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## **Government Policy on the Management of Competency Development for Indonesian Air Force Avionics Technicians to Support National Defense Self Reliance (Case Study: Maintenance Unit 21, Depohar 20)**

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### **ABSTRACT**

This research aims to analyze government policy in the management of the development of the competence of Indonesian Air Force avionics technicians to support national defense independence, with a case study in Maintenance Unit 21 Depohar 20. The study uses a qualitative approach with descriptive-analytical methods through interview techniques, observation, and document study. The results of the study indicate that the policy of developing the competence of avionics technicians has not been fully able to meet the needs of the quantity and quality of human resources. There is a significant gap between the needs and the realization of the number of technicians, as well as limited competence that is still dominated by internal certification and does not meet global standards. From a managerial aspect, the implementation of the POAC function has not been running optimally, especially in the planning, implementation, and supervision stages. In addition, collaboration between the government, the Indonesian Air Force, the defense industry, and universities within the Triple Helix framework has not been effectively integrated, thus hampering technology transfer and competency improvement. The gap between policy and implementation indicates that the policy is still normative and not fully operational. This study concludes that an integrative, adaptive, and collaborative policy model is needed to improve the competence of avionics technicians in a sustainable manner to support national defense independence.

**Keywords:** Public policy; avionics technician competency; human capital; human resource management; national defense independence

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### **INTRODUCTION**

Global geopolitical dynamics in recent years have shown a significant increase in tension and have fundamentally impacted the structure of international security (Allison, 2018; Brands & Gaddis, 2021). The strategic rivalry between the United States (US) and China has evolved into a multidimensional competition encompassing economics, technology, cybersecurity, foreign policy, and even military dominance in the Indo-Pacific region (Mastro, 2019; Doshi, 2021). This situation is exacerbated by the emergence of various regional conflicts, such as the Russia–Ukraine war and the escalation of conflict in the Middle East, which demonstrate that global stability is increasingly fragile and unpredictable (Freedman, 2022; Walt, 2022). The transformation in the character of threats from conventional warfare to multidomain warfare, involving the integration of land, sea, air, cyber, and space domains, further emphasizes that modern military strength is not only determined by the number of Main Weapon Systems (Alutsista), but also by the ability to master technology and the readiness of human resources to operate and maintain it (Biddle & Oelrich, 2019; Gray, 2020). In this context, countries that are unable to independently master defense technology will be highly dependent on other countries and potentially experience strategic vulnerability (Ministry of Defense of the Republic of Indonesia, 2025).

Indonesia, as a developing country located in the Indo-Pacific region, holds a strategic position yet is vulnerable to these geopolitical dynamics (Chauhdry et al., 2025; Ibrahim et al., 2023; Shekhar, 2018; Solehudin, 2023; Zeng & Zhang, 2021). As the world's largest archipelagic nation with vast and complex airspace, Indonesia requires a defense system that is not only strong but also adaptive and independent (Amrin et al., 2025; Jordan, 2022; Pramudya et al., 2026; Wijaya, 2025). This is increasingly important given the potential for both military and non-military threats, such as airspace violations, technological espionage, and cyber threats to defense systems. Therefore, developing national defense independence is a strategic imperative that cannot be postponed. This independence encompasses not only the ability to produce defense equipment but also the ability to maintain it, master technology, and sustainably develop human resources for defense (Widjajanto, 2012).

In the context of air defense, the Indonesian Air Force (TNI AU) plays a vital role as the vanguard in safeguarding the sovereignty of national airspace. The operational readiness of the TNI AU is largely determined by the readiness of its air defense systems, particularly fighter aircraft and air support aircraft. One of the main components that determines the operational effectiveness of aircraft is the avionics system. Modern avionics systems encompass various complex subsystems, such as radar, tactical communication systems, data links, satellite-based navigation systems, electronic warfare systems, and mission computers integrated into a single operating system. This complexity demands avionics technicians who not only possess basic technical skills but are also able to adapt to increasingly sophisticated, digital-based technological developments integrated into network-centric warfare systems.

