



ENHANCING NATIONAL DEFENSE CAPABILITIES THROUGH COLLABORATIVE PROGRAMS: INSIGHTS AND POLICY RECOMMENDATIONS FOR INDONESIA*

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Abstract. This study analyzes the program planning in the Indonesian defense sector with a focus on the impact of defense spending on economic growth. Through a combination of quantitative analysis of Indonesian defense spending data and qualitative discussions with Indonesian defense economists, the study investigates the effectiveness of productive programs such as collaboration, dual-use capabilities, and empowerment. The findings reveal a positive association between Indonesia's defense spending and economic growth, emphasizing the significance of well-designed collaborative programs. However, ensuring budget certainty for these programs to yield practical benefits is crucial. The study emphasizes the need for the defense budget policy to be clearly stated in the national defense law, ensuring its effective implementation. Furthermore, the study explores potential new collaborative programs and defense and security initiatives that can enhance national defense capabilities. It underscores the importance of fostering collaboration between military and civilian organizations to accelerate innovation in science and technology, proposing the establishment of a defense science and technology park as a platform for such collaboration. The research has implications for policy development and decision-making in the defense sector. By emphasizing the significance of collaborative programs, the study provides insights for policymakers to enhance the effectiveness and practicality of defense initiatives. It also highlights the importance of ensuring budget certainty and incorporating defense budget policy into the national defense law.

Keywords: defense spending; collaborative programs; economic growth; national defense law; defense science and technology park

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1. Introduction

Many studies have shown the importance of collaborative programs, including in the national security and defense fields. Although collaboration is not a new method, and Indonesia has collaborated significantly with other communities owing to the availability of communication technology, there has recently been a strong push for cooperation programs in the field of national defense. Collaboration has been suggested for accelerating innovation, reducing uncertainty, and receiving mutual assistance when implementing a program. For example, science and technology parks (STP) in the scope of defense and security are a proposed form of collaborative organization to increase the productivity of defense R&D (Vásquez-Urriago et al., 2014). Collaborative programs are also productive activities that need government policy support for the planned provision of people, costs, and infrastructure. Within this context, we focus this study on the relationship between defense spending and productivity, highlighting Indonesia's related defense spending policy. Do they include a straightforward cooperation program? Is there sufficient evidence that Indonesia's collaborative defense spending is productive? What are the obstacles to their implementation? This study also discusses innovative ideas for finding solutions and ensuring that programs characterized by collaboration, dual-use, and empowerment are effective. To ensure that acceleration is essential for such a context, we conduct self-convincing data analysis and propose recommendations to policymakers.

Many experts agree that international collaboration can promote closer relations between countries. Intergovernmental collaboration agreements promote close cooperation in science. One of the significant driving contexts for such promotions is the exchange of research experiences and the implementation of technology, education, and cultural policies. However, the collaborative approach is not only in research and technological collaboration but has already been developed in crucial areas, such as overcoming hunger, infectious diseases, and natural disasters.

The discourse on the theme of this collaboration perfectly fits with Indonesia's current and future conditions. Indonesia is a maritime country with various cultural, political, and ecological realities on thousands of islands at the equator. The territory is rich in biodiversity but vulnerable to natural disasters (Timperio et al., 2020). Geopolitically, Indonesia views the importance of global interaction as a new paradigm – how the international community responds to political instability, climate change, and disasters in a region, which in the end, the international view as a widespread problem. The phenomenon of global change transcends national boundaries, and effective risk mitigation requires local and global responses. Such interactions require policy responses to adapt and mitigate risks such as Covid-19. This case demonstrates the application of the new paradigm. Such participants in collaborative organizations voluntarily find effective ways to mitigate Covid-19 risks (Rho et al., 2021). The collaboration lessons related to Covid-19 have reaffirmed the importance of local and globally collaborative activities, now and in the future, especially when urgent decision-making is needed (Ehlers et al., 2021).

