

POPPERIAN PROBLEM-SOLVING EPISTEMOLOGY; EXPANDING DEFENSE INDUSTRY STRATEGY DEVELOPMENT

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Abstract. Competition between developed and developing countries in developing the defense industry in the era of globalization has crossed the boundaries of a country's alliances. However, in the transfer of technology (ToT) process, it remains the object of domination by large countries, and developing countries remain confined in a rigid bureaucracy. Researchers offer a problem-solving approach to developing the defense industry experienced by developing countries. The researcher's first step describes the bureaucracy of developing countries, and then the researcher projects the development of a strategy as a solution. The researcher realizes that the trial and error approach offered by Karl R. Popper demands further testing, so the researcher also explains the weaknesses of the solutions offered. The researcher concludes that the Problem-Solving approach can solve problems and anticipate problems. Problem-Solving is no longer seen as containing a simple method but an epistemology; Solutions appear before the problem itself appears. The researcher corrected the problem-solving position, as explained by Ian Angus, who moved from one line to a new line continuously. Researchers see not moving lines and continuing but reality entering a broader flow.

Keywords: Epistemology, Karl R. Popper, Problem-Solving, Defense Industry, and Developing Countries

Introduction

The strength of a country is highly dependent on innovation and responsiveness to seize technological and industrial advantages (Gansler, 1990). The industry life cycle in an era of technological change is linked to mergers, acquisitions, downsizing, and global team engagement. It is essential to focus on continuous improvement in the competency domain. (Springer, 2023). The technology of transfer (ToT) in the high-tech defense industry by developing countries through cooperation with developed countries is more promising than cooperation with both or more developing countries. For decades, developing countries have collaborated with developed countries (Faunce, 2012). This readiness can be seen in institutional arrangements, regulations, finances, and so on (Giannopoulos & Munro, 2019). However, developing country industries find it challenging to compete with developed countries due to strategic management issues, policies, and regulations that could be more profitable for developing countries (Wignaraja, 2003).

Developing a sustainable defense industry requires socio-political aims based on the logic of technical development and logic of discovery (Angus, 2019). Researchers aim to evaluate defense industry competition problem-solving strategies from a critical perspective (Goldman, 1983) and encourage the defense industry to be competitive and open. The researcher took a case study of the joint development of the KXF/IFX Combat aircraft or KAI KF-21 Boramae between Indonesia and South Korea. According to the South Korean mass media, it was noted that the Indonesian government was in arrears of US\$67 out of a total payment of US\$1.3 billion US dollars to South Korea. The policy of the Indonesian government 2018 wanted to evaluate this collaboration because Indonesia wanted to get several aircraft from the collaboration and the ownership of The Intellectual Property Rights (IPR) from the results of aircraft research and development.

Cooperation between countries in developing the defense industry differs from other industries, and the defense industry as a military force will face substantial challenges from the Western allies (Bresser-Pereira, 2008). In addition to the distribution of capital and profits, alliances between countries also influence technology supply chains through IPR arrangements (Edler et al., 2015). Indonesia intends to request a renegotiation of the ongoing agreement to increase the benefits of the Defense Industry for Indonesia's economy and defense itself.

In general, the benefits of institutionalizing the defense industry for a country; 1. Franchise, as an agent or representative of a foreign company. 2. Supply chain, supply chain, or intermediary for purchasing military weapons; 3. Collaboration, cooperation, collaborating with domestic and foreign parties to carry out a series of activities to supply and develop the primary weapons system tools; 4. Research & Development (R&D) Research and Development of Defense Systems; 5. The producer produces products in the form of Alutsista; 6. Seller, selling defense equipment products both domestically and abroad (Andrew Latham, 2013)

Under Jokowi's leadership, Indonesia wants to increase the benefits of the defense industry not only as a supply chain but also to produce and sell. The challenge for developing countries is that they have to follow the interests and regulations made by developed countries. Several actors carry out the mastery of IPR in the defense industry's high technology, and they can become powerful state vehicles in technology monopoly in the long term. The results of Indonesia's negotiations showed that the sharing of joint venture capital between companies by Indonesia did not determine the percentage of acquisition of the development IPR. Therefore, IPR is the primary strategy of the corporation a country (Wignaraja, 2003). HKI's position in technology development cooperation has been an essential element since the beginning of the agreement (Bulut, Pelin Aka, and Nazli, 2021).