From a theoretical perspective, the development of avionics technician competency can be understood through Human Capital Theory, which states that investment in education and training is a key factor in increasing individual productivity and organizational competitiveness (Becker, 1993). In the defense context, competent avionics technicians are strategic human capital that directly contributes to the operational readiness of defense equipment and the sustainability of high-tech weapons systems. Therefore, the development of avionics technician competency cannot be viewed merely as an administrative activity, but rather as part of the country's strategic investment in building defense independence.

However, real-world conditions indicate significant challenges in developing the competency of Indonesian Air Force avionics technicians, particularly in Maintenance Unit 21 (Sathar 21) of Maintenance Depot 20 (Depohar 20). Organizational data indicate a requirement for 93 avionics technicians, but only 64 positions have been filled. This reflects a significant personnel shortage that could potentially impact the effectiveness of air defense equipment maintenance. Furthermore, the ideal number of 25 avionics inspectors has only been met by 13, indicating limitations in the oversight and quality assurance functions of maintenance (Sathar 21, 2026).

Beyond the issue of quantity, there is also a gap in the quality and competency of avionics technicians. Ideally, avionics technicians should be certified according to global standards to handle increasingly complex modern avionics systems. However, in reality, most technicians still rely on internal certification, creating a gap between their competency standards and the technological demands they face. Furthermore, existing education and training curricula have not fully kept pace with technological developments in the latest generation of fighter aircraft, such as the Rafale and F-16 AM/BM, which employ digital-based avionics systems and highly

integrated sensor systems. This mismatch has the potential to create a competency gap that could impact maintenance effectiveness and the long-term operational readiness of defense equipment.

At the organizational level, avionics maintenance capabilities within the Indonesian Air Force are implemented by Depohar 20 through Sathar 21, a technical unit with a strategic role in maintaining the readiness of air defense systems. However, the increasing complexity of technology is not matched by a human resource development system that is fully adaptive to these advancements. This indicates that the challenges faced are not only technical in nature but also relate to managerial and policy aspects of developing avionics technician competencies.

In line with national policy, the government has emphasized the importance of strengthening the defense industry and improving the quality of human resources as part of the defense independence strategy. However, various obstacles remain in its implementation, such as limited technology transfer from producing countries, dependence on foreign vendors for defense equipment maintenance, and suboptimal synergy among the Indonesian Air Force (TNI AU), the defense industry, and universities. From an innovation ecosystem perspective, collaboration among government, industry, and academia is a crucial factor in driving technological development and improving human resource competency (Etzkowitz & Leydesdorff, 2000).

Furthermore, from a public policy perspective, the development of avionics technician competencies also requires systematic analysis. Policy Cycle theory explains that public policy must go through the stages of agenda setting, formulation, implementation, and evaluation to ensure its effectiveness (Dunn, 2018). In practice, problems often arise not only at the policy formulation stage but also in suboptimal implementation and evaluation. This indicates a gap between formulated policies and actual conditions on the ground, particularly in the development of the competencies of Indonesian Air Force avionics technicians.

From a managerial perspective, the development of avionics technician competency must be managed systematically through management functions that include planning, organizing, implementing, and monitoring (Terry, 2006). Without structured and sustainable management, competency development efforts risk being ineffective and unable to meet the challenges of increasingly rapid technological advancement. Based on this description, it can be concluded that there is a significant gap between the strategic needs for developing avionics technician competency and existing real-world conditions, both in terms of policy, management, and implementation. This gap indicates the need for a comprehensive study of government policy in managing the development of avionics technician competency in the Indonesian Air Force to formulate an integrative, adaptive, and sustainable policy model that supports the realization of national defense independence.

The purpose of this research is to understand the implementation of policies for developing the competency of Indonesian Air Force avionics technicians in Sathar 21 Depohar 20, analyze the gap between policies and real conditions based on management and human capital perspectives, and formulate an integrative and collaborative policy model to support national defense independence. The benefits of this research include both academic and practical contributions. Academically, this research contributes to the development of public policy studies and defense human resource management through the application of Human

Capital Theory, policy cycle approaches, and triple helix collaboration models. Practically, this research is expected to serve as a basis for improving the development of avionics technician competencies in the Indonesian Air Force, as a consideration for policymakers in strengthening defense human resources, and as a reference for industry and universities in building training, certification, and research cooperation.