Collaboration is a constant feature of modern society (Patel et al., 2012). Although there are still obstacles to implementing interdisciplinary collaboration, the collaborative research approach has received significant attention from many groups (Smolka, 2020). Additionally, the national defense program is a multidisciplinary field. The difficulty often faced in implementing programs that require a prominent level of multidisciplinary care is the limited number of personnel and scientific competence. This forces officers to outsource human resources and collaborate with universities, industries, and NGOs. Defense spending policy documents usually do not hold an explicit "collaboration" program; therefore, implementing units may not execute the program collaboratively. Another problem that often arises when implementing a collaborative approach is the civil-military cultural gap, characterized by the system's non-technical nature and weak interaction between technical and social components to translate defense strategies into work system applications (Liwång, 2022). For example, in this context, the strategic vision of national defense is often challenging to understand by universities and the industrial

community because it is structured in many documents and has a military-specific style, so it is not entirely clear how the vision should be translated into systems design, including the lack of methodological support for the transition from strategy to work system (Hannay & Gjørven, 2021). Despite discussing such difficulties, as many have suggested in the literature, the defense R&D community believes that collaboration between researchers in defense R&D, industry, academia, and NGOs will significantly benefit and have multiple impacts. By continuing to conduct collaborative methods, in the end, there will be a diffusion of understanding of the "work culture" among the civil-military (Patel et al., 2012). Of course, the problem must be addressed is how such an initiative can be sustainably set up and explicitly stated in the defense spending planning policy. Referring to the literature on collaboration, we assumed that defense spending in specific fields with a collaborative approach would positively affect national security and welfare. This study proposes the following hypotheses: (1) defense research and technology have a positive effect on welfare, and (2) research and technology collaboration has a positive effect on welfare.

We conducted a case study to prove both hypotheses using a defense spending dataset and related variables available at the Ministry of Defense, TNI Headquarters, Statistics Indonesia (BPS), Bank Indonesia, and the World Bank.

2. Literature Review and Methods

Collaborative Approach

A collaborative approach between the government, community organizations, universities, and industry has long been proclaimed as an effective working model to solve problems related to defense (Akbar et al., 2021), allowing technology diffusion (Annosi et al., 2021; Endri, 2020) and empowerment (Jackson et al., 2019). The fields are varied, but the most popular are collaborations to solve environmental problems (Yeganeh et al., 2020), energy supply (Kim, 2021), health (Jit et al., 2021), and education (Caniglia et al., 2017). Given that the field of national defense is multidisciplinary, many experts have reviewed the defense aspect's collaborative approach and stated many benefits (Liwång, 2022; McGuire, 2007). Collaboration in national defense and security in Indonesia is implicit in the doctrine of the total defense system, which is contained in many official documents. In addition, to various events, the Indonesian Defense Minister stated the importance of collaboration (Setiadji, 2020). However, cooperation programs are not explicitly stated in Indonesia's defense spending policy documents. Thus, there is no sign in the document of whether an initiative or program will be implemented collaboratively. Even if such collaborative programs exist, documents are usually shown separately (another obstacle).

The Nexus of Defense Spending and Welfare

The defense spending plan has received the most attention, specifically concerning its effect on welfare; for research, proxy data for welfare can be found in economic growth. In Indonesia, defense spending is judged to have a negative or positive effect depending on the regressor variable and the analytical technique used. The positive effects of defense spending on economic growth include job creation (Wing, 1991), security stability (Saputro et al., 2020), and productive investment in human capital (Chairil et al., 2013). A comparison of the effect of defense spending on economic growth between Indonesia and Turkey is interesting; in Indonesia, this effect is positive, while in Turkey, it is negative. If an allocation is unsuitable for the target, economic growth will harm economic growth. Given the importance of a collaborative approach in executing a program, the idea of explicitly spelling it out in a defense spending policy document is fascinating. Not only will it be a guide for program execution, but the collaborative program will also show the effect of defense spending, as shown in the research above. To reinforce the idea of a collaborative program in future defense spending planning documents, we need to update the research described above by adding the latest data to better understand the possible changes in the outcome.

