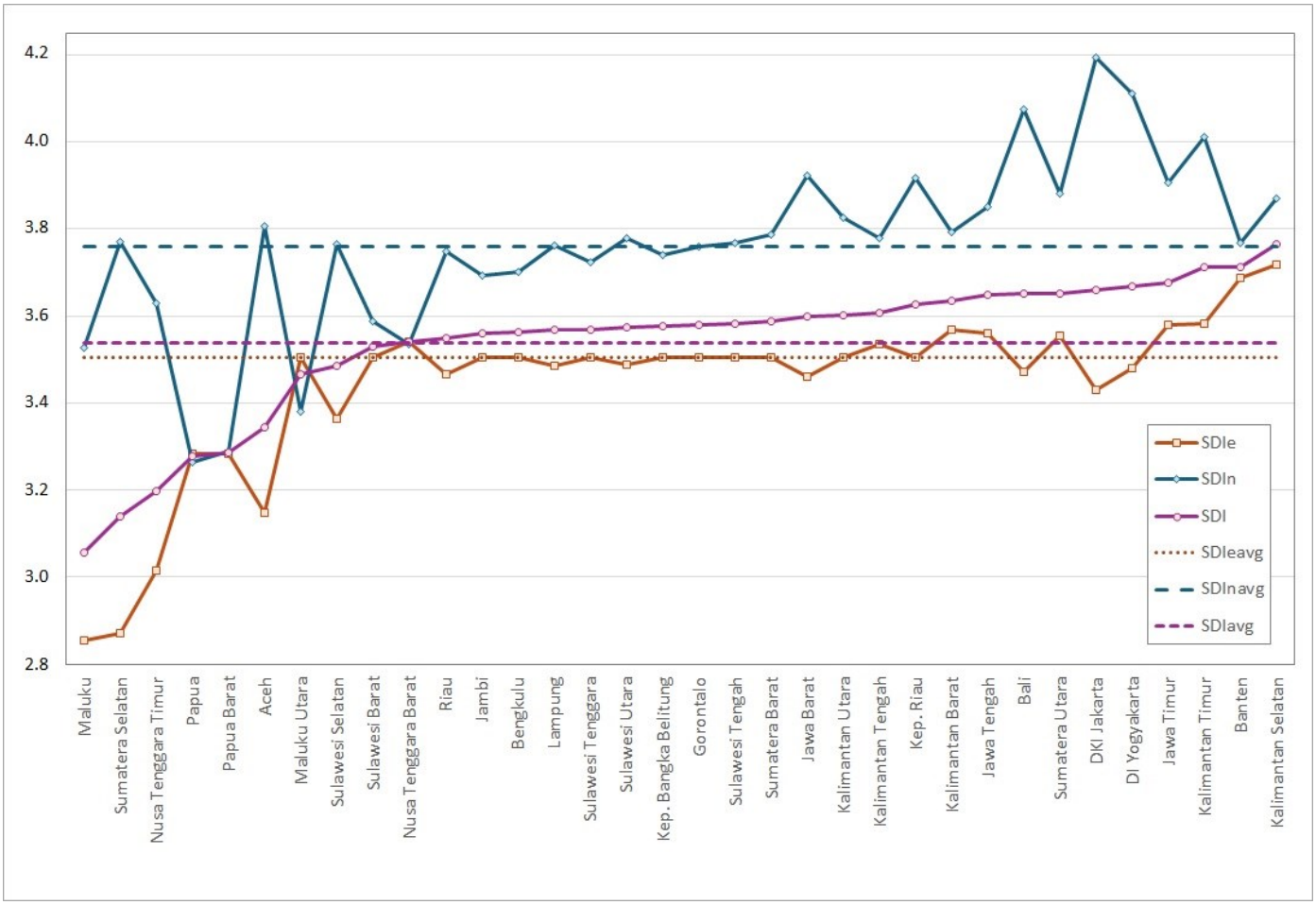

Figure 4. SDI values vs. various indices (IDI and HDI) by province.

4.5.3. Analysis of SDI values

The SDI values for most provinces are clustered around the average value of 3.54, indicating relatively consistent state defence preparedness across the country. Provinces with SDI values above the red dashed line are performing better than the national average. These provinces include Kalimantan Selatan, Banten, Kalimantan Timur, Jawa Timur, DI Yogyakarta. These provinces demonstrate stronger state defence capabilities, possibly due to effective policies, strong community engagement, and robust defence infrastructure. However, the SDIe values for Kalimantan Selatan and Banten may still change significantly as the survey is ongoing and, as shown in **Figure 3**, their respondent counts are still far below the threshold.

Provinces with SDI values below the red dashed line are performing below the national average. These provinces include Maluku, Sumatera Selatan, Nusa Tenggara Timur, Papua, Papua Barat, and Nanggroe Aceh Darussalam. These regions may need to strengthen their state defence measures and address specific challenges that might be impacting their overall preparedness. However, the SDI values for these provinces may still change significantly as the survey is ongoing and, as shown in **Figure 3**, their respondent counts are still far below the threshold.

The key provinces such as Kalimantan Timur, with an SDI value significantly above the average, shows excellent state defence preparedness, likely attributed to its

strategic importance and robust security measures. Jawa Timur, another top-performing province with a high SDI value, reflecting effective local governance and defence strategies. For these provinces, policymakers can continue to support and invest in existing defence strategies and initiatives. These provinces may serve as models for other regions to emulate.