National interests dominate the international political arena (Cervo, 2010). ToT occurs across countries, even across global market alliances and innovations; sometimes, they are no longer bound by global alliances (von Delft et al., 2019). Knowledge and power strengthen the national interests of a country. The interests of the United States in determining the cooperation between Indonesia and South Korea for the development and the Korean ToT Fighter Xperiment and Indonesia Fighter Xperiments (KF X / JFX). Since the initial stage of the ToT calculation covers 133 key technologies, 120 technologies can be made available to Indonesia, intergovernmental relations directly influence the negotiation process, especially in determining market power. (Meerts, 2015) .

The new round of Indonesia-South Korea negotiations is the visit of the Minister of Defense of the Republic of Indonesia, Prabowo Subianto, on 8 April 2021 to South Korea. There are two signs: First, the launch of KFX/IFX shows the success of South Korea in building its fighter aircraft. Second, President Joko Widodo's virtual remarks show Indonesia's commitment to continue investing in the development of KFX/IFX aircraft, even though it is currently under the scrutiny of the Indonesian public as a project with poor performance. (Prashanth Parameswaran, 2021).

Method

The approach in this essay uses the Problem-Solving approach by Karl R. Popper (1975). All Life is a Problem-Solving resource book (K. Popper, 2007) and a schematic approach to Objective Knowledge. An Evolutionary Approach (Petersen, 2016, p. 77) can be described;

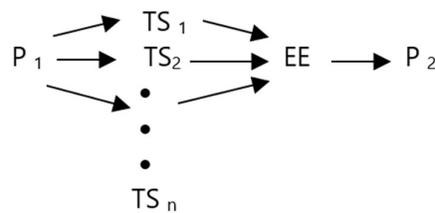


Figure 1; Schematic Writing Method

Notes:

- The initial problem (P1)
- The Tentative solution (TS)
- The Error Elimination (EE) phase:
- The new problem (P2): C-function
- The Tentative solution (TS2) to the new problem:

To explain the problem of developing fighter aircraft technology, the authors identified 500 Google Scholar index articles. The gap and the relevance of the concept in the articles are seen in the strategy for developing fighter aircraft, the most important of which is the problem of "program". Then, the phrase program is related to phase and "new development". Indonesia considers new development problems to have the potential for IPR fighter aircraft as additional problems and The Joint Strike Fighter (JSF) (the US military and NATO). This means that technology development in the defense sector needs to pay close attention to the program and its planning. Meanwhile, negotiation issues related to IPR, trade-in patent cooperation, technology, and other developments are discussed. However, they remain the subject of this essay because they inhibit Indonesia from continuing this collaboration.

Result and Discussion

The hope of the Jokowi- era government was that the defense industry would be self-sufficient in producing and selling the industry's products themselves. Explanation of the Secretary General of the Indonesian Ministry of Defense Marsdya TNI Donny Ermawan Taufanto, MDS, when leading the Socialization event to form the TA Defense Industry SOE Holding. 2020

(21/10/2020) at the Urip Sumohardjo Building, Ministry of Defense, Jakarta. Strategic Industry SOEs, whose members are PTDI, PT Pindad, PT LEN, PT Dahana, and PT PAL Indonesia, are expected to participate in the Socialization activities for the Establishment of Defense Industry SOE Holdings at the Indonesian Ministry of Defense in Jakarta. Establishing the Defense Industry BUMN Holding in the Indonesian Defense Industry Branding (DEFEND ID) is a form of collaboration between BUMNs within the BUMN Defense Industry Sub-Cluster to realize the independence of the defense industry. (Ministry of Defense, 2020) .

The formulation of this collaboration is an advancement because various defense industry companies have been seen as a team. Nevertheless, from the perspective of the triple helix apart from the industry, it needs to be complemented by users and academia. The triple helix framework has three essential aspects; government, academia, and users. Then, when combined with the development readiness program, in the context of utilizing PTDI for the development of the Indonesian Air Force Combat Aircraft, it can be formulated as follows;

| | Investment | Institutional | Regulation |
|------------|-----------------------------|----------------------|--|
| Government | representative; dominant | global team | Multi-national |
| Academics | Research and development | Independent team | Cooperation; Employment contract |
| Industry | Private engagement | competitive | open |