The data reviewed as the focus of the analysis in this study are GDP, defense spending, population, labor force participation, national R&D budget, number of soldiers per thousand population, manufacturing (value-added), number of university graduates per ten thousand population, and soldiers' welfare index. Indonesia's defense spending in the ASEAN region is classified as low based on its ratio to GDP according to the average World Bank data from 1990 to 2020. Based on the average over the past decade, Indonesia's defense expenditure is significantly high, ranking just below Singapore's. Despite defense spending, there is an agreement that expenditure must supply security and increase welfare. This study focuses on understanding defense spending that can increase productivity, economic growth, and welfare. In this context, the literature shows that productivity is related to human resource technology and working capital development. Thus, we presumed that some defense spending would be for working capital and the other would ensure security and protection.

Productivity growth depends on innovation and increased physical and human capital (Gordon, 2018). There are indications that productivity growth is also related to the standard of living costs (Jones & Klenow, 2016) and purchasing power (Ge & Tang, 2020). In Indonesia, the average labor force participation was more than 60%, which at the end of 2005 showed 64%, and in 2020 showed 67.4%. This percentage shows the potential for available labor (productive human resources). To understand the effect of capital, we refer to manufacturing value-added data associated with labor force participation and college graduates. Meanwhile, the welfare level of soldiers with proxies of the per-capita-defense-spending ratio data and the consumer price index will provide an overview of soldiers' standard of living costs, denoted by the soldier's welfare index.

The Model of Defense Spending and Welfare

In the statistical analysis, GDP was the dependent variable, and the others were the independent variables. Inferential statistical analysis was used, which involves various tests commonly applied in econometrics. We conducted twice Focus Group Discussion (FGD) to confirm the findings involving defense economists, NGOs, academics, and representatives of institutions related to the national economy, such as Bank Indonesia, the Ministry of Finance, the Ministry of Education, and TNI Headquarters.

The framework used in this study adopts several neoclassical production function models that have been described in several related studies (Ben Zeev & Pappa, 2015; Edquist & Henrekson, 2017; Herrera & Gentilucci, 2013) in which the formula of the gross output production function is

$$d(Y)=Y(t-1)+m+ m(t-1)+\log(s)+\log(g+n+d)$$

where Y is log(GDP), m is log(defense spending), s is gross domestic fixed capital formation, g is technology value-added in manufacturing, n is the labor force participation index and undergraduates, and d is the GDP deflator. In addition to using the Solow model, the relationship between these variables using the vector autoregressive (VAR) and autoregressive distributed lag (ARDL) approaches is used to understand the shock and the long-term effect of the independent variable on the dependent variable.

The findings of the quantitative analysis were further confirmed through qualitative analysis by discussing the quantitative findings in two focus group discussions (FGDs). The FGDs involved economists from the National Development Planning Agency, Bank Indonesia, Ministry of Finance, University of Indonesia, Indonesian Defense University, National Development University, Presidential Staff, and national economic observer organizations (NGOs) experts. In addition to the FGDs, in-depth interviews were conducted with three Indonesian Defense economists, including a former Minister of Defense, a former Secretary General of Defense, and a Presidential Staff member, focusing on specific themes related to collaboration.

3. Results and Discussion

Productive Program of Defense Spending for Economic Growth

In theory and practice, national security is a priority in every country, but large military expenditures can burden the government considerably and harm people's welfare. Therefore, an effective military budget plan is necessary. How much military spending is “adequate” is always debatable, given that any money spent affects other public expenditures (Benoit, 1978). In a theoretical economy with only two goods, a cliché comes into play: guns vs. butter (Bove et al., 2017). The results of earlier studies generally lead to positive relationships with productivity (Alptekin & Levine, 2012; Chen et al., 2014; Wang et al., 2012). Table 1 shows the relationship between defense spending (M) and economic growth (Y), where M has a significant positive effect on economic growth, which is 11%. However, the lag in defense spending, M(-1), had a significant negative impact of 13% and a total negative effect of -1.86%. This finding is consistent with the results of previous studies (Fatah & Salihoglu, 2016; Revika & Yeniwati, 2019; Wing, 1991). Thus, we conjecture that the nexus of defense spending with economic growth is a short-term effect. Therefore, it is necessary to analyze other dynamic models.

