

How Can Defense Industries Balance Innovation with Cost-Effectiveness and Budget Constraints

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Abstract

The defense industry is required to always innovate in order to face changes in the way of fighting and maintaining national defense. Various schemes can be implemented to realize innovation in the defense industry, such as research in educational institutions, joint production and optimization in potential private industries, but the defense industry facing the problem that always accompanies the development of defense technology, namely the lack of budget, the research budget in Indonesia alone is only around 0.8% of GDP. This figure does not cover research activities in other sectors. How the defense industry overcomes this challenge, of course it must have the best strategy to optimize the available budget, the government can take a crucial role in this matter by making its own regulations if foreign suppliers want to market their products in Indonesia, regulations can take the form of an obligation to provide production cooperation or even the obligation to provide training or technology to Indonesia, another scheme can also be pursued by playing with potential industries that already have basic technology to be developed into military technology so that the main defense industry is not too burdened with complex development activities and starts from zero.

Keywords: *Optimize Budget, Innovation, Defence Industry*

INTRODUCTION

The biggest challenge in the defense industry is the need for rapid innovation in the face of a very dynamic economic situation. The high cost of research in the field of maintenance means that economically strong countries automatically have good and superior defense development capabilities. developed countries must allocate a research and development budget to GDP of more than 1 percent or 2 percent, why is that because the key to excellence, including in the defense sector, lies in how a country treats research and development for progress.

Defense technology and industry developed very rapidly during the Cold War. This condition was related to the arms race between the two superpowers at that time. When the Cold War ended, some people assumed that the arms race would stop and defense technology and industry would not develop as rapidly as during the Cold War. This opinion is based on the writings of Francis Fukuyama who stated that with the end of the Cold War the world would become more peaceful and weapons would no longer be the country's main concern (Amann et al., 2021).

Mastery of technology is still hampered by various problems, including the low capability and capacity of national science and technology institutions. In 2001, Indonesia was ranked 60th out of 72 countries in the Technology Achievement Index (IPT) and in 2024 it was ranked 45th, while in the world Innovation Index Indonesia was ranked 61st out of 132 countries. One of the causes of low competitiveness is weak mastery of technology. The lack of technological resources is also reflected in the low quality of human resources in the technology sector. Another problem is the ineffective communication system between research and development (R&D) institutions and strategic industries.

The development of the defense industry requires technology that is much more sophisticated than other industrial technology, while technology in Indonesia is still very limited.

The Chairman of the Executive Board of the National Private Defense Industry Association (Pinhantanas) also explained that technology in the military sector is currently very sophisticated and military missions are very risky if the equipment used does not have specifications according to standards and needs (Commission 1 2021). Currently, weapons technology with stealth capabilities and unmanned weapons such as Unmanned Aerial Vehicles (UAV) are the mainstay products of the defense industry in developed countries. Meanwhile domestic products are not yet able to meet technological specifications, engineers capable of high technology in the country are still limited, the scope of Research and Development (R&D) is also still small to be able to reach complete technological needs and requires quite a lot. Money. The birth of modern technology must begin with research and development to apply knowledge that has been studied in depth and in a planned manner. Human resources are the main component in determining the success of R&D work. Limited quality and quantity of technology experts will only hamper the R&D function. Research and development is a bridge that connects science and technology with human interests. Therefore, R&D institutions must be supported by qualified technological experts and in sufficient numbers (Antvik, 2009). Many types of military equipment produced by the Industry are being seriously impacted by unsustainable cost increases. Several studies show how high the costs are for each new generation of frigate class ships, main battle tanks, fighter aircraft and other defense equipment which is currently experiencing a push for innovation such as unmanned aircraft or drones which are considered more efficient to support risky defenses. operations with more complex characteristics.

