

# Penta Helix Model Approach Strategy Towards the Effectiveness of Stunting Reduction Programs in Surabaya City

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## ABSTRACT

**Purpose:** This study examines the effectiveness of the Penta Helix model—integrating academia, business, community, government, and media—in reducing stunting rates in Surabaya, Indonesia. Through path analysis, the research assesses the individual and collective impacts of these sectors on the effectiveness of the stunting reduction program. The findings reveal that government, business, and media sectors play significant roles in the success of the program, with government involvement being the most critical factor. In contrast, academia and community involvement demonstrate limited impact, suggesting potential gaps in research application and community engagement.

**Design/methodology/approach:** This study employs a quantitative research design to examine the effectiveness of the Penta Helix model in reducing stunting rates in Surabaya. The research uses Structural Equation Modeling (SEM) with Smart PLS 3 to analyze the relationships between various variables within the model. A total of 250 respondents were selected for the study. The sample size was determined based on the recommendations for SEM, which suggest a minimum of 200 respondents for robust analysis.

**Findings:** The study's results are contextualized within Indonesia's national policies, particularly the National Strategy to Accelerate Stunting Prevention (Stranas Stunting), highlighting the importance of governmental support and coordinated efforts across sectors. The positive contributions of the business sector underscore the value of public-private partnerships, while the significant role of media reinforces the importance of strategic communication in public health initiatives.

**Research limitations/implications:** The need for stronger linkages between academic research and practical implementation, as well as more robust community engagement strategies. These insights have important implications for refining the Penta Helix model to achieve more effective and sustainable stunting reduction outcomes in Surabaya and other regions. By addressing these gaps, the model can be optimized to better support Indonesia's ongoing efforts to combat stunting, ultimately contributing to improved public health outcomes nationwide.

**Practical implications:** Given that a majority of the sectors (Government, Business, and Media) show significant individual contributions, it is reasonable to conclude that the hypothesis that all variables collectively have a significant effect on the effectiveness of the stunting reduction program is likely accepted. However, this conclusion is based on the assumption that the combined effect of the variables is assessed through an appropriate overall model fit measure, which is typically significant if most individual paths are significant.

**Originality/value:** This research represents an original contribution to the field of public health and urban development through its innovative application of the Penta Helix model to the issue of stunting reduction in Surabaya. While existing studies have explored various approaches to addressing stunting, this study distinguishes itself by integrating a Penta Helix framework a multi-stakeholder model involving academia, business, government, community, and media into the analysis of program effectiveness.

**Paper type:** Research Paper

**Keywords:** *Stunting, Public Health, Academic, Community, Business, Government, Media, People, Surabaya.*

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## I. INTRODUCTION

Achieving the vision of a "Golden Generation 2045" is a critical ambition for Indonesia as the country approaches its 100th anniversary. The objective is to capitalize on the demographic dividend, which offers a unique opportunity to propel the nation forward through the development of a high-quality human resource pool. These resources include individuals who are healthy, intelligent, creative, and competitive. The cornerstone of this national vision lies in the preparation of a superior generation that will lead Indonesia into a prosperous future. However, one of the major challenges in achieving this goal is the prevalence of stunting among Indonesian children.

Stunting is a condition marked by impaired growth and development that children experience as a result of chronic malnutrition, especially during the first 1,000 days of life—from conception to the child's second birthday (Siswati et al., 2024). This issue is a major public health concern because it not only affects the physical growth of a child but also has significant impacts on cognitive development, educational performance, and productivity in adulthood. The immediate impacts of stunting include hindered brain development, reduced intelligence, stunted physical growth, and metabolic disorders. In the long term, stunted children are at risk of having diminished cognitive development, learning difficulties, weakened immunity, and a higher likelihood of chronic diseases later in life (Darumurti, Atmojo and ..., 2023).

Given these severe consequences, the Indonesian government has made stunting prevention a top priority. President Joko Widodo has set an ambitious target to reduce stunting prevalence to 14% by 2024. Efforts at the national and local levels have included various programs aimed at improving nutrition, promoting maternal and child health, and ensuring adequate access to health services (Arieffiani and Ekowanti, 2024). In the city of Surabaya, numerous initiatives have been rolled out to reduce stunting rates, including specific strategies that focus on family-based interventions. These interventions target high-risk groups, such as prospective brides and grooms, pregnant women, new mothers, and children aged 0–59 months.