Table 1. Effect of Defense Spending on GDP without Collaborative Programs

Dependent Variable: Y; Method: Least Squares; Sample: 1975-2021; Included observations: 47				
Variable	Coefficient	Std. Error	t-Statistic	p-value
Y(-1)	0.815425	0.049763	16.38626	0.0000
M	0.111354	0.041544	2.680376	0.0105
M(-1)	-0.129981	0.042172	-3.082151	0.0036
S	0.157876	0.043788	3.605476	0.0008
C	0.782037	0.300961	2.598463	0.0129
R-squared	0.997079	Mean dependent var		15.60847
Adjusted R-squared	0.996801	S.D. dependent var		0.313440
S.E. of regression	0.017729	Akaike info criterion		-5.126937
Sum squared resid	0.013201	Schwarz criterion		-4.930113
Log-likelihood	125.4830	Hannan-Quinn criterion		-5.052871
F-statistic	3583.981	Durbin-Watson stat		1.364862
Prob(F-statistic)	0.000000			

Source: raw data from MoD Indonesia, BPS, Bank Indonesia, and World Bank

Meanwhile, technology and participation (X) cause defense spending to affect growth positively. This effect is apparent when Tables 1 and 2 are compared. When we add X (participation and involvement of academia, R&D programs, and dual-use programs in education) into the model (Table 2), the total effect of defense spending becomes positive at 3.8%. Moreover, the constant term (C) significantly increased from 0.78 to 2.41. We interpret this as a strong influence of technology and participation (X) not only on the effect of defense spending but also on other growth factors. Thus, we interpreted the participation and involvement of academia in the program as essential. Another interpretation is that the program in defense spending must exist in the context of encouragement, which is in line with the opinion of most experts that defense spending will encourage the formation of human capital and technological mastery, provide a spin-off, and create productivity. However, some experts believe the net effect is harmful because it still passes through many impact chains (Grobar & Porter, 1989). This opinion can be annulled if defense spending is deliberately directed to encourage growth through collaboration, dual-use, and empowerment programs.

Table 2. Effect of Defense Spending on GDP with Collaborative Programs

Dependent Variable: Y; Method: Least Squares; Sample: 1975-2021; Included observations: 47

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y(-1)	0.579901	0.085381	6.791921	0.0000
M	0.117078	0.047278	2.476385	0.0176
M(-1)	-0.079009	0.040918	-1.930928	0.0606
S	0.167438	0.039638	4.224161	0.0001
X	0.018489	0.047852	0.386375	0.7013
C	2.408866	0.603751	3.989834	0.0003
R-squared	0.997733	Mean dependent var		15.60847
Adjusted R-squared	0.997393	S.D. dependent var		0.313440
S.E. of regression	0.016004	Akaike info criterion		-5.295394
Sum squared resid	0.010245	Schwarz criterion		-5.019840
Log-likelihood	131.4418	Hannan-Quinn criterion		-5.191701
F-statistic	2934.210	Durbin-Watson stat		1.244477
Prob(F-statistic)	0.000000			

Source: raw data from MoD Indonesia, BPS, Bank Indonesia, and World Bank

The inference from Table 3 shows that evidence. It shows that defense spending will improve its effect on economic growth if it involves regressors of effective programs such as R&D, education, and job creation - at least productive factors will reduce the adverse effects or increase the positive effects. Meanwhile, the opinion that the positive effect of defense spending is only possible in developed countries is refuted by research that finds a direct impact of security stability on growth, where security stability is claimed to be a condition for the emergence of economic growth (Chairil et al., 2013).