Previously, there were several studies related to the journal that is currently being researched. Research by (Amann et al., 2021) examines the concept generation process for complex defense equipment by looking at how the affordability of defense equipment is managed and finding possible ways to stop increasing costs for unsustainable types of defense equipment. The research examined two cases of conceptualizing future combat air equipment based on the company's perspective. While both cases show that neither concept was judged to be able to reduce cost escalation, they do offer ways to encourage a more innovative concept generation process that is oriented towards future defense equipment capabilities. (Putra et al., 2025) used Bidle and Thomas' role theory, which includes three main aspects, namely role behavior, role conflict, and role ambiguity to analyze the contribution of the defense economy to national economic growth. The study emphasizes that government decisions in determining defense budget allocations can support economic growth. However, transparency and efficient management of the defense budget determine its effectiveness. (Pukhova et al., 2021) analyzes the main steps needed in implementing more effective public-private partnership (PPP) mechanisms in the implementation of large-scale infrastructure projects to develop the innovation potential of the Russian defense-industrial complex. The study presents a graphical interpretation of the financing procedure of the Russian State Defense Order (SDO) as well as shows the system of interaction between the elements of the procedure elements and makes recommendations for the development of public-private partnerships (PPP). Research into how the defense industry can balance innovation with cost-effectiveness and budgetary constraints is critical as the sector faces unique challenges in developing advanced technologies while ensuring financial sustainability. The pressure to continually innovate to meet increasingly complex threats, while at the same time working within tight budget constraints from both government and industry partners puts the defense industry under constant pressure. Therefore, this article aims to discuss how the problem of limited defense equipment budgets is faced with increasingly complex innovation demands from the perspective of how the defense industry overcomes these problems

RESEARCH METHODS

This paper uses a descriptive analytical approach by collecting data through secondary sources derived from existing literature, combining innovation drive and budget constraints by looking at the most effective model in formulating innovation strategies in the defense sector coupled with the best systems thinking model to solve existing problems. Descriptive analysis is an empirical study that investigates a specific phenomenon and aims to gain a deeper understanding of the relationships between variables. This research data was collected from secondary data obtained from various sources, such as journals, articles, government reports, and others. The data or information obtained is then processed through systems thinking by producing a model called the Causal Loop Diagram (CLD). The research question is How can the defense industry balance innovation with cost effectiveness and budget constraints?

RESULT AND DISCUSSION

There are three things that can be considered to be implemented in facing the challenges of the global defense industry ecosystem in the context of Defense Industry Innovation with a limited budget. First, the national defense industry can map strategic alliances that have an impact on the distribution of defense technology, especially strategic alliances that are relevant to the development of the defense industry in Indonesia. This mapping is carried out to find out what cooperation model is in accordance with the development of the Indonesian defense industry. The existence of a strategic alliance is expected to help encourage innovation so that the Indonesian defense industry in the future can produce products with high and new technology. Technology transfer efforts with selected strategic partners will be easier to achieve, and will help facilitate effective and efficient technology mastery so that it can advance the national defense industry in the long term (Dzikri, 2016).

The next step is to identify strategic defense industry partners and technology needs. The right defense industry partners will later facilitate the technology transfer process, and other cooperation modes that can later affect the profitability of the industry. The right cooperation partners will have the potential to benefit the national defense industry. The spread of innovation will also be easy to do without being constrained by various requirements or other policies that hinder cooperation.

The last is to encourage the creation of a global ecosystem by preparing all forms of its needs, such as building relevant digital infrastructure. The readiness of digital infrastructure will have a long-term impact, and will facilitate the management process from an internal industrial perspective. In addition, the readiness of digital infrastructure will affect the development of digital technology innovation. Through the discussion above, efforts to contribute to the global supply chain are steps for the Indonesian defense industry to advance. Some examples of cooperation that have been carried out by the Indonesian defense industry are such as joint ventures, joint development, joint research, and offsets. Of all the cooperation models, the joint venture cooperation model gets the main focus from various parties involved in the defense industry. Joint venture efforts must be accompanied by collaboration with the government in investment planning, workforce provision, and research and innovation. In addition, management of working relationships with international partners is also needed. Managing sustainable working relationships (Ayers, 1996).

Financial capability has become a significant challenge for Indonesia to develop its defense capability, including the national defense industry. Adequate financial capability is