## **METHOD**

The research was conducted at Maintenance Unit 21 (*Sathar 21*) of Maintenance Depot 20 (*Depohar 20*), located at Iswahjudi Air Base, Madiun, East Java. This study used a qualitative descriptive–analytical approach to examine government policies on developing the competencies of Indonesian Air Force (*TNI AU*) avionics technicians, particularly the gap between policy and implementation in *Sathar 21 Depohar 20* (Moleong, 2018). The analysis applied a public policy perspective using the Policy Cycle framework to assess stages from formulation to evaluation (Dunn, 2018), along with a managerial perspective through the POAC concept to evaluate planning, implementation, and supervision (Terry, 2006). The study also considered collaboration among government, the defense industry, and universities through the Triple Helix approach (Etzkowitz & Leydesdorff, 2000), supported by Human Capital Theory, which views technician competency as a strategic investment (Becker, 1993). This combination enabled a comprehensive analysis of policy, management, and collaboration aspects.

This research was descriptive in nature and aimed to provide an in-depth account of government policies in developing the competencies of *TNI AU* avionics technicians to support national defense independence, focusing on actual conditions and the gap between policy and implementation in *Sathar 21 Depohar 20*. The approach emphasized an objective description of phenomena and allowed for a comprehensive understanding of policy dynamics, organizational factors, and managerial aspects (Sugiyono, 2019; Arikunto, 2013; Sukmadinata, 2006). Data were collected systematically through interviews, observations, and documentation to generate accurate findings and relevant policy recommendations. Overall, the study provided a comprehensive overview of the conditions and challenges in developing avionics technician competencies, as well as an analysis of government policy and its implementation.

Informants were selected using purposive sampling, based on their relevance to the research objectives. Selected participants included personnel involved in human resource development within the *TNI AU*, particularly in avionics maintenance, as well as avionics technicians at *Sathar 21 Depohar 20* with direct field experience (Sugiyono, 2019; Moleong, 2018; Creswell, 2014). The number of informants was determined flexibly and expanded until data saturation was reached, ensuring that the data collected were comprehensive and sufficient for in-depth analysis.

Data collection was carried out using three main techniques: in-depth interviews, document analysis, and observation (Creswell, 2014). In-depth interviews served as the primary method, allowing researchers to obtain detailed information from informants directly involved in policy implementation, including human resource personnel and avionics technicians. These interviews provided insights into policy implementation, constraints, competency gaps, and development needs. Document analysis was used to examine relevant

regulations, policies, personnel data, training curricula, and maintenance reports, enabling comparison between formal policies and field implementation. Observations complemented these methods by providing direct insights into maintenance activities, technician performance, and workplace conditions, thereby helping identify gaps between expected competency standards and actual practice.

Data analysis followed the interactive model proposed by Miles, Huberman, and Saldaña (2014), which involves continuous interaction between data collection and analysis. This approach allowed the researcher to identify patterns, relationships, and meanings while the data were being collected. The analysis process focused on identifying gaps between policy and implementation, particularly in *Sathar 21 Depohar 20*, and was conducted iteratively to refine findings and ensure validity.

The analysis consisted of three main components: data reduction, data display, and conclusion drawing/verification. Data reduction involved selecting and organizing relevant information, such as issues related to technician numbers, competency gaps, and policy implementation constraints. Data display involved presenting information in a structured narrative form to facilitate interpretation. Conclusion drawing and verification involved interpreting findings and continuously validating them through comparison and cross-checking to ensure accuracy.

To ensure data validity, this study applied triangulation techniques consistent with qualitative research standards (Moleong, 2018; Creswell, 2014). Source triangulation was conducted by comparing information from different informants, including *TNI AU* personnel, avionics technicians, and related stakeholders. Method triangulation compared findings from interviews, document analysis, and observations to ensure consistency. Theoretical triangulation was applied by analyzing data using multiple perspectives, including Human Capital Theory, the Policy Cycle, POAC, and the Triple Helix approach.