Despite the significant efforts by the Surabaya city government, including providing nutritional education, supplements, and routine health check-ups, the effectiveness of these interventions remains less than optimal. Although Surabaya boasts the lowest stunting prevalence in East Java and Indonesia—standing at 4.8% in 2022, compared to the national average of 21.6%—there are still challenges in fully eliminating stunting (Arieffiani and Ekowanti, 2024). One key question that arises is why, despite intensive intervention efforts, new cases of stunting continue to appear.

This challenge suggests that the existing strategies may not be fully addressing all dimensions of the problem. The effectiveness of stunting reduction programs can be influenced by various stakeholders, including academics, community groups, businesses, government bodies, and media organizations. A holistic approach involving these stakeholders—known as the Penta Helix model—could potentially enhance the success of stunting reduction initiatives. The Penta Helix model emphasizes the synergy and strong commitment among these five types of stakeholders, which is essential for addressing complex social issues like stunting.

In Surabaya, the Penta Helix model could play a crucial role in optimizing stunting reduction efforts by facilitating collaboration among stakeholders. For instance, academia can contribute through research and evidence-based policy recommendations. Community groups can raise awareness and encourage behavioral changes at the grassroots level. Businesses can support through corporate social responsibility initiatives that provide resources and funding for nutrition programs. Government bodies are responsible for policy formulation, coordination, and implementation of stunting reduction strategies. Finally, media organizations can amplify messages about the importance of proper nutrition and health practices, reaching a broad audience to create a supportive environment for these initiatives.

To illustrate, one of Surabaya's ongoing programs involves weekly distribution and socialization of the benefits of Iron Tablets (Tablet Tambah Darah or TTD) to adolescent girls in schools. This program, aimed at preventing anemia and promoting better health, is essential because anemia in adolescence can increase the risk of stunting in future generations (Pratama et al., 2024). Additionally, health checks and nutritional education sessions are conducted for young mothers and their children. This includes counseling on complementary feeding and the provision of special foods for children with specific medical conditions, prescribed by pediatricians. Various other initiatives, such as ASI (breastfeeding) villages, food fortification, and healthy cooking demonstrations, further support stunting prevention efforts.

Despite these comprehensive interventions, challenges remain, particularly concerning the emergence of new stunting cases post-intervention. This raises questions about the existing gaps in the implementation and monitoring of stunting reduction programs. One potential explanation is the lack of sustained engagement and accountability among stakeholders, which is where the Penta Helix approach can add value. By integrating the roles and expertise of different stakeholders, this model can help to identify and address barriers that may not be evident from a single perspective (Kania et al., 2023).

Research on the effectiveness of the Penta Helix approach in stunting reduction is essential because it provides insights into how stakeholder collaboration can be optimized to enhance program outcomes. Previous studies, such as Priyono's research on stunting prevention strategies in rural areas, have highlighted the importance of community engagement and cross-sectoral collaboration. Similarly, Dewi and colleagues have explored how targeted interventions in Banten province can accelerate stunting reduction (Erison, 2024), while Siswati et al. (2022), have examined the role of corporate social responsibility in supporting stunting prevention initiatives. These studies provide valuable lessons but are primarily qualitative in nature, focusing on specific contexts. The research questions concluded with:

1. Does the role of Academic (X1) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya?
2. Does the role of the Community (X2) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya?
3. Does the role of Business (Economic Sector) (X3) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya?
4. Does the role of Government (X4) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya?
5. Does the role of Media (X5) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya?
6. Does the role of Academic, Community, Business (Economic Sector), Government, Media simultaneously positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya?

This research aims to expand on these findings by employing a quantitative approach to assess the effectiveness of the Penta Helix model in Surabaya. The study will examine the relationships between various stakeholders' involvement—academics, community groups, businesses, government, and media—and the overall effectiveness of stunting reduction programs. Specifically, it will measure key indicators such as program success rates, target achievement, participant satisfaction, input-output levels, and overall goal attainment.

The findings of this study are expected to have significant theoretical and practical implications. Theoretically, the research will provide a deeper understanding of the Penta Helix model's role in public health interventions, offering evidence-based recommendations for enhancing stakeholder engagement. Practically, the data obtained from this study will serve as a guide for policymakers and stakeholders in Surabaya, helping them refine their strategies to achieve stunting reduction goals. Furthermore, this research could serve as a reference for other regions looking to develop effective stunting reduction strategies aligned with national standards and regulations.