expected to increase the bargaining power of the Indonesian government to obtain a return in the form of technology transfer from the purchase of defense equipment. Indonesia is expected to have wider options in purchasing defense equipment. The defense budget, which is set at around 1 percent of total GDP, in reality provides very limited room for maneuver for Indonesia's defense spending. This budget limitation has long been the cause of the imbalance in the defense economy. Increasing the defense budget can certainly have a positive impact on the development of Indonesia's defense capability. However, this budget increase does not necessarily guarantee the use of funds that are appropriate and on target. Therefore, additional funds for defense spending must be focused on being appropriate and on target by allocating an integrated acquisition budget. Increasing the defense budget in general will be difficult to produce maximum results for at least two reasons. First, the component of defense equipment spending in the defense budget is limited. It is common knowledge that the current defense budget has a significant allocation of employee spending, around 60-70 percent of the total. In the 2023 budget, the percentage of the defense equipment modernization budget, nondefense equipment, and defense infrastructure covers around 26 percent of the total defense budget. Meanwhile, the allocation of funds for research, industry, and education is still less than one percent. Based on the composition of the 2023 defense budget, it can be said that increasing the defense budget in general will only have a minimal impact on the quality of weapons procurement. Second, there are differences of opinion on the priority of defense equipment acquisition between the military and the Ministry of Defense. The Headquarters (Mabes) of the Armed Forces has played a vital role in determining the acquisition of defense equipment. Based on the Regulation of the Minister of Defense Number 17 of 2014 concerning "Implementation of Procurement of Main Weapons Systems within the Ministry of Defense and the Indonesian National Armed Forces", the Armed Forces Headquarters has the authority to determine the technical specifications (spektek) of the defense equipment to be purchased. After the determination of the spektek by the Armed Forces Headquarters, the purchase proposal is then forwarded to the TNI Headquarters to obtain approval from the TNI leadership. The next stage is the discussion and consideration process by the Ministry of Defense. Reflecting on the second problem above, a breakthrough is needed to ensure alignment between the purchase of defense equipment by the military and the development of the national defense industry, especially in pursuing the transfer of technology needed by the strategic industry.

Therefore, providing a special budget for the acquisition of defense equipment alone is not enough. A guideline is needed that aims to ensure that the purchase of weapons produces a return on the transfer of technology needed by the national defense industry. Therefore, this special acquisition budget must be focused on the purchase of types of defense equipment that can provide positive returns on the 10 priority programs of the national defense industry initiated by the KKIP. The implementation of this guideline is expected to maximize the impact of acquisition through a special budget for the national defense industry.

In addition, the strategy above will strengthen the control of the Ministry of Defense in the TNI defense equipment acquisition process. The Ministry of Defense will have strong justification in guiding the acquisition of weapons, where this role has been carried out by the ministry. In addition to the special acquisition budget, a special budget is also needed to support technology development activities. The stability of the research budget is an absolute requirement to maintain technological development in the national defense industry. This special research budget is provided to ensure financial support in the research sector. The continuity of the availability of research budget will provide consistency of efforts in the field of technology development. In addition, it is also necessary to apply special stimulation for research. The provision of research budget can be allocated in the annual defense budget with a percentage set

by the government. Similar to the acquisition budget explained above, this special research budget must also be linked to the plan to succeed the national priority program.

Empowerment Of Potential Industries

Additional funding support can also be provided to improve the performance of the supporting and component industry. There are at least five reasons why the supporting and component industry needs special attention. First, improving the performance of the supporting and component industry can strengthen Indonesia's position in the global supply chain so that it can become a supplier of supporting components and a provider of supporting services. Strengthening Indonesia's position in the global supply chain is expected to have a snowball effect on the national defense industry, especially with international cooperation that can facilitate technology transfer. Second, the post-COVID-19 pandemic conditions provide economic opportunities in the supporting and component industry. The COVID-19 pandemic has caused severe disruption to the global logistics distribution system, including the defense distribution chain. Many productions from various industries have stagnated, which is also experienced by the defense industry. As a consequence, the need for supporting components is high. This is certainly a business niche that can be explored by Indonesia. Post-pandemic conditions also make the global industry prepare to return to the rhythm of activities and readiness as before the pandemic broke out. Defense readiness requires readiness of defense equipment which of course requires harwat to maintain this readiness. However, the scarcity of spare parts due to the disruption of the pandemic and sudden massive demand has made it difficult for the global harwat network to meet existing demand (Prihandoko et al., 2023).

Third, special subsidies for the supporting component industry can increase the spin-on and spin-off capabilities of the supporting component industry. Many of the supporting component products are not only exclusive to war equipment, but also for civilian use. Of course, increasing the capacity of the supporting component industry can have a broader positive impact on the economy in general, not only in the defense economic sector (Croissant, 2009).