In addition, member checking was conducted by confirming findings with informants to ensure accuracy, and prolonged engagement in the field helped the researcher gain a deeper understanding of the research context and minimize bias. Through these validation techniques, the study produced credible and reliable findings to support the analysis of government policy and the development of recommendations for improving avionics technician competency development in the *TNI AU*.

## **RESULTS AND DISCUSSION**

### **Overview of Research Results**

The research results were obtained through in-depth interviews, observations, and document analysis in Maintenance Unit 21 (*Sathar 21*) of *Depohar 20*. The focus of the study was to analyze government policy in the development of Indonesian Air Force avionics technician competencies and to identify the gap between policy and its implementation in the field.

## Condition of Avionics Technician Personnel Quantity

**Table 1. Needs and Realization Personnel Technician Avionics**

No	Category Personnel	Ideal Needs	Realization	Difference
1	Technician Avionics	93 people	64 people	-29
2	Avionics Inspector	25 people	13 people	-12
<b>Total</b>		<b>118 people</b>	<b>77 people</b>	<b>-41</b>

Source : Data Sathar 21 Depohar 20 (2026)

Based on Table 1, a significant gap can be observed between the required and actual number of avionics technicians. A shortfall of 41 personnel indicates that human resource development policies have not been able to optimally meet operational needs.

From the perspective of Human Capital Theory (Becker, 1993), this condition reflects a low level of strategic investment in the development of technical defense human resources. This personnel shortage not only increases workload but also has the potential to reduce the quality of defense equipment maintenance.

From a POAC perspective, this weakness indicates that human resource planning has not been based on a thorough analysis of workload and modern avionics technology development.

## Competency Level and Technician Certification

**Table 2. Certification Levels of Avionic Technician**

No	Types of Certifications	Number	Percentage
1	Indonesian Air Force Internal Certification	50 people	78%
2	International Certification	8 people	12%
3	Not Yet Certified	6 people	10%
<b>Total</b>		<b>64 people</b>	<b>100%</b>

Source : Processed data researcher (2026)

Table 2 shows that most technicians still relied on internal certification, while internationally recognized certifications aligned with global standards remained very limited. This condition indicated a significant competency gap, particularly in responding to modern avionics technologies such as digital systems and network-centric warfare.

Within the Policy Cycle framework (Dunn, 2018), this condition suggested that, at the implementation stage, training and certification programs had not yet been fully aligned with technological demands. In addition, from a Triple Helix perspective, the low level of international certification reflected suboptimal collaboration among the Indonesian Air Force (TNI AU), the defense industry, and educational institutions in enhancing technicians' global competencies.

## Implementation of Competency Development Management (POAC)

**Table 3. Evaluation of Competency Development Management (POAC)**

No	Function Management	Condition Implementation	Information
1	Planning	Not optimal	Planning Not yet based technology latest
2	Organizing	Enough	Structure there is , but coordination limited
3	Actuating	Less than optimal	Training Not yet equitable and sustainable
4	Controlling	Weak	Evaluation Not yet based indicator performance

Source : Analysis results researcher (2026)

The evaluation results showed that management functions had not yet operated optimally or comprehensively:

- 1) Planning: Had not yet referred to the defense equipment modernization roadmap.
- 2) Organizing: Still faced coordination constraints between institutions.
- 3) Actuating: Had not yet produced uniform competency levels.
- 4) Controlling: Had not yet utilized a performance-based evaluation system.

These findings indicated that the problem lay not only in policy but also in aspects of managerial implementation. According to Terry (2006), failure in one of the management functions affects the entire system. In this context, weak controlling was identified as the primary factor causing ineffective policy implementation.