Ultimately, this study seeks to contribute to the broader body of knowledge on stunting prevention and provide actionable insights that can help Surabaya and other cities in Indonesia make strides toward realizing the vision of a Golden Generation 2045. By leveraging the strengths of the Penta Helix model, the hope is to foster a collaborative, sustainable, and impactful approach to stunting reduction, ensuring that future generations are given the best start in life.

## II. METHODS

This research uses a quantitative approach with Structural Equation Modeling-Partial Least Squares (SEM-PLS) to analyze the effectiveness of the Penta Helix model in reducing stunting rates in Surabaya. SEM-PLS is a robust statistical method that does not rely on numerous assumptions and is suitable for exploring complex relationships between latent variables. The data analysis is conducted using SmartPLS version 3, a software tool that provides advanced capabilities for SEM-PLS analysis (Al-Tawil, Gantasala and Younies, 2021).

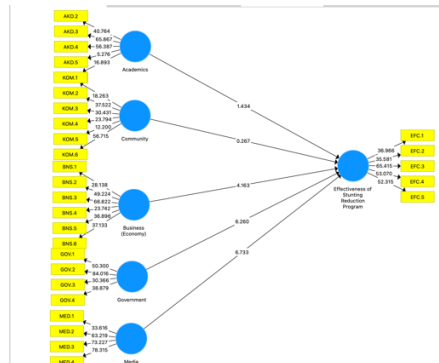
### A. Data Collection Techniques

Data collection was conducted using a structured questionnaire (survey) instrument. The questionnaire consists of 30 questions designed to measure respondents' perceptions of the effectiveness of stunting reduction programs and the roles of the five stakeholders involved in the Penta Helix model: academics, community, businesses, government, and media. The Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), is employed to assess these aspects. With 250 samples The data processing steps include:

1. Editing: Before data analysis, data checking (editing) is performed to ensure the completeness and consistency of responses.
2. Coding: The data is then coded by assigning numerical values (1–5) to the responses. For instance, "Strongly Agree" is coded with a score of 5. This step simplifies the data for further analysis.
3. Tabulation and Data Entry: After coding, data is tabulated and inputted into SmartPLS for statistical analysis.

## B. Hypotheses

The study's variables are divided into independent variables and a dependent variable related to Independent Variables (Penta Helix Model Components) related in this picture below:



Picture 1. Hypotheses Framework

Source: (Self-Identified, 2024)

- Hypothesis 1 (H1):** The role of Academic (X1) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya.  
This hypothesis tests whether the involvement of academic institutions contributes significantly to the success of stunting reduction initiatives, through research, training, and evidence-based interventions.
- Hypothesis 2 (H2):** The role of the Community (X2) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya.  
This hypothesis examines the impact of community engagement and participation, such as local health volunteers and parental education, on the program's effectiveness.
- Hypothesis 3 (H3):** The role of Business (Economic Sector) (X3) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya.  
This hypothesis investigates how businesses, through Corporate Social Responsibility (CSR) activities and nutritional support programs, contribute to reducing stunting rates.
- Hypothesis 4 (H4):** The role of Government (X4) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya.  
This hypothesis assesses the impact of government policies, funding, and coordinated public health efforts on the program's outcomes.
- Hypothesis 5 (H5):** The role of Media (X5) positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya.  
This hypothesis examines the effect of media campaigns, awareness programs, and public information dissemination on improving community understanding and engagement in stunting reduction efforts.
- Hypothesis 6:** The role of Academic, Community, Business (Economic Sector), Government, Media simultaneously positively influences the Effectiveness of Stunting Reduction Programs (Y) in Surabaya.

## C. Data Analysis Technique

The analysis of data is carried out using the Partial Least Square (PLS) method via SmartPLS version 3. PLS is selected because of its robustness, particularly when handling small sample sizes, complex models, and non-normal data distributions. PLS is also effective for both confirming theories and explaining relationships between latent variables (Sayer, 2020).

- The outer model evaluates the validity and reliability of the measurement indicators for each latent variable. The tests conducted include the table below:
  - Convergent Validity:** assessed using the Average Variance Extracted (AVE) and the factor loadings of each indicator. According to Ghazali, convergent validity is achieved when the AVE value is greater than 0.5, and the factor loadings for each item exceed 0.5.
  - Discriminant Validity:** ensures that each construct is distinct and does not overly correlate with other constructs. Discriminant validity is checked by comparing the square root of the AVE with the inter-construct correlations.
  - Composite Reliability:** the determine the consistency of the measurement model. A variable is considered reliable if it has a composite reliability score of 0.7 or higher, as suggested by Sekaran.

2. The structural model evaluates the relationships between latent variables based on substantive theories. This includes testing the paths between constructs and examining the overall fit of the model. Key evaluations include:
  - a. R-square ( $R^2$ )
  - b. Higher R-square values suggest that the model has strong explanatory power, indicating that the predictors (independent variables) effectively explain the variability in the outcome (dependent variable).
  - c. Bootstrapping Analysis
  - d. This technique is used in SmartPLS to generate t-values and standard errors for hypothesis testing. The bootstrapping procedure allows for resampling of the data to create a distribution of parameter estimates.
  - e. Criteria for Hypothesis Acceptance: Hypotheses are considered accepted when the calculated t-value exceeds the critical t-value from the t-table, typically set at a 95% confidence level ( $\alpha = 0.05$ ). If the t-statistic is higher than the critical value, the hypothesis is confirmed or proven.

### III. RESULTS AND DISCUSSION

#### A. Results

##### 1. Outer Model Analysis

The outer model, also known as the measurement model, assesses the validity and reliability of the indicators used to measure each latent variable. The primary objective is to ensure that the observed variables accurately represent the latent constructs. The evaluation involves the following tests:

##### 2. Convergent Validity

Convergent validity examines whether the indicators of a construct are correlated and truly represent the same underlying concept. It is assessed through:

*Table 1 Outer Model Analysis*

	<i>Cronbach's Alpha</i>	<i>rho_A</i>	<i>Composite Reliability</i>	<i>Average Variance Extracted (AVE)</i>
<i>Academics</i>	<i>0,825</i>	<i>0,881</i>	<i>0,882</i>	<i>0,612</i>
<i>Business (Economy)</i>	<i>0,929</i>	<i>0,933</i>	<i>0,944</i>	<i>0,739</i>
<i>Community</i>	<i>0,865</i>	<i>0,871</i>	<i>0,900</i>	<i>0,602</i>
<i>Effectiveness of Stunting Reduction Program</i>	<i>0,930</i>	<i>0,930</i>	<i>0,947</i>	<i>0,780</i>
<i>Government</i>	<i>0,916</i>	<i>0,926</i>	<i>0,941</i>	<i>0,799</i>
<i>Media</i>	<i>0,931</i>	<i>0,940</i>	<i>0,951</i>	<i>0,828</i>

Source: (Smart PLS 3, 2024)

The study utilized a Partial Least Squares Structural Equation Modeling (PLS-SEM) approach to assess the measurement model, focusing on the validity and reliability of the constructs involved in evaluating the effectiveness of stunting reduction programs in Surabaya through the Penta Helix approach. The analysis was conducted using key indicators, including Cronbach's Alpha, rho\_A, Composite Reliability, and Average Variance Extracted (AVE). These measures were critical in validating the constructs of Academics, Business (Economy), Community, Government, Media, and the Effectiveness of the Stunting Reduction Program. All constructs achieved AVE values above 0.5, the threshold indicating sufficient convergent validity. For instance, the Effectiveness of the Stunting Reduction Program had an AVE of 0.780, indicating that 78% of the variance in its indicators is explained by the construct itself. The Media construct showed the highest AVE (0.828),

confirming that the indicators robustly represent this latent variable. These AVE values ensure that the items share a substantial amount of common variance, strengthening the model's convergent validity.

**3. Discriminant Validity**

Discriminant validity tests whether a construct is distinct from other constructs within the model. This is crucial to ensure that each latent variable measures a unique aspect of the phenomenon under study. Discriminant validity is typically evaluated by comparing the square root of the AVE of each construct with the correlations between that construct and other constructs. A construct demonstrates adequate discriminant validity if its square root of AVE is greater than its correlation with any other construct, indicating that it shares more variance with its own indicators than with other constructs. While not directly mentioned, it is implied that discriminant validity was assessed by comparing the square root of the AVE values with inter-construct correlations. Sufficient discriminant validity ensures that constructs are distinct from each other, providing clarity in understanding their unique contributions within the model.

**4. Composite Reliability**

The Composite Reliability scores of all constructs exceeded the recommended threshold of 0.7, with values ranging from 0.882 to 0.951. High scores reflect that the indicators are reliable in measuring their respective constructs consistently. The highest reliability was observed in Media (0.951) and Business (Economy) (0.944), confirming the strong consistency of measurement in these constructs. The reliability evaluates the internal consistency of the indicators for each construct, assessing how well the items collectively measure the latent variable. A composite reliability in the results already above score of 0.7 or higher is considered acceptable, as it indicates that the measurement model is reliable and consistent in capturing the intended construct. According to Sekaran, meeting this threshold confirms that the indicators reliably measure the associated latent variable.

**5. Inner Model Analysis**

The structural model, also known as the inner model, examines the relationships between the latent variables based on theoretical expectations. This evaluation includes assessing the strength, direction, and significance of hypothesized relationships. The path coefficients and associated t-values were evaluated to determine the strength and significance of relationships between variables. Bootstrapping analysis provided a means to generate t-values and assess statistical significance, with hypotheses accepted if t-values exceeded critical values at the 95% confidence level. The significance of each relationship was established, confirming the hypothesized impacts of the constructs on the effectiveness of stunting reduction efforts. The use of SmartPLS 3 software enabled precise calculations of these relationships, supporting a robust statistical evaluation of the hypotheses.

**6. R-Square (R<sup>2</sup>)**

R-square measures the model's explanatory power, indicating the proportion of variance in the dependent variable that is explained by the independent variables.

*Table 2 R-Square Analysis*

	<i>R Square</i>	<i>R Square Adjusted</i>
<i>Effectiveness of Stunting Reduction Program</i>	0,728	0,722

Source: (Smart PLS 3, 2024)

This metric evaluates the explanatory power of the model for dependent variables. It indicates the proportion of variance in the dependent variable explained by the independent variables. The R-Square value of 0.728 indicates that 72.8% of the variance in the "Effectiveness of Stunting Reduction Program" is explained by the independent variables in the model. This high R-Square value suggests that the predictors (latent variables such as government policy, community involvement, private sector participation, academia, and media influence, which may be part of the Penta Helix model) have a substantial impact on the effectiveness of the stunting reduction program Hypotheses 6 accepted.

An R-Square value above 0.70 is generally considered strong in social sciences, implying that the model has a good fit and that the independent variables collectively explain a significant portion of the dependent variable's variability. Thus, the high explanatory power signifies that the model effectively captures the factors influencing the success of stunting reduction efforts.

**7. Path Coefficients and t-tests**

Path coefficients represent the strength and direction of the relationships between constructs in the model. Hypothesis testing is conducted using t-tests to determine whether the relationships are statistically significant. In this research, bootstrapping is a resampling technique used in SmartPLS to generate estimates of standard errors and t-values for hypothesis testing. By repeatedly resampling the data, bootstrapping creates a distribution of parameter estimates, allowing for robust testing of the model's paths. The generated t-values are then used to determine the statistical significance of the hypothesized relationships.

*Table 3 Path Coefficients Analysis*

	<i>Original Sample (O)</i>	<i>Sample Mean (M)</i>	<i>Standard Deviation (STDEV)</i>	<i>T Statistics ( O/STDEV )</i>	<i>P Values</i>
<i>Academics -&gt; Effectiveness of Stunting Reduction Program</i>	-0,083	-0,082	0,058	1,434	0,152
<i>Business (Economy) -&gt; Effectiveness of Stunting Reduction Program</i>	0,219	0,213	0,053	4,163	0,000
<i>Community -&gt; Effectiveness of Stunting Reduction Program</i>	0,024	0,030	0,090	0,267	0,789
<i>Government -&gt; Effectiveness of Stunting Reduction Program</i>	0,453	0,453	0,072	6,260	0,000
<i>Media -&gt; Effectiveness of Stunting Reduction Program</i>	0,369	0,369	0,055	6,733	0,000

Source: (Smart PLS 3, 2024)

- 1. Academics -> Effectiveness of Stunting Reduction Program:**  
 The path coefficient is -0.083, with a T-Statistic of 1.434 and a P-Value of 0.152. The negative coefficient suggests a slight negative relationship between academic involvement and the effectiveness of the stunting reduction program. However, the relationship is not statistically significant (P-Value > 0.05), meaning that we do not have sufficient evidence to say that academic contributions significantly influence the program's effectiveness.  
 The hypothesis that academic involvement positively affects the effectiveness of the stunting reduction program (H1) is not accepted.
- 2. Business (Economy) -> Effectiveness of Stunting Reduction Program:**  
 The path coefficient is 0.219, with a T-Statistic of 4.163 and a P-Value of 0.000. The positive coefficient indicates that economic activities from the business sector have a significant positive impact on the effectiveness of the stunting reduction program. The relationship is statistically significant (P-Value < 0.05). The hypothesis that business sector involvement positively affects the effectiveness of the stunting reduction program (H2) is accepted.
- 3. Community -> Effectiveness of Stunting Reduction Program:**  
 The path coefficient is 0.024, with a T-Statistic of 0.267 and a P-Value of 0.789. The community's involvement shows a very slight positive impact on the program's effectiveness, but the relationship is far from being statistically significant (P-Value > 0.05). The hypothesis that community involvement positively affects the effectiveness of the stunting reduction program (H3) is not accepted.
- 4. Government -> Effectiveness of Stunting Reduction Program:**  
 The path coefficient is 0.453, with a T-Statistic of 6.260 and a P-Value of 0.000. Government involvement has a strong and significant positive impact on the program's effectiveness. The high T-Statistic and low P-Value indicate a robust statistical significance (P-Value < 0.05). The hypothesis that government involvement positively affects the effectiveness of the stunting reduction program (H4) is accepted.

#### 5. Media -> Effectiveness of Stunting Reduction Program:

The path coefficient is 0.369, with a T-Statistic of 6.733 and a P-Value of 0.000. The media plays a significant positive role in enhancing the effectiveness of the stunting reduction program, with statistically significant results (P-Value < 0.05). The hypothesis that media involvement positively affects the effectiveness of the stunting reduction program (H5) is accepted.

### **B. Discussion**

#### **1. The role of Academic influences the Effectiveness of Stunting Reduction Programs in Surabaya**

The analysis indicated that the academic sector had a negative and statistically insignificant impact on the effectiveness of the stunting reduction program. This is surprising given the expectation that academia, through research, education, and evidence-based interventions, would play a crucial role in shaping effective strategies. However, the insignificant p-value (0.152) suggests that in the context of Surabaya, the contributions from academia might not be well-integrated or sufficiently targeted towards the practical needs of the program. This could point to potential gaps in the application of academic knowledge to real-world challenges or possibly a lack of collaboration between academic institutions and other stakeholders.

The role of academia in public health initiatives has been well-documented, particularly in the areas of research, policy development, and the provision of evidence-based practices. Studies have shown that academic institutions contribute by generating knowledge that informs effective interventions. The insignificant impact of academia found in your study diverges from the positive contributions generally noted in previous research. This discrepancy could be due to a gap between academic research and its application in the field different with previous research according to Yunas (2024). In Surabaya, it may indicate a disconnect between academic institutions and the practical implementation of stunting reduction programs. Similar challenges have been observed in other regions where academic contributions are not fully leveraged due to barriers in translating research into practice.

#### **2. The role of the Community influences the Effectiveness of Stunting Reduction Programs in Surabaya**

In contrast, the business sector exhibited a significant positive impact (path coefficient of 0.219, p-value of 0.000) on the program's effectiveness. This underscores the importance of economic support in public health initiatives. Businesses likely contribute through funding, corporate social responsibility (CSR) activities, and the provision of resources that enhance the reach and sustainability of stunting reduction efforts. The significant result has contradiction in Trisnaningtyas, et. al. (2023), emphasizes that economic factors and the involvement of private enterprises are crucial for the successful implementation of health programs. This finding supports the idea that public-private partnerships can be highly effective in addressing public health challenges.

The positive role of the business sector in public health has been highlighted in numerous studies, particularly through corporate social responsibility (CSR) initiatives and public-private partnerships. These collaborations often provide vital resources and innovative solutions to public health challenges.

Correlation: Your study's finding that the business sector has a significant positive impact aligns well with this body of research. In Indonesia, and particularly in urban areas like Surabaya, businesses have increasingly engaged in health-related CSR activities, supporting initiatives such as nutrition programs and community health services. This support has been crucial in scaling up efforts to reduce stunting.

#### **3. The role of Business (Economic Sector) influences the Effectiveness of Stunting Reduction Programs in Surabaya**

The community's involvement, surprisingly, showed a negligible and statistically insignificant effect (path coefficient of 0.024, p-value of 0.789) on the effectiveness of the program. This could indicate several potential issues, such as insufficient community engagement, lack of awareness, or cultural barriers that prevent the community from effectively contributing to the program's goals. This result suggests that merely involving the community is not enough; there needs to be a more strategic approach to ensure that community efforts are aligned with the program's objectives. Enhancing community participation through education, empowerment, and more inclusive decision-making processes could be necessary steps forward.

Community involvement is often considered a cornerstone of effective public health interventions, with participatory approaches leading to better outcomes. Studies have shown that when communities are actively engaged, there is greater ownership of health programs and improved sustainability of outcomes (Syamsuadi, Febrianita and Febriani, 2023). The insignificant role of the community in your study is somewhat surprising and suggests that the potential of community engagement may not be fully realized in the context of Surabaya. This could reflect challenges such as lack of awareness, cultural barriers, or insufficient empowerment of community members. Similar issues have been documented in other settings where community engagement has been more symbolic than substantive.



#### **4. The role of Government influences the Effectiveness of Stunting Reduction Programs in Surabaya**

The government's role stood out as the most significant, with a strong positive impact on the program's effectiveness (path coefficient of 0.453, p-value of 0.000). This is consistent with the understanding that government policies, regulations, and funding are foundational to the success of public health initiatives. The government's significant influence likely comes from its ability to create an enabling environment, provide essential resources, and mobilize large-scale efforts to combat stunting. This result underscores the importance of strong governmental leadership and coordination in public health campaigns.

Government leadership is consistently recognized as critical to the success of public health initiatives. Strong policy frameworks, adequate funding, and effective coordination are key factors that contribute to the success of programs like stunting reduction related to Daniel et al. (2023). The strong positive impact of government involvement in your study corroborates this established understanding. In Indonesia, the government has been a driving force behind national stunting reduction efforts, particularly through programs such as the National Strategy to Accelerate Stunting Prevention. The significant influence observed in your study reflects the effectiveness of these governmental efforts, particularly in urban centers like Surabaya.

#### **5. The role of Media influences the Effectiveness of Stunting Reduction Programs in Surabaya**

The media also showed a significant positive impact on the effectiveness of the stunting reduction program (path coefficient of 0.369, p-value of 0.000). Media's role in raising awareness, educating the public, and advocating for behavior change is critical in public health initiatives. The significant contribution of media highlights the power of communication in shaping public perceptions and behaviors, which are essential in tackling stunting. This finding suggests that media campaigns should be an integral part of public health strategies, ensuring that key messages about nutrition, hygiene, and health are effectively disseminated to the target population.

The media's role in shaping public health outcomes is well-documented, particularly in raising awareness and driving behavior change. Media campaigns have been effective in various public health areas, including nutrition, where they have helped to educate the public and promote healthier behaviors. The significant impact of media in this study is consistent with (Utami, Kosasih and Sayidin, 2023). In Surabaya, media campaigns likely played a crucial role in disseminating information about stunting and promoting practices that help prevent it. This finding underscores the importance of continued media engagement in public health initiatives.

#### **6. The role of Academic, Community, Business (Economic Sector), Government, Media simultaneously influences the Effectiveness of Stunting Reduction Programs in Surabaya**

Although individual analysis of the sectors shows that not all components of the Penta Helix model had significant impacts, the combined influence of the model is likely to be positive. The significant contributions from the government, business, and media sectors suggest that when these sectors work together, they can create a synergistic effect that enhances the overall effectiveness of the stunting reduction program. However, the insignificant results from academia and community involvement highlight areas that need further development to maximize the potential of the Penta Helix approach (Purnomo et al., 2023). Given the underwhelming impact of academia observed in your study, future efforts should focus on bridging the gap between academic research and field implementation. This could involve more collaborative research efforts and the development of frameworks that ensure research findings are effectively translated into practice.

The study's exploration of the Penta Helix model's effectiveness in reducing stunting rates in Surabaya provides valuable insights into the roles and contributions of various sectors—academia, business, community, government, and media—within the framework of public health initiatives. The results underscore the significance of certain sectors, while also highlighting areas where improvement is necessary, particularly in translating research into practice and engaging communities effectively.

The findings reveal that government involvement is the most significant contributor to the program's success. This aligns with existing research that emphasizes the critical role of governmental leadership in public health interventions. Government policies, such as Indonesia's National Strategy to Accelerate Stunting Prevention (Stranas Stunting), have been pivotal in coordinating nationwide efforts to reduce stunting (Afandi et al., 2022). The significant impact observed in this study reflects the effectiveness of these policies, particularly in urban centers like Surabaya, where governmental support has facilitated the implementation of large-scale public health initiatives. This finding reinforces the idea that strong policy frameworks, adequate funding, and effective coordination are essential components of successful public health programs.

The business sector also demonstrates a significant positive impact on the program's effectiveness, which is consistent with previous research highlighting the importance of economic support and public-private partnerships in public health. In Indonesia, the business sector has increasingly engaged in Corporate Social Responsibility (CSR) activities focused on health and nutrition, contributing to the broader efforts to combat stunting. These initiatives provide crucial resources and innovative solutions that complement governmental efforts. The positive

role of the business sector in this study suggests that economic contributions are not only beneficial but necessary for sustaining and scaling up stunting reduction programs. This aligns with the broader literature that advocates for the inclusion of the private sector in public health strategies, especially in resource-limited settings where government resources alone may be insufficient.

Media's role in the study is also significant, reflecting its power to influence public behavior and awareness. The effectiveness of media campaigns in shaping health outcomes has been well-documented, particularly in promoting behavior change related to nutrition and hygiene, which are critical in stunting prevention. In the context of Indonesia, where media penetration is high, media campaigns have been instrumental in disseminating health information to a broad audience, thereby amplifying the impact of public health interventions. The study's findings suggest that continued media engagement is vital for sustaining public awareness and encouraging behaviors that support stunting reduction. This resonates with previous research that underscores the importance of strategic communication in public health, particularly in reaching diverse and widespread populations.

However, the study also reveals significant gaps in the contributions of academia and community involvement. The negligible impact of academia is particularly concerning, as it suggests a disconnect between academic research and its application in the field. This divergence from previous research, which typically highlights the importance of evidence-based practices in public health, may indicate that academic institutions in Surabaya are not sufficiently integrated into the practical aspects of stunting reduction efforts. This gap could be due to various factors, including limited collaboration between researchers and practitioners, or a lack of mechanisms to translate research findings into actionable strategies (Caraka et al., 2021). The Indonesian government's policy initiatives, such as the Stranas Stunting, often rely on academic input for the development of effective interventions. Therefore, enhancing the role of academia in this context is crucial for ensuring that public health strategies are informed by the latest research and are tailored to address specific local challenges.

Similarly, the limited impact of community involvement suggests that efforts to engage communities in the stunting reduction program may not be fully effective. While community participation is often lauded as a key component of successful public health initiatives, the study's findings indicate that in Surabaya, this potential is not being fully realized. Previous research supports the idea that community engagement leads to better health outcomes through increased ownership and sustainability of programs. However, in practice, there may be barriers such as cultural differences, lack of awareness, or insufficient empowerment that hinder meaningful community participation. The Indonesian government's community-based health programs, such as Posyandu (integrated health service posts), are designed to engage local communities in health promotion activities. The insignificant role of the community in this study suggests that these programs may need to be re-evaluated and strengthened to ensure that they are effectively mobilizing community resources and participation.

#### IV. CONCLUSION

The results of this study have several implications for both policy and practice in Indonesia. First, the significant impact of government involvement underscores the importance of maintaining and strengthening governmental support for public health initiatives. The success of policies like Stranas Stunting in reducing stunting rates in Surabaya suggests that similar strategies could be effectively replicated in other regions of Indonesia. However, it is also important to ensure that these policies are adaptable to local contexts and are supported by adequate resources.

Second, the positive role of the business sector highlights the need for continued engagement with private enterprises in public health initiatives. Policies that encourage and facilitate public-private partnerships, particularly in areas such as health financing and resource allocation, could further enhance the effectiveness of stunting reduction programs. The Indonesian government could consider expanding incentives for businesses to participate in health-related CSR activities, thereby increasing the availability of resources for public health initiatives.

Third, the significant influence of media suggests that strategic communication should remain a central component of public health strategies. The government, in collaboration with media outlets, should continue to invest in public health campaigns that raise awareness and promote healthy behaviors. These campaigns should be culturally sensitive and tailored to the specific needs of different communities to maximize their impact.

Finally, the limited contributions of academia and community involvement indicate areas where policy interventions could be targeted to improve outcomes. Strengthening the link between academic research and public health practice is essential for developing evidence-based strategies that are effective in the local context. This could involve creating more opportunities for collaboration between academic institutions and public health practitioners, as well as providing support for the translation of research findings into practical interventions.

Additionally, enhancing community engagement through more inclusive and participatory approaches could help to ensure that public health programs are more responsive to the needs and preferences of the local population.

In conclusion, while the Penta Helix model demonstrates considerable potential in reducing stunting rates in Surabaya, the effectiveness of this approach depends on the active and meaningful involvement of all sectors. The significant contributions of government, business, and media sectors highlight the strengths of the model, but the limited roles of academia and community involvement suggest that there is room for improvement. By addressing these gaps and fostering greater collaboration across sectors, the Penta Helix model can be further optimized to effectively tackle the complex challenge of stunting, not only in Surabaya but across Indonesia. The findings of this study underscore the importance of a holistic and integrated approach to public health, where all sectors work together to achieve common goals and improve health outcomes for all.

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