The Implementation of the Triple Helix Model in the Indonesian Aerospace Defense Industry

Achmad Sugiono, Akim, Rizki Ananda Ramadhan

Abstract

National defense can be defined as any effort to defend the country's sovereignty, territorial integrity and security from threats and harassment. Ideally, the fulfillment of defense equipment for strengthening the country's defense makes use of domestic production. In general, the current Indonesian defense industry particularly Aerospace Defense is not independent yet. The fact that the fulfillment of defense equipment has been mostly from imported products results from a lack of implementation of research and development. On the other hand, the implementation of the research and development of the defense industry cannot be separated from the role of the three pillars, i.e., the government, universities, and industries. This paper discusses the triple helix concept of the three pillars in the defense industry that could present both obstacles and chances to the Indonesian defense system particularly in relation to development and adaptation capability of the Indonesian defense industries.

Keywords: triple helix, industry, government, university

Introduction

The objectives of the Republic of Indonesia as stated in the preamble to the 1945 Constitution are to protect the entire Indonesian nation and the entire homeland of Indonesia and realize the necessary defense and security systems. The defense and security of a strong state

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will ensure the sovereignty and the survival of a nation as well as guarantee its national goals. Realizing a strong defense and security would require a strong military force, supported by the availability of major weapons systems (Alutsista). Defense equipment needs can be met in several ways, one of which is through independent defense industries. The independence of the defense industry is an ideal condition in which the needs of the state of defense equipment can be met.

On the basis of the establishment of the Law of the Republic of Indonesia Number 16 the Year 2012 on the Defense Industry, self-reliance defense arrangements were contained in the provisions of Articles 3 and 4. According to the law, the purpose and function of the organization of the defense industry are to realize the independence of the fulfillment of defense equipment and security, independence on national defense and security systems, increase the ability to produce defense equipment and security and improve the maintenance service in order to build the strength of the defense and security reliably. Defense industry undertaken is directed to ensure the availability, affordability, and quality of the main tools of weapons systems and tools of special materials.

The direction and goals of the defense industry contain dualism because the direction of the defense industry in the development of strategic industries takes a long time, while on the other hand the development of the defense force cannot wait for a long time and requires a complex defense industry. The situation which encourages the development of the defense forces through the procurement of major weapons systems (defense equipment) can be expressed almost from everything they obtain from abroad.

Indonesia's defense industry covers various fields including the aerospace defense industry, one of which is PT Dirgantara Indonesia (PT.DI). Conditions of PT. DI is the same as other defense industries that are still dependent on the foreign aerospace industry. The establishment of PT. DI which began with the establishment of the Aviation Industry Preparation Institute (LAPIP) was inaugurated on December 16, 1961, formed by Chief of Airforce Staff (KASAU) to prepare the Aviation Industry which was expected to have the ability to support Indonesia's national aviation activities. Then in 1966 LAPIP was merged with the Self-Reliance Aircraft Industry PN to become the Nurtanio Aviation Industry Institute (LIPNUR). On April 24, 1976, the Division of Advanced Technology and Aviation Technology (ATTP) owned by

Pertamina joined LIPNUR, a company called PT. Nurtanio Aircraft Industry (IPTN) based on Notarial Deed No. 15, April 24, 1976, led by Prof. Dr. Ing. B.J.Habibie. Then in April 1986, the company name was changed to PT Nusantara Aircraft Industry (IPTN), and on August 24, 2000, under the era of President Abdurahman Wahid, the company name was officially changed to PT Dirgantara Indonesia (PT. DI)[1].

PT DI as an aerospace industry is engaged in the development and production of aircraft components, fix wing aircraft, helicopters, and other aeronautical products. The biggest potential owned by PT. DI in the development of Fix Wing aircraft was shown by the ability of PT. DI to develop the N