Table 3. Summary of the Impact of Collaboration and Empowerment on the Defense Spending Relationship and Indonesia's Economic Growth 1975-2021

Year	Non-collaborative Spending				Collaborative Spending			
	M	M-1	Total	Sig.	M	M-1	Total	Sig.
1975-2000	13.29%	-19.69%	-6.40%	<0.05	10.51%	-14.25%	-3.74%	<0.05
2001-2010	-0.24%	2.66%	2.42%	<0.05	4.04%	2.62%	6.66%	<0.05
2011-2021	1.61%	-3.71%	-2.10%	>0.05	1.03%	-2.29%	-1.26%	>0.05
1975-2021	11.14%	-13.00%	-1.86%	<0.1	11.71%	-7.90%	3.81%	<0.05

Source: raw data from MoD Indonesia, BPS, Bank Indonesia, and World Bank

Subsequently, we used the vector autoregressive (VAR) approach to analyze the long-term effects and shocks on economic growth that may occur when the elements of productivity, dual-use, and participation are involved. We find that the defense spending response caused a shock to economic growth in the third year, although there was a slight downward effect in the fourth year, as shown in Figure 1. In advance, we replaced capital with Foreign Direct Investment (FDI), and it shows that the growth response becomes negative (<-1%), and we interpreted that it does not cause a shock.

Academic participation is essential in another simple simulation using ordinary least squares (OLS). As Table 4 shows, defense spending positively affects economic growth by 12%. Meanwhile, when we excluded X, the model was unfit (worse, by looking at the Durbin-Watson statistic < 1.00), so we could not interpret it further.

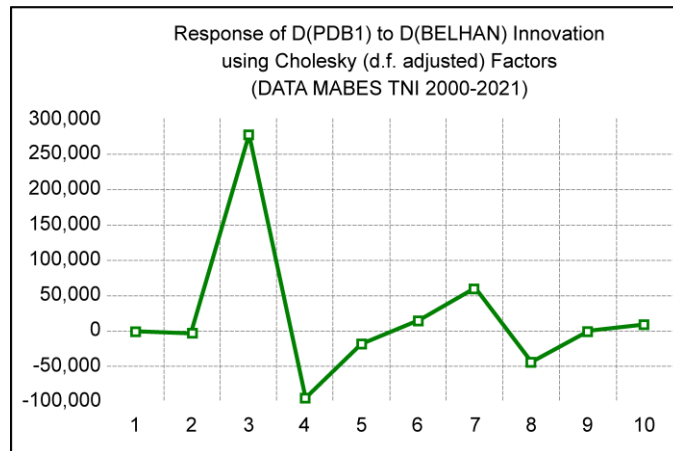


Fig. 1. Response of Economic Growth (PDB1) to Defense Spending (BELHAN) with technology, skill labor, and capital formation
Source: raw data from MoD Indonesia, BPS, Bank Indonesia, and World Bank

Table 4. Simple Simulation Results

Dependent Variable: Y; Method: Least Squares; Sample: 2000-2019; Included observations: 22				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
M	0.117969	0.032344	3.647283	0.0020
S	0.518610	0.128422	4.038315	0.0009
X	1.344836	0.143667	9.360808	0.0000
DEF	-0.999091	0.120123	-8.317196	0.0000
C	0.585944	0.700801	0.836107	0.4147
R-squared	0.997486	Mean dependent var		15.87625
Adjusted R-squared	0.996895	S.D. dependent var		0.188782
S.E. of regression	0.010520	Akaike info criterion		-6.074389
Sum squared resid	0.001881	Schwarz criterion		-5.826425
Log-likelihood	71.81828	Hannan-Quinn criterion		-6.015976
F-statistic	1686.432	Durbin-Watson stat		1.919685
Prob(F-statistic)	0.000000			

Source: raw data from MoD Indonesia, BPS, Bank Indonesia, and World Bank

Tangible and Intangible Effect of Defense Spending on Economic Growth

We held the Focus Group Discussion (FGD) on June 29, 2022. The FGD was attended by experts in the defense economy in Indonesia with four main speakers, including Prof. Purnomo Yusgiantoro, former Minister of Defense of the Republic of Indonesia, and Prof. Jaleswari (Presidential Expert Staff). The FGD discussed perfecting the effect of defense expenditure on economic growth. From the FGD, we noted several criticisms of the use of the model, such as 1) the model only involves tangible data, while the defense spending effect should also refer to the intangible effect; and 2) the model uses macro data, while a plainer effect will be seen in microdata.