Fourth, increasing the support capacity for the main guide industry. Providing a special funding support scheme for the supporting component and harwat industries can be a solution to indirectly improve the performance of the main guide industry. As previously mentioned, one of the problems of the national defense industry is the lack of local supply chain support for the main guide industry. Therefore, the development of the supporting component industry is expected to improve the quality of the local supply chain.

Fifth, increasing Indonesia's bargaining power in intergovernmental defense industry business agreements (G-to-G). The heating geopolitical conditions do not necessarily open up greater opportunities for the Indonesian defense industry to develop. As mentioned in the previous section, the heating geopolitical conditions actually weaken the bargaining power of countries like Indonesia that have limited financial capabilities. However, the scarcity of spare parts and excess capacity of spare parts depots globally certainly make parties who have access to both have stronger bargaining power. Coupled with the increase in defense budgets in several countries, defense spending has become more stable. Therefore, Indonesia's success in improving its performance in the field of supporting component production and spare parts can strengthen Indonesia's bargaining power in negotiations on acquisition agreements and defense cooperation and take advantage of the heating geopolitical conditions.

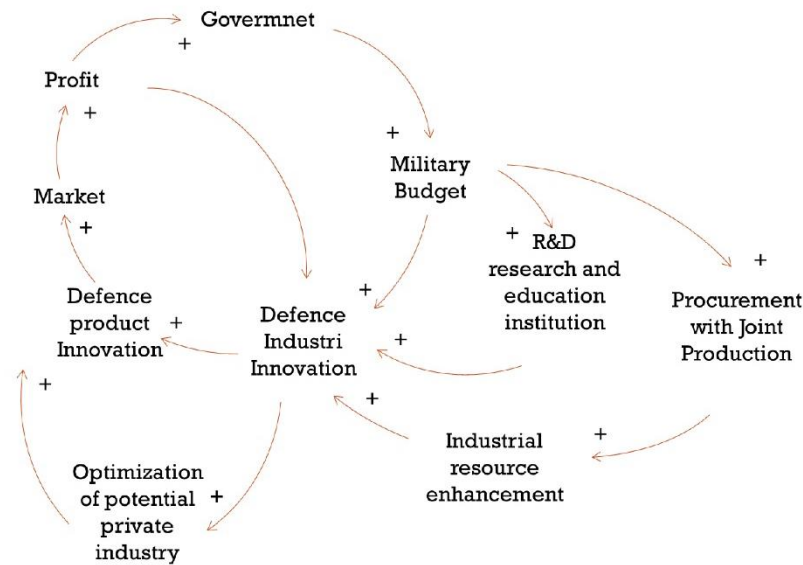


Figure 1: System Thinking on defense industries balance innovation with cost-effectiveness and budget constraints

- The government provides a military budget that can be used for various activities, although limited to obtain research and innovation value
- The defense budget can be used for research and development in research institutions and education to accelerate defense innovation in the industry
- The military budget can also be used for joint production programs when purchasing imported weapons as a requirement for foreign suppliers to market their products in Indonesia, the results of the joint production program are useful for increasing capacity in the defense industry.
- The use of the military budget directly given to the defense industry can be used to optimize potential private industries that already have previous technology
- The entire budget ceiling given with various usage schemes will have an impact on innovation in the defense industry itself.
- Defense industry innovation will produce defense innovation products that can compete in the market.

The profits obtained from defense innovation products can be reused for innovation in the defense industry or entered into the government and budgeted again for military needs

CONCLUSION

The budget constraints for defense in developing countries are an extraordinarily complex challenge including Indonesia, on the one hand the economies of developing countries struggle for the basic needs of citizens on the other hand there is the defense sector that must be considered because defense threats haunt at all times. The defense industry faces complex innovation demands but limited budgets, requiring strategic and tactical schemes so that limited budgets can be optimized very well. Schemes that can be used to optimize innovation budgets can be through research and development in research and development institutions and joint production programs when procuring military defense equipment from abroad Major defense industries have a logical scheme by optimizing the private defense industry so as not to burden activities in major industries. In figure 1, system thinking provides an overview of how to think

conceptually how the challenge of budget constraints for the military can be overcome with several strategies, the demands of innovation due to feedback from users and market changes are the main points in the development of the defense industry, strategies to support innovation in the defense industry can be pursued through international cooperation during the procurement of defense equipment. In addition, using capabilities optimally in higher education institutions is an important part that should not be ruled out in the development of the defense industry.

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