Figure 3: PT Dirgantara Indonesia's Combat Aircraft Development Collaboration

Each preparatory element in the triple helix can be developed and plays a role in each stage of the preparatory program for developing fighter aircraft. Each stage of industrial development has relevance to the tasks of different ministries and agencies. Based on the Indonesia-South Korea MoU, there are three stages of development;

- a. **Technology Development (TD) Stage.** The TD stage is the first stage to determine the configuration of fighter aircraft to study the core technology. At this stage, government agencies are included in the National Research and Innovation Agency (BRIN) work unit, following Presidential Regulation Number 78 of 2021 concerning the BRIN functions to carry out integrated research, development, study, and application, as well as inventions and innovations in carrying out nuclear and space affairs and to implement the provisions of Article 48 of the Indonesian law—number 11 of 2019 concerning the National System of Science and Technology. As a user at this stage, the Indonesian Air Force explains the needs according to the expected doctrine and strategy, basically what the plane is for. Of course, tactically, the Indonesian Air Force will also consider similar opposing aircraft at that time as competitors ;
- b. **Stage the Engineering & Manufacturing Development (EMD).** The EMD stage is the final stage of configuration completion, carrying out the detailed design by making prototypes, testing, evaluating, and finalizing production specifications and standards. The Production & Development phase includes the manufacture and testing of fighter aircraft. Related to the production of an industry, it is necessary to involve the Ministry of Industry. Following Presidential Regulation of the Republic of Indonesia Number 69 of 2018 concerning Amendments to Presidential Regulation Number 29 of 2015 concerning the Ministry of Industry, formulation, and determination of policies in the field of deepening and strengthening industrial structures, increasing competitiveness, developing business climate, promoting

industry and industrial services, standardization industry, industrial technology, strategic industrial development. TNI's involvement during testing is a necessity ;

c. Joint Marketing Production & Development (PD) stage. Business competition is increasingly competitive, and business owners must continue to look for fresh ideas to improve the quality of their products. One strategy that needs to be considered to win this competition is product development. A complete and thorough development process to produce a new product or improve the quality of an existing marketing product is necessary for the Ministry of Trade. The TNI as a user, at this stage, is allocated financing for the purchase of fighter aircraft from the Ministry of Defence. TNI activities include the promotion of the aircraft.

The Indonesian government's strategy in developing IFX fighter aircraft can be seen in the aim of the aircraft industry PTDI in collaboration with South Korea to obtain cheap fighter aircraft. The calculations are simple; Indonesia received 48 combat aircraft with a composition of 20 percent of the development budget. Seeing the issue of HKI ownership and rising costs, Indonesia renegotiated and prepared funds of 24.8 Trillion Rupiah (T) or (@517 Billion Rupiah). The fee is for stages; TD worth IDR 0.1 T, EM D Phase worth IDR 20 T, Technology Readiness worth IDR 0.7 T, and Operations and Infrastructure worth IDR 4 T.

This price is comparable to IFX's replacement aircraft, the Rafale aircraft. Indonesia has contracted these fighter aircraft for 42 aircraft valued at US\$ 8.1 billion or Rp 115.8 trillion (exchange rate of Rp. 14,300) (@2.7 T). The price of the Rafale includes the cost of training aircrews, logistical support for several airbases, and a training center equipped with two simulators (interviews, 2018; Berty, 2022).

As a developing country, Indonesia needs defense technology, and to achieve defense independence, buy and transfer technology. Defense industry companies provide military strength, independence, and economic opportunity. The development of IFX fighter aircraft, the Ministry of Defense uses 100% of the State Budget.

Based on the Regulation of the Minister of Defense of the Republic of Indonesia Number 6 of 2016, Article 10 explains that the IF-X Program is implemented by involving: a. Ministry of Defence; b. Defense Industry Policy Committee (KKIP); c. TNI; d. Defense Industry; And e. other parties deemed necessary according to the needs. Looking at the formulation of institutional collaboration so far, the ones involved are still dominated by the military, even though there have been efforts for PT DI, which are at the Ministry of BUMN, to be dominated by civilians. To fix or reformulate PT DI can be done through; a. Financial independence. Because the funding aspect is still 100% from the state, it will be an obstacle for private parties to participate; b—institutional independence.