To follow up on the criticism, we conducted a preliminary analysis of the relationship between defense spending and growth using interpolated data on the "Indeks Bela Negara (IBN)." IBN is a measure of Indonesian citizens' intention to defend the country since 2016 by MoD Indonesia. Conceptually, the IBN represents the intangible effect of defense spending on growth. To predict the impact of defense spending on IBN, we performed a linear interpolation of IBN with the BPS criminality data regressor (2005-2019) to obtain sufficient data for the preliminary study. We find that defense spending positively affects IBN (see Table 5). Based on the results of the preliminary analysis of this study, we interpret that defense spending, including its intangible effects, has a

positive effect on welfare if it has empowerment, dual-use, and collaborative programs (see Table 6). Of course, we need the actual measurement results of the IBN to obtain sufficient information about the intangible effects of defense spending on economic growth. Therefore, we encourage researchers to do so when the amount of IBN data is sufficient or when there is another regressor with proper data.

Table 5. The Effect of Changes in Defense Spending on IBN

Dependent Variable: IBN; Method: Least Squares; Sample: 2002-2018; Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M)	1.707846	0.571669	2.987473	0.0097
X	12.05109	0.451303	26.70289	0.0000
C	-126.1588	7.214093	-17.48782	0.0000
R-squared	0.980755	Mean dependent var		66.48843
Adjusted R-squared	0.978006	S.D. dependent var		3.191143
S.E. of regression	0.473258	Akaike info criterion		1.500433
Sum squared resid	3.135623	Schwarz criterion		1.647470
Log-likelihood	-9.753678	Hannan-Quinn criterion		1.515049
F-statistic	356.7364	Durbin-Watson stat		2.465953
Prob(F-statistic)	0.000000			

Source: The raw data are from MoD Indonesia, BPS, Bank Indonesia, and World Bank

Table 6. The Effect of IBN and Defense Spending on Economic Growth

Dependent Variable: D(Y); Method: Least Squares; Sample: 2002-2018; Included observations: 17

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M)	0.158533	0.042733	3.709837	0.0007
D(IBN)	0.002493	0.001048	2.379563	0.0226
C	0.022517	0.002970	7.581949	0.0000
R-squared	0.364167	Mean dependent var		0.024510
Adjusted R-squared	0.329797	S.D. dependent var		0.022680
S.E. of regression	0.018567	Akaike info criterion		-5.062783
Sum squared resid	0.012756	Schwarz criterion		-4.936117
Log-likelihood	104.2557	Hannan-Quinn criterion		-5.016984
F-statistic	10.59567	Durbin-Watson stat		1.709918
Prob(F-statistic)	0.000230			

Source: The raw data are from MoD Indonesia, BPS, Bank Indonesia, and World Bank

Table 7. The Thematic Maps of the Defense R&D Collaboration Program Resulting from FGDs and Expert Interviews

Collaborative Programs of R&D	Scope	Perceived Impact	Participants in Programs
KFX/IFX	Indonesia-ROK-Italy-US	High	Universities, R&D agencies, defense industries
MEF	Multilateral	Low	Military R&D and defense industries
UAV	Indonesia-Turkey	Mid	Universities, R&D agencies, defense industries
Munition	Domestic	Low	R&D Agency (MoD) and Dahana (Defense Industry)
Humanities/Social (e.g., Pandemic Threats)	Domestic	Low	Universities, R&D agencies, NGO
Other Tech & Innovation	Multilateral	Low	Universities, R&D agencies, defense industries
Other special military programs	Military - Multilateral	Very low	Military R&D agencies, defense industries

