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High Technology Mastery: Challenges and Strategies in the National Defense Sector

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Abstract

In the era of globalization and increasingly rapid technological development, mastery of high technology is one of the main keys in maintaining the sovereignty and security of a country. Indonesia, as a country with a large territory and significant strategic interests, needs to strengthen its technological capabilities, especially in the field of defense. Advanced defense technology not only functions as the main tool in maintaining national security, but also as a support in overcoming various increasingly complex threats and challenges. Indonesia has set a long-term vision of "Indonesia Maju 2045" and has identified ten main technologies (10TU) that have great potential to accelerate Indonesia Maju 2045. The system thinking approach allows us to understand the relationship and interaction between various components in the defense technology system. Thus, key factors that influence each other in mastering the technology can be identified. Meanwhile, SWOT analysis helps identify the strengths, weaknesses, opportunities, and threats faced in the development of defense technology in Indonesia. To strengthen the ability to master national defense technology, Indonesia must adopt a comprehensive and sustainable approach. One of the initial steps is to improve the quality of education and training in the field of defense technology. The government needs to strengthen policies that support technology transfer and international cooperation. By implementing this comprehensive and sustainable strategy, Indonesia will be better prepared to face future challenges and threats, and will be able to effectively defend national sovereignty and security.

Keywords: Technology Mastery, System Thinking, Swot

INTRODUCTION

In the era of globalization and increasingly rapid technological development, mastery of high technology is one of the main keys in maintaining the sovereignty and security of a country. Indonesia, as a country with a large territory and significant strategic interests, needs to strengthen its technological capabilities, especially in the field of defense. Advanced defense technology not only functions as the main tool in maintaining national security, but also as a support in overcoming various increasingly complex threats and challenges.

The development of high technology, especially in the field of defense, has a strategic role in strengthening the sovereignty and security of a country. In Indonesia, mastery of defense technology is crucial considering the geopolitical challenges and security dynamics that continue to develop. Increasing the capabilities of national defense technology and industry is not only important to meet domestic defense needs, but also to increase competitiveness in the international arena.

Efforts to develop defense technology in Indonesia face various factors that influence it. These factors can be internal strengths such as human resources and technological infrastructure, weaknesses in the management and funding systems, opportunities from international cooperation and technology transfer, and threats from global and regional political dynamics.
The importance of mastering high technology in the defense sector in Indonesia has become a major concern for the government. This is reflected in various policies that encourage the improvement of technology and the capabilities of the national defense industry. However, to

achieve optimal technological mastery, a comprehensive analysis of the various factors that influence it is needed.

Mastery of high technology, including defense technology, is very important in improving the capabilities and competitiveness of a country. Indonesia, as a country with a long-term vision of "Golden Indonesia 2045", has set a strategy to improve technological mastery in various sectors, including defense. However, technological mastery in Indonesia still faces several challenges. The latest data shows that technological mastery in Indonesia is still low.
According to BSN, Indonesia's national industry is considered still weak in technological mastery, especially in the research and development (R&D) facilities owned by the industry. In addition, the Chairman of the National Alliance Pontjo Sutowo also said that technological mastery in Indonesia is still very low, due to the lack of a conducive national innovation ecosystem.

The use of digital technology is also still limited. Indonesia has a large population, but Internet penetration and the use of digital technology are still low. According to Internetlivestats, Internet penetration in Indonesia in 2014 was around 17 percent, while in India it reached 19 percent. The Internet penetration rate in Indonesia is even far lower than Southeast Asian countries, such as Vietnam (43 percent), the Philippines (39 percent), Malaysia (40 percent), and Singapore (81 percent). Indonesia has set a long-term vision of "Indonesia Maju 2045" and has identified ten key technologies (10TU) that have great potential to accelerate Indonesia Maju 2045. However, there are still many challenges to be faced, such as the downstreaming of research results and innovations produced by research institutions or universities which still face various problems.

Figure 1. Ten Key Technologies To Accelerate Indonesia's Progress In 2045

Source: Directorate of Resource Arrangement, Directorate General of Resource Arrangement and Postal and Information Technology Equipment (Ditjen SDPPI)

In synthesis, mastery of high technology, including defense technology, is very important in improving the capability and competitiveness of a country. However, mastery of technology in Indonesia still faces several challenges, such as low mastery of technology, limited use of digital technology, and many problems in downstreaming research and innovation results.

The system thinking approach allows us to understand the relationship and interaction between various components in the defense technology system. Thus, key factors that influence each other in mastering the technology can be identified. Meanwhile, SWOT analysis helps identify the strengths, weaknesses, opportunities, and threats faced in the development of defense technology in Indonesia.

This study aims to analyze in depth the factors that influence the mastery of defense technology in Indonesia, using the system thinking method and SWOT analysis. The results of this study are expected to provide strategic recommendations for policy makers in an effort to strengthen national defense technology capabilities, so that Indonesia can be better prepared to face challenges and threats in the future.

RESEARCH METHODS

Combining the System Thinking and SWOT analysis methods can provide a comprehensive view in understanding and overcoming problems faced by an organization. System Thinking is an approach that looks at how various elements in a system influence and interact with each other. Meanwhile, SWOT analysis is a technique used to identify strengths, weaknesses, opportunities, and threats in the internal and external context of the organization.

The process of combining these two methods begins by using System Thinking to understand the big picture of the existing system. This approach helps in identifying the main components and the relationships between them, as well as the impact of each element on the entire system. Once a thorough understanding of the system is obtained, a SWOT analysis can be used to assess each component of the system.

The first step is to map the system using System Thinking, which includes identifying the main elements and the interactions between them. For example, in a company, these elements can be departments, business processes, human resources, and the technology used. By understanding how these elements are interrelated, the organization can identify critical points that require special attention.

Once the system mapping is complete, a SWOT analysis can be applied to each element that has been identified. For each element, the organization can determine its strengths and weaknesses, and evaluate the opportunities and threats that exist. For example, in the analysis of a marketing department, strengths might include an experienced team and effective marketing strategies, while weaknesses might relate to limited budget or outdated technology. Opportunities might include new market trends or unexplored market segments, while threats might come from new competitors or regulatory changes.

By integrating the results of the SWOT analysis into a Systems Thinking framework, the organization can see how the strengths, weaknesses, opportunities, and threats of each element affect the entire system. For example, if the analysis shows that weaknesses in technology are negatively impacting marketing performance, the organization can design strategies to improve the technology or allocate additional resources to address this issue.

This combined approach not only provides a deeper understanding of the internal and external dynamics of the organization, but also helps in designing a more effective and holistic strategy. By understanding the complex interactions within the system and assessing the SWOT factors holistically, the organization can make more informed and targeted decisions to achieve its long-term goals.

RESULT AND DISCUSSION

SWOT Analysis

The SWOT analysis used in this analysis aims to find important aspects of weaknesses, strengths, threats, and opportunities related to the phenomenon being

studied. The purpose of the SWOT analysis is to map the strengths, weaknesses, opportunities, and threats related to the phenomenon. Thus, SWOT analysis can help in identifying the factors that influence the phenomenon and provide recommendations for appropriate solutions to overcome problems related to the phenomenon. (Erwin Suryatama, 2020).

SWOT analysis is an analysis tool to determine the strengths and weaknesses of an organization both internally and externally. Through recognition of these aspects, strategies can be formulated to achieve goals by using existing strengths and eliminating organizational weaknesses (Bryson, 2011).

Discussion Analysis

Assaraf and Orion (2005) classify systemic thinking skills into four hierarchical levels. At the first level, the most basic, this skill includes the ability to identify components and processes in a system. The purpose of this ability is that individuals can recognize and understand the basic elements that form the system and the processes or interactions that occur between these elements.

This ability is very important because it is the foundation for a more complex understanding of how a system works. For example, in the context of an ecosystem, someone with first-level systemic thinking skills can identify various components such as plants, animals, water, soil, and sunlight. In addition, the individual can also understand basic processes such as photosynthesis, food chains, water cycles, and nutrient cycles that connect these components.

The ability to identify components and processes in a system allows individuals to build a clearer and more complete picture of the system. This is also the first step to being able to analyze and understand more complex interactions at higher levels of the systemic thinking hierarchy. In other words, this ability is the basis for developing a deeper understanding of system dynamics and how changes in one component or process can affect the entire system.

Mastery of technology is the main foundation in a country's ability to produce and use advanced technology. This includes not only the development of new technology but also the effective use of existing technology. To achieve optimal mastery of technology, superior human resources are needed. Human resources who have in-depth skills and knowledge in the field of technology are able to become catalysts for innovation.

Technological innovation is the result of active interaction between competent human resources and the development of new ideas and discoveries. This innovation can be in the form of developing new products, new processes, or significant improvements to existing technology. To support this innovation process, adequate investment and funding are needed. This investment is not only limited to financial funds but also to the allocation of resources, time, and mature strategic planning.

Then, the results of good investment and funding will strengthen the ability to create or master more technology. This creates a positive circle where progress in the use of technology opens the door to further innovation, which then requires additional investment to maintain competitive advantage.

In a national or organizational context, this cycle must be managed carefully and coordinated. This involves policies that support the development of human resources in technology, strategies to stimulate and support innovation, prudent financial management

to ensure timely and effective investment, and the ability to respond to changes and challenges in the external environment. When these four elements support and reinforce each other, a country or organization can achieve sustainable technological mastery and increase its competitiveness in the global arena. This approach takes into account the complexity of the relationships between elements in the technological system, and recognizes that achieving the higher goals of technological mastery requires good coordination between all aspects involved.

Table 1. SWOT Analysis 1

There are still many superior Indonesian Human Resources in the field of technology.	- Dependence on External Investment - Lack of funding to improve Human Resource capabilities
STRENGHT	**WEAKNESS**
OPPORTUNITY	**THREATS**
Collaboration Opportunities with partners - International	- The emergence of competitors who fill weaknesses that cannot be fulfilled

A SWOT analysis of the technology development cycle involving technology acquisition, human resources, technological innovation, and investment and financing can provide a comprehensive picture of the relevant strengths, weaknesses, opportunities, and threats.

First of all, the strength of this approach lies in the strong focus on the development of advanced technologies as the foundation for national or organizational progress. Good technological acquisition provides a significant competitive advantage, allowing a country or organization to not only follow trends but also lead in innovation. This is supported by superior human resources, which are the main force in advancing technology through effective research, development, and implementation.

However, there are also some weaknesses that need to be considered. One of them is the challenge in obtaining high-quality and trained human resources in the field of technology. The shortage of skilled workers can slow down the process of innovation and development of new technologies. In addition, limited access to adequate investment and financing can be a barrier to optimizing the potential of available technologies.

The opportunities in this cycle include the potential to utilize international cooperation in technology research and development. This cooperation can expand access to global resources and knowledge, and facilitate technology transfer that supports further innovation. In addition, opportunities to increase investment and funding in technology can drive sustainable economic growth and create new jobs.

On the other hand, threats that need to be addressed include rapid changes in global technology that can make existing technologies obsolete or less relevant. In addition, political and economic uncertainty can also affect the ability to allocate sufficient resources for technology development. These threats emphasize the importance of flexibility and responsiveness in the management of the technology development cycle to address challenges that may arise.

Based on the previous SWOT analysis, human resources are identified as a crucial internal factor. To improve other factors, the strategy chosen is to improve education and provide

training to these human resources. This approach aims to strengthen the organization's internal competencies, improve operational efficiency, and prepare human resources to face complex external challenges. Improving education and providing training to human resources not only has an impact on improving individual technical skills, but also increasing adaptability and innovation.

In addition to internal factors, other identifications are external factors, namely opportunities. Carrying out international cooperation is an important strategy in an effort to improve a country's technological mastery. In the context of SWOT, international cooperation can be a significant opportunity. Collaboration with developed countries or with international institutions can provide access to the latest technology, in-depth knowledge, and best practices in various fields, including technology. Through this cooperation, a country can accelerate the pace of innovation and technological development that may not be achieved independently. For example, through researcher exchanges, technology transfers, or joint projects, countries can expand their knowledge base and utilize broader resources. This not only enriches the national innovation ecosystem but also strengthens the research and development (R&D) infrastructure.

Table 2. SWOT Analysis 2

Creation of superior Human Resources due to increased training and education **STRENGHT**	- Still need funding for improving Training and Education - Do not yet have “self income” for investment funding **WEAKNESS**
OPPORTUNITY By creating superior Human Resources, we can create new technological innovations that produce sales value.	**THREATS** - If we continue to rely on foreign technology, it will create information security risks in the transfer of science and technology.

Internally, education & training as a new variable shows strengths in improving the quality of human resources. With good education programs and structured training, human resources can be improved to be more superior. Competent teaching staff and experts produced from this education & training process become valuable assets in advancing technological innovation in the country.

However, challenges (weaknesses) arise especially in the management and improvement of the quality of education & training itself. The availability and limitations of funds and resources to implement this program, one of which is by building education and training facilities, need to be considered, because investment in this aspect is not small to do.

From the external side, international cooperation is considered a great opportunity. By establishing partnerships with developed countries or international institutions, the transfer of knowledge & technology becomes more open. This can accelerate the transfer of new technology and innovation into the country, strengthen the knowledge base, and improve the overall national technological capability.

However, there are also threats that need to be watched out for, such as the potential for dependence on foreign technology or information security risks in the transfer of knowledge & technology. Therefore, it is necessary to have wise policies and strategic planning in implementing international cooperation to minimize risks and maximize benefits for domestic technological development. Overall, the integration of education & training variables and international cooperation in technological system thinking is a strategic step to optimize national

technological development, overcome challenges, and take advantage of opportunities in the dynamics of globalization and current economic competition.

After the formation of superior human resources through effective education and training processes, technological innovation becomes a significant result. Skilled and knowledgeable human resources are able to create various technological innovations that not only increase efficiency and effectiveness, but also produce new products that have high sales value.

This technological innovation paves the way for the creation of competitive sales products in the market. These sales products, in addition to having the potential to increase economic income, are also able to strengthen national and international market positions. The income obtained from the sale of these products can then be reallocated into investment and funding, creating a sustainable cycle. Personal income from the sale of these products can be used to fund investment without having to rely on external sources, strengthening economic independence.

Investments and funding from this internal income can then be used to strengthen human resources and education and training programs. With sufficient funds, training programs can be improved in quality, creating an increasingly competent and innovative workforce. This cycle continues to repeat itself, where increasingly superior human resources will continue to produce new technological innovations, new sales products, and increasing economic income.

In addition to providing financial benefits, sales products resulting from this technological innovation also contribute to job creation. As production and demand for products increase, the need for labor also increases. This opens up new job opportunities and reduces unemployment rates, positively impacting the social and economic well-being of society. This cycle shows the interconnectedness of superior human resources, technological innovation, marketable products, economic income, investment and funding, and education and training. All of these elements support and reinforce each other, creating a sustainable ecosystem for economic growth and technological advancement. By leveraging revenue from marketable products to invest in education and training, human resources can be continuously improved, which in turn will result in more technological innovation and superior marketable products. This is a cycle that continuously improves a country's economic and technological capabilities, ensuring sustainable progress and prosperity for the entire society.

Mastery of technology is the result of a series of interconnected processes and requires a holistic approach. Initially, superior human resources are needed who are able to adapt and thrive in a dynamic environment. To achieve this, education and training are important elements that must be improved. Good education and relevant training require competent teaching staff. Competent teaching staff can produce experts in various fields.

These experts, with the knowledge and skills they have, will be able to develop superior human resources. Superior human resources are not only technically skilled but also have the ability to innovate. Technological innovation is one of the results of these superior human resources. With technological innovation, various new products that have sales value can be created.

These products not only create economic income but also open up new jobs. With increasing economic income, people can reinvest in education and training, strengthening the cycle that leads to continuous improvement of human resources. In addition, these sales products generate income that can be used for further investment and funding in various technology and education projects.

International cooperation also plays an important role in the transfer of knowledge and technology. Through collaboration with external parties, advanced science and technology can be learned and adapted, creating new technological innovations. These innovations then enrich the local technological ecosystem and encourage broader technological mastery.

The entire series of processes, from improving education and training to international collaboration, are mutually reinforcing and create an environment conducive to technological mastery. With superior human resources, technological innovation, competitive selling products, and effective international cooperation, technological mastery becomes an inevitability that can be achieved and maintained.

CONCLUSION

To strengthen the ability to master national defense technology, Indonesia must adopt a comprehensive and sustainable approach. One of the initial steps is to improve the quality of education and training in the field of defense technology. By focusing on the development of superior human resources, Indonesia can create experts who are able to innovate and adapt to the latest technological developments. In addition, it is important to build adequate research and development (R&D) infrastructure, which allows collaboration between academics, industry, and government.

The government needs to strengthen policies that support technology transfer and international cooperation. Through collaboration with developed countries, Indonesia can obtain advanced knowledge and technology that can be adapted to local needs. The development of the domestic defense industry must also be encouraged by providing incentives to companies that invest in R&D and production of defense technology. In facing the challenges of dual-use technology disruption, Indonesia needs to develop policies that ensure that the technology is used for defense interests effectively and efficiently.

It is also important to anticipate and respond to the dynamics of evolving threats by strengthening intelligence and monitoring systems. The implementation of flexible and adaptive policies will enable Indonesia to face threats from the use of advanced technologies such as artificial intelligence in defense. By implementing this comprehensive and sustainable strategy, Indonesia will be better prepared to face future challenges and threats, and will be able to effectively defend national sovereignty and security.

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