PT DI allows for mergers, acquisitions, downsizing, and engagement of global teams, etc.; limited regulatory independence. Because PT DI is a government company related to the interests of the TNI, it is necessary to regulate PT DI's authority in making acceptable policies. These restrictions already exist but need to be expanded but not exceeded. For example, mergers-related matters need the President's approval, while acquisitions need the President's and DPR RI's approval. In comparison, the purpose and function of weapons in the air war strategy need recommendations from the TNI. Meanwhile, financial and workforce management matters are the duties and authorities of the Ministry of BUMN or the designated ministry. This opportunity for independence is supported by Regulation instead of Law

Number 2 of 2022 concerning Manpower Creation, 2022 instead of Law Number 16 of 2012 concerning the Defense Industry.

Then Article 11 explains the authority of the Minister of Defense; a. establish policies regarding the division of tasks and the responsibilities of industry and related institutions other; b. provide direction in negotiations with the South Korean side; c. determine the organization of the IF-X program; And d. establish budget allocations for the plan IF-X program budget requirements. Seeing this article, the authority of the Ministry of Defense is extensive. In general, this independence is related to the Ministry of BUMN and the TNI Commander as users who can describe the independence of the development of the current defense industry (Yoedhi Swastanto et al., 2022). Even though the Regulation instead of Law Number 2 of 2022 Concerning Manpower Creation, the problem of negotiating with foreign parties is the Ministry of Foreign Affairs domain. To determine the organization under PT DI, it should be more on the task of the Ministry of BUMN or the Ministry of Trade. To determine the proper budget allocation proportionally, according to the stages, the research and development stage is part of the Ministry of Research and Technology or BRIN.

Epistemology of Extended Solutions

Problem-solving offers steps to solve problems. In future defense industry development, it is essential to involve coalition forces and civil-military institutions. Civilians and the military must find cooperation and government institutions that fit their functions. The Ministry of Defense coordinates collaborating on investment, regulatory and institutional issues. It is necessary to criticize regulations as a basis for cooperation in forming, developing, and implementing policies and learning from Argentina's failure to reform the defense industry impacted access to global military complexity. The cooperation, which can be judged successful through the integrative relationship between Material Córdoba which obtained concessions for the maintenance of Air Force aircraft to the Lockheed Aircraft Corporation, these reforms allowed Argentina to benefit from the transmission of technology, technical data and industry know-how. Cooperation that is considered a failure such as Chile with ENAER. (Grimes, 2021).

Then it is necessary to consider that technology is developing rapidly and expanding. Technological developments related to its time, now fighter aircraft have entered their 5th generation. Joint project agreement between the Ministry of Defense of the Republic of Indonesia and the Defense Acquisition Program of the Administration of the Republic of Korea (DAPA) regarding the K FX /IFX Joint Development Engineering and Manufacturing Development Phase entering the 4.5 generation. However, Indonesia is in the process of learning because, so far, PT DI has never made this type of fighter. IPR protection issues; the parties agree that any intellectual property rights arising from implementing this MoU will be regulated separately in their respective laws and regulations in the agreement.

The link between the current condition (P1) and the expected condition (TS1) with efforts to reduce errors (EE) with methods can be described as a fighter development strategy. Colonel Arthur F. Lykke Jr. describes the strategy in three components; end, means, and ways (Meiser, 2016). Then every strategy executed has a risk if the strategy is not implemented. For this reason, the fighter aircraft development strategy can be described as follows;

| Strategy | At the moment | Expected | Method | Risk |
|-------------------------|--|---|---|----------------------------|
| End (Objective) | Fulfilling the Needs of the TNI, changed to Own Production | Vision Independence in institutional, financial, and regulatory aspects | Revisionary: <i>national security</i> , not <i>government</i> | Hard inside renegotiation |
| Ways (Method) | Research and Development Assistant | R&D Mastery of Intellectual Property Rights | <i>comparative advantages</i> | Cannot Production |
| Means (Resource) | HR 74 general technicians, all employees of PT DI | <i>Expert</i> 350 people openly | - <i>Open Bidding</i> -R&D -Kerma | Exclusive |
| | APBN Funding 100% | APBN 55% for APBN | Private partnership | Stay majority |
| | Use of PT DI Limited Facilities | In own country | <i>Interoperability</i> Context Han neg | Depends on other countries |
| | Closed info system | Open info system | Transparency | Anti democracy |

Table 1: Combat aircraft development strategy by PTDI

The current condition is that the Indonesia-South Korea cooperation program contains IPR potential, both in the form of patents and copyrights, but in agreements that belong to South Korea. Jokowi's government policy in the future, Indonesia must be able to produce, so it needs to be renegotiated. Indeed, not all IPRs are economic; sometimes only moral (Ahammad et al., 2016). The condition expected in this development is to optimize PT DI to produce fighter aircraft in the future as a joint problem through renegotiations. Mastery of IPR due to the development of cooperation between KFX/IFX has become a significant problem in Indonesia and South Korea (Salsabiela et al., 2017).