Source: Authors

Table 7 provides a valuable thematic map derived from the Focus Group Discussion (FGD) and expert interviews, shedding light on the Defense Research and Development Collaborative Program (R&D) which further explains the quantitative results. We mapped out the themes of the FGD results and interviews about the perspectives of experts and FGD participants (qualitative approach). Table 7 is a summary of examples of collaborative programs

discussed. The table allows us to examine the scope of these programs, their perceived impact, and the diverse range of participants involved. This insightful information, sourced from a study conducted in 2022, reveals that not all Defense R&D collaboration programs are regarded as having a significant impact on production capacity and independence. In fact, most programs are perceived to have a low effect. These findings critically examine the results of the quantitative approach. Even though collaboration is known to have a positive effect quantitatively, the correction is given by the results of an expert perspective which stimulates further discussion. Several proposals for new strategies to increase their impact were in the discussions. One potential approach is establishing a Science and Technology Park and encouraging start-up technology innovation. By engaging promising and emerging researchers, these initiatives can facilitate the development of their skills and capacities, thereby contributing to the effectiveness and productivity of collaborative programs. As such, the analysis provided has underlined the importance of continuous evaluation and exploration of innovative steps to augment the impact of the Defense R&D collaboration program. By utilizing new approaches and involving various stakeholders, the defense sector can strive for greater efficiency and effectiveness in research and development efforts, increasing the capability and independence of national defense.

The following section discusses the quantitative results combined with the interviews and FGDs (qualitative approach) results.

Lessons from Pandemic Era: Collaborative Programs

Although the research results between defense R&D and universities in Medan and Padang in 2019 have demonstrated the hypothesis of a biological attack and found weaknesses in the national organization for handling pandemics, these results have received little response from relevant agencies. In 2020, there was a Covid pandemic, proving their findings that the organization for handling the national Covid pandemic was not ready for various reasons and obstacles. This fact shows that research results related to national defense in social threats have not received sufficient attention - indicating a low effect on influencing stakeholders.

Moreover, the FGD discussed collaboration programs during the Covid pandemic, which showed that collaboration was necessary. The experts taking part in the FGD indicated that the problems that arose could no longer be overseen on a sectoral basis because of limited human resources, infrastructure, and unavailable technology. This problem will continue in the future, considering the increasingly diverse sources of threats, such as climate change and environmental damage, limited energy sources, and political instability in several regions of the world. In the context of learning from the covid pandemic, resources, such as public and private hospitals and other facilities, are limited. In this context, TNI health facilities throughout Indonesia have been transformed, and their ability has increased to minimize the pandemic risk. Likewise, the budget for doctors, nurses, pharmacists, and even military defense has been diverted to deal with the pandemic on a large scale. What has been done in Indonesia has also been done in many countries.

Nevertheless, the pandemic has taken a heavy toll and shows there are still shortcomings in handling it, and perhaps Indonesia is too ego sectoral. However, the pandemic has strengthened Indonesia's belief that there are common problems that will occur that must be discussed and addressed together at the national, regional, and global levels. Therefore, a strategic community should evaluate alternative procedures to prepare for adjustments. Many scholars have voiced such ideas, for example, the hope for evaluation of defense policies under new scenarios (Hoffman, 2021), the need to develop a massive global collaborative framework for virus research, and the need for collaboration between stakeholders during and after the pandemic (Lepore et al., 2021). In line with the encouragement of these experts, the Indonesian Vice Minister of Defense conveyed the importance of collaboration in implementing 2022 work programs. Finally, this paper also underlines the importance of the work program in the policy document of the national defense spending plan marked "collaborative program."

The context of the collaboration program has recently become warmer with the COVID-19 pandemic. Most government expenditures, including some defense programs, have been suspended and reallocated. All health infrastructure and military medical personnel, including nonmedical soldiers, were deployed to overcome the pandemic and enforce health protocols. Under such conditions, collaboration occurs simultaneously, and previously unthinkable problems arise, such as influential interagency roles and the need for planned collaborative programs.