Maluku, this province falls below the average, indicating areas where improvements in state defence readiness might be necessary. Nanggroe Aceh Darussalam and Papua are also below average. This is consistent with the fact that, as **Figure 4** illustrates, their respective SDIn (geomean of IDI and HDI) values are much lower than the national averages. These provinces may face unique challenges related to their previous history of conflict (Lele, 2023; Werner and Lambsdorff, 2020) that need to be addressed to enhance its state defence preparedness. For provinces with SDI values below the national average, policymakers should prioritize identifying and addressing specific challenges that are impacting their state defence preparedness. This may involve conducting more in-depth assessments of local security threats, strengthening community engagement, improving defence infrastructure, and implementing targeted training programs for security personnel. Additionally, policymakers should consider the unique historical and socio-economic contexts of these regions, such as in Nanggroe Aceh Darussalam and Papua, and tailor their interventions accordingly. By leveraging the SDI as a diagnostic tool, policymakers can allocate resources more effectively and implement evidence-based policies to enhance state defence capabilities across Indonesia.

In all, the chart provides a clear visual representation of state defence readiness across different provinces, with the overall average serving as a benchmark. Provinces above the average line exhibit stronger defence preparedness, while those below the average line highlight areas needing further attention and improvement. Policymakers can use this information to target interventions and allocate resources more effectively to bolster state defence capabilities nationwide.

4.6. Validation

To validate our results, we compared the State Defence Index estimates (SDI) with the predictions made by experts, namely commanders of military districts, regional police officials and regional government officials, regarding the state defence awareness in each region. The prediction data from experts was obtained from the Officials Perception Survey (Ministry of Defence, 2024b). We conduct ANOVA and Brown-Forsythe tests to compare the similarity/equality of mean and variance between the 2 (two) datasets respectively. Both test results accept the null hypothesis at 5% significance level, which means that the SDI estimates and experts' predictions have the same mean and variance within 95% confidence interval. It can be concluded with 95% confidence that the SDI model is valid and accurate.

4.7. Future research

Comparative analysis with prior studies reveals that our SDI captures a broader range of factors, offering a more detailed and accurate picture of state defence preparedness. This advancement is crucial for policymakers as it provides actionable

insights and a clearer direction for improving civic awareness and readiness. The study's limitations, such as variability in results for under-sampled regions and the constraints of polynomial regression, highlight areas for future research. Enhancing the model with more comprehensive survey data and leveraging advanced machine learning techniques can further refine the SDI, ensuring even greater precision and utility.

However, using polynomial regression is still constrained by classic statistical assumptions such as normality, homoscedasticity, and independence of the residuals (James et al., 2013). To address these limitations, for the future studies alternative methods should be explored such as machine learning algorithms (e.g., decision trees, random forests, and neural network) which can handle non-linear relationships effectively without requiring explicit assumptions about the functional form.

Our findings pave the way for future research to build on this foundation, exploring longitudinal data and conducting comparative studies with other countries to validate and extend the applicability of the SDI. This continued effort will further enhance the impact and implementation of the SDI, making it an invaluable tool for policymakers aiming to bolster state defence preparedness in Indonesia and beyond.

5. Conclusion

This research successfully developed a comprehensive measurement method for the State Defence Index (SDI) to evaluate and benchmark SDI values across different regions in Indonesia. The conceptual framework of the SDI includes five key elements: attachment to the homeland, nation awareness, belief in the national ideology, willingness to sacrifice for the nation, and basic capability to defend the nation. Additionally, a non-element-based SDI index (SDIn) was introduced to account for hidden factors influencing civic awareness, derived from existing national social indices.

Data collection involved extensive online surveys conducted by the MoD, capturing perceptions of state defence from both the general public and officials. The dataset was meticulously cleaned to ensure reliability and accuracy. Using Principal Component Analysis (PCA) and Structural Equation Modeling (SEM), the study constructed a model that demonstrated good predictive power, especially after applying these advanced analytical techniques to reduce dimensionality and enhance measurement precision. The model showed good reliability and validity, with the final results indicating consistent state defence preparedness across most provinces.

The SDI calculation combined SDIe and SDIn values to produce the overall SDI, revealing provinces performing above or below the national average. This analysis highlights provinces, such as Maluku, Sumatera Selatan, Nusa Tenggara Timur, Papua, Papua Barat, and Nanggroe Aceh Darussalam, needing further attention and improvement. Validation of the SDI model through comparison with experts' predictions confirmed its accuracy and reliability. Overall, the developed SDI provides a valuable tool for measuring and benchmarking civic awareness in state defence, offering crucial insights for policymakers to enhance national security and defence strategies.

Nevertheless, this research has several limitations. First, the SDIe values are

calculated utilising data collected between 1 March to 26 June 2024 from an online survey that will remain open until the end of 2024. As a result, for certain under-sampled regions, SDI results remain highly variable. Second, the SDIn values are calculated using only the regional HDI and the IDI. Third, the model to calculate SDI is still developed using polynomial regression which is constrained by classic statistical assumptions such as normality, homoscedasticity, and independence of the residuals.

For future works, a more robust and accurate model to measure SDI values needs to be developed which utilise (1) more complete survey data so that the number of respondents for each region, sub-regions, or other social groups exceed the minimum threshold, (2) other social indices which might influence citizen's intention to contribute to state defence such as Social Welfare Index, Corruption Index, and regional crime rate, and (3) other machine learning techniques which are more adept at handling nonlinearity.

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