The negotiation goal for the collaboration involved in developing KFX/IFM needs to be considered co-financing. South Korea is interested in funding support for 20% of development costs from Indonesia, and funds of that size could boost these activities. These development projects for Indonesia initially wanted new aircraft to replace old ones, and this pattern of cooperation is quantitative, although experimental. Because this is a joint development, Indonesia hopes it can be further developed as a business with commercial value, so Indonesia needs to clarify the portion of IPR it will own. Therein lies the problem for Korea, where when Indonesia becomes a seller, Korea still maintains its position as a producer, along with the United States as the owner of the core IPR of the aircraft.

Developing fighter aircraft between South Korea and Indonesia requires balanced capital, skills, and interests. Indonesia needs fighter planes to replace its old planes at low prices. At the same time, he wanted to gain expertise in making planes to produce and eventually sell the planes. The Korean side wants to sell fighter planes and support working capital. IPR is only a

tiny part of the negotiation process but is a central issue because it is vital for South Korea and its allies.

According to HKI legal expert from the University of Indonesia Agus Sarjono, many people need to understand the position of IPR. The state's constitution can respond to IPR with laws according to needs. In order to negotiate an IPR issue, it must be clear what is meant by IPR and what is being negotiated. Because IPR is a legal recognition that contains novelty and clarity and applies in the industrial world, the parties must understand it; otherwise, IPR will be another matter. Is the element under study a collaborative finding or ToT, or is it outdated? IPR issues are not urgent in mastering defense technology because trade secrets are far more urgent (Sardjono, 2011; Interview, 2018).

IPR is an essential factor in negotiations because of the different positions and interests between Indonesia and South Korea. The bargaining position of each party can be described in three main issues;

First, ownership of HKI, South Korea wants to keep the development results private from Indonesia. Whatever the reason, South Korea received technology from the United States, so South Korea's IPR cannot be decided alone. For this reason, the will of the United States is highly expected. This development process was seen as a strong effort during the administration of Barack Obama. However, the administration of Donald Trump still needs support from the United States Senate.

Second, Indonesia's perception of the initial funding is that it hopes to receive a royalty share in the amount of the funding charged. This thinking is seen as fair because it is funded proportionally, but that does not mean that the initial funding for South Korea is only a tie for cooperation so that Indonesia can ensure that it will buy. If so, Indonesia becomes a forced buyer who is not fully convinced of the expected quality.

Third, Indonesia cannot own the background data owned by the aircraft, and it is tantamount to collaborating without knowing what it will be collaborating with. Indeed, the background data is related to the results of previous research, so South Korea wholly owns the Intellectual Property Rights resulting from development and research during the Technology Development (TD) period and the Intellectual Property Rights granted by the United States.

The renegotiation offered by Indonesia is in response to South Korea's reluctance to change IPR ownership, share royalties, and background data. Maybe if the Indonesian government does not question this primary issue, it will be in a dilemma with its people because, apart from the disproportionate ToT standard in defense offsets, it will also make Indonesia a mere military weapons technology market. Another tentative solution (TS2) for Indonesia to develop this fighter is cooperation with France or Russia. A new problem (P2) arose when Indonesia proposed adding Sukoi aircraft, the United States would challenge Indonesia's cooperation with Russia. The right tentative solution is PTDI with the Dassault Aviation Rafale. The two companies have signed a cooperation contract on the Rafale fighter jet offset and ToT (By Tassilo Hummel and Stanley Widiyanto, 2022).

Even though Indonesia has been looking for alternatives, dynamics arise when the parties have ideas in the Indonesia-South Korea negotiation process. Negotiation preparation and formulating bargaining process dynamic models. (Simosi et al., 2019). Indeed, awareness of the feeling of winning or losing does not necessarily appear at the negotiating table all at once because it can occur after a job is completed or work is in progress. A good winner in a

negotiation is not a loser because if one party goes against one party and feels defeated by the other party, then the negotiation fails. A good negotiator creates a conducive atmosphere for cooperation, where it is very important to maintain the methods and approaches used. Establishing effective collaboration between related partner companies is very important for negotiators (Jean-Louis Schaan, Micheál J. Kelly, 2007). This means that Indonesia will not immediately leave South Korea, and vice versa. Cooperation between Indonesia and France to obtain a KFX replacement aircraft is not yet certain. However, increasing human resource capacity is still needed so that South Korea remains a partner.

The contribution of negotiation to the sense of justice of both parties may need to be refined to consider the cultural impact. The role of justice in explaining whether post-agreement negotiations emerge or not must be considered. The relationship between types of justice, both procedural and outcome, is also essential to consider. It should be understood that justice is the main goal, which will become an obstacle in cooperation if it is perceived as a problem (Albin, 1993). Whether industry generates greater market power or efficiency has been a subject of public policy discussion. The US defense industry over the last two decades, with its focus on causing a wave of defense industry consolidation, downsizing contractors, antitrust response and mergers, has impacted the total and per unit cost of weapons systems.

According to Hensel's (2010) analysis, reduced spending drove post-Cold War merger activity more, so economical and market considerations were more robust and dynamic. After consolidation, 39 to 44% of systems experience a statistically significant change in total cost and cost per unit. Slightly more systems exhibit lower post-merger unit costs. The merger is seen as an alternative solution to problems in the defense industry. In addition, the analysis analyzes the impact on the cost of defense equipment by type, manufacturer, and service (Army, Navy, Air Force) in many industries, and consolidation has proven to increase efficiency. The Army and Navy have reduced unit costs, while the Air Force's weapon systems vary in performance. As PTDI is the center for developing the Indonesian Air Force Defense Industry, the air force is experiencing almost the same process.

The limited ability of PTDI's human resources to master Intellectual Property Rights, infrastructure, and finance, so in the perspective of problem-solving epistemology, it is relevant for Indonesia to carry out a comparative advantages approach to benefit all parties. Economic interests cannot necessarily be calculated linearly with defense interests, so it is necessary to view defense financing as an alternative investment. Defense programs related to the nation and state's safety need solid legal protection to always bind the government's economic vision of defense. Renegotiation of IPR ownership from technology development cooperation depends on agreement and openness for justice. Time will pass, and the strategic environment will demand change of its own accord. Win-lose in negotiations shows success or failure. In the end, the strength of a country will be tested.

Conclusion

Epistemology of Problem-Solving can change the paradigm of the defense industry development approach, which is increasingly widespread. Reformulation of fighter aircraft technology development needs a long-term program and goes through the government of each party, which allows different visions and missions to change. The Policy for the Independence

of the Indonesian Air Force Combat Aircraft Development needs to emerge from stakeholders (triple helix) faced with the critical elements of arrangement (investment, institutions, and regulations). Past failures and successes guide the development of future policies. Renegotiation to change the contract regarding HKI ownership has failed because Korea still refers to the basic agreement, so it does not change each party's position; Indonesia is the seller vs. South Korea, and the USA is the producer.

The development strategy involves various government agencies and private parties with a triple helix approach and planning. Through the problem-solving approach, Karl R. Popper's perspective demands renewal. Suppose the military has dominated the Defense Industry all this time. In that case, the role of professional civilian agencies has become an alternative without reducing state goals and military tactical and strategic interests. Indonesia's goal in developing combat aircraft is to meet the needs of the Indonesian Air Force to obtain a 5th or 4.5th generation fighter aircraft with fast and accurate cruising capabilities. Besides that, fighter aircraft products also have the economic potential to seize market prospects in the ASEAN region, which is a significant concern, so it becomes a separate offer for investors.

Cooperation between Indonesia and South Korea in developing KFX/IFX fighter aircraft is constrained by the interests of big countries through global regulations. South Korea's caution in the ToT process with Indonesia disrupts the development of capacity building in the Indonesian military sector. It has an impact on changing the map of Indonesia's international relations with other countries. Because of that, Indonesia is trying to find strategic partners, especially Russia and France, to get fighter aircraft that are more or less on the same level or higher than KFX/IFX. Using knowledge (IPR) to strengthen the dominance of significant power remains a power without competition. The legal strength of the United States and South Korea is reflected in the mastery of knowledge by controlling IPR, distribution of royalties, and sharing databases of defense technology development supported by institutional and financial strength.

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