Lessons from the Minimum Essential Force (MEF) policy: a More Definite Defense Spending Plan

In addition to the type of cooperation program, the next effort discussed in the FGD was strengthening the science and technology community and its organization in the context of the policy to fulfill weapons capacity, known as the MEF policy. The main program in the MEF policy has been realized at 63% and should be completed by 2024. However, owing to various obstacles, especially the annual defense budget uncertainty, the MEF program may be delayed until 2030. Based on the MEF obstacle experience, the FGD experts highlighted the need to optimize defense spending by highlighting the efficiency of operating costs, maintenance, spare parts fulfillment, and reducing depreciation rates, all of which will appear in the cooperation program. They also emphasized the importance of SciTech acceleration programs for human capacity building, such as research and education, and the preparation of infrastructures, such as laboratories, places of education, and places of practice.

In contrast, others highlight the stability of the annual defense budget so that the execution of its programs can be directed consistently to provide positive support for economic growth. Therefore, the uncertainty of MEF budgeting has inspired FGD participants to propose a more definite defense spending plan. Their idea is to include a percentage of the defense budget in the amendments to the National Defense Law, 2002 (Act No. 3/2002), based on a GDP of 1% or an APBN of 10%.

Defense Science and Technology Park (DSTP): a Collaboration Model for Accelerating Innovation

One idea to accelerate the collaborative initiative is to set up a defense STP. For example, this idea involves the development of a defense equipment maintenance depot using the STP model. The new idea of uniting military equipment maintenance depots by adopting the Science and Technology Park (STP) model (Balle et al., 2019) is interesting for further elaboration. The STP model is considered suitable for accelerating the increase in the capacity of defense technology and innovation (Vásquez-Urriago et al., 2016), which is generally an advanced and relatively updated technology (not obsolete technology). This model is also considered suitable for providing facilities for the SciTech community because it will be dual-use and can empower small industries (start-ups) to the defense industry, which is already solid. The government of Indonesia declared the STP. They included the STP in the 2015 National Development Plan. The Government of Indonesia announced one hundred STPs in 2019, though only 22 STPs are currently being developed. The STP is intended to cultivate science and technology in Indonesia and is expected to be the motor of collaborative programs in a regional context. Therefore, building an equipment maintenance depot for the military with the STP model has a double effect: as a military facility, as well as serving the community's needs. It will accelerate the dissemination of military technology to the public, academia, and industry and serve as a platform for the SciTech Community. Finally, it is essential to emphasize that effective programs characterized by collaboration, dual-use, and empowerment must be included in planning policy documents to implement them according to their targets. This study highlights the context of collaboration, dual-use, and empowerment for effective spending programs in Indonesia's future defense spending to support national economic growth.

Conclusion

The results demonstrate the positive impact of defense spending on economic growth in Indonesia, mainly when defense initiatives and programs prioritize productivity, dual-use capabilities, and empowerment through collaboration. However, it is important to acknowledge that the lag in defense spending has a significant negative effect, indicating a short-term influence on economic growth.

Regarding the practical implications of these findings, fostering collaboration between military and civilian organizations to expedite innovation in science and technology is crucial. Establishing a defense science and technology park (DSTP) in Indonesia could serve as a viable solution to facilitate such collaboration. The DSTP can have a dual effect by providing maintenance facilities for both military and civilian equipment, facilitating the dissemination of military technology knowledge to the public, academia, and industry, and acting as a platform for the Science and Technology (SciTech) Community to generate ideas and foster interaction among its members. Furthermore, ensuring the certainty of the annual defense budget will facilitate effective planning and ensure its successful implementation. Therefore, we recommend further research focusing on the inclusion of the specific defense budget amount in the amendments to the National Defense Law.

This study contributes to scientific novelty by highlighting the importance of collaboration, dual-use capabilities, and productivity in defense spending programs for stimulating economic growth. Additionally, the proposal of a defense science and technology park as a platform for collaboration and innovation represents a novel approach to enhancing the effectiveness and practicality of defense initiatives.

It is important to acknowledge the limitations of this research. Firstly, the study relied on available data and may not capture all relevant variables that could impact the relationship between defense spending and economic growth. Secondly, the analysis was conducted within a specific time frame and may not account for long-term effects or changing dynamics in defense and economic policies. Further research should consider these limitations and explore additional factors that may influence the relationship between defense spending and economic growth in Indonesia.

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