## Collaboration in Competency Development (Triple Helix)

**Table 4. Level of Collaboration Between Stakeholders**

No	Actor	Current Role	Optimality Level
1	Government	Regulator	Enough
2	Indonesian Air Force	Executor main	Good
3	Defense Industry	Provider technology	Not enough
4	College	Human Resources Development	Not enough

Source : Analysis results (2026)

Table 4 shows that collaboration between actors in the development of avionics technician competency has not yet operated optimally. The roles of the defense industry and educational institutions remained limited, even though both are essential elements in technology transfer and research-based competency development. From the perspective of the

Triple Helix (Etzkowitz & Leydesdorff, 2000), weak collaboration hindered innovation and the strengthening of national capacity. This condition affected:

- 1) Industry-based training programs
- 2) The lack of adaptive curricula aligned with the latest technologies
- 3) The constrained process of technology transfer

### **Synthesis of Research Results**

Based on the overall research results, it can be concluded that there were three main problems:

- 1) The gap in human resource quantity → a significant shortage of technicians
- 2) The gap in competency quality → certification had not yet met global standards
- 3) Weak managerial capacity and collaboration → policy implementation was not optimal

These problems indicate that policies for developing avionics technician competency remained partial and had not yet been systematically integrated.

### **Implications for Defense Independence**

The competency gap among avionics technicians directly affected:

- 1) The operational readiness of defense equipment
- 2) Dependence on foreign vendors
- 3) The slow pace of technology mastery

This confirms that the development of technical human resources is a key factor in achieving national defense independence.

The discussion in this study integrated empirical findings with the theoretical frameworks of Human Capital Theory, the Policy Cycle, POAC, and the Triple Helix to explain the gap between avionics technician competency development policies and actual conditions in Sathar 21 Depohar 20. The findings revealed a significant shortage of avionics technicians, amounting to 41 personnel below the ideal requirement, reflecting weaknesses in strategic planning rather than merely administrative issues. From the perspective of Human Capital Theory, human resources should be treated as strategic assets requiring long-term investment; however, existing policies had not fully positioned avionics technicians as critical human capital. This imbalance was evident in planning processes that did not adequately account for defense equipment modernization, technological complexity, and operational workload, resulting in increased burdens on existing personnel and potential risks to maintenance quality.

In terms of competency, the study identified a considerable gap, as most technicians still relied on internal certification while international certification remained limited. This indicated weaknesses in policy implementation within the Policy Cycle framework, where training curricula were not yet adaptive to modern avionics developments, access to international training was restricted, and technology transfer from the defense industry was insufficient. Consequently, investments in competency development remained suboptimal, creating discrepancies between existing capabilities and global standards.

From a managerial perspective, the main issues lay in the actuating and controlling functions of POAC. Training programs were not evenly distributed, lacked sustainability, and were poorly integrated with operational needs. Meanwhile, the absence of measurable

performance indicators, systematic evaluation, and continuous monitoring demonstrated weak control mechanisms, leading to ineffective policy implementation. Additionally, collaboration among the government, the Indonesian Air Force (TNI AU), the defense industry, and higher education institutions remained limited. The Triple Helix model had not been effectively implemented, resulting in suboptimal technology transfer and a lack of integration within the innovation ecosystem.

Overall, the study highlighted a clear gap between policy formulation and implementation, particularly in the stages of execution and evaluation. These shortcomings contributed to reduced operational readiness, increased dependence on foreign vendors, and limited mastery of defense technology, ultimately hindering the achievement of national defense independence. Therefore, strengthening avionics technician competency development should become a strategic priority through integrated policies, effective management, and enhanced multi-stakeholder collaboration.

## CONCLUSION

The study found that government policies for developing Indonesian Air Force (TNI AU) avionics technician competencies at Maintenance Unit 21 Depohar 20 had not yet been effectively implemented in an integrated manner. Significant gaps remained in both the quantity and quality of personnel, with shortages indicating weak strategic human resource planning and competencies still largely dependent on internal certification that did not meet global standards. Managerially, development efforts were not optimally executed due to weak integration across planning, implementation, and evaluation functions, while collaboration among government, the TNI AU, the defense industry, and academia remained limited, constraining technology transfer and curriculum development. Overall, a clear disconnect persisted between policy formulation and practical implementation, resulting in largely normative rather than operational outcomes and contributing to suboptimal readiness in supporting modern avionics systems and national defense independence. Future research should focus on developing and testing an integrated policy implementation model that incorporates measurable performance indicators, industry-based training systems, and stronger multi-stakeholder collaboration to enhance the effectiveness and sustainability of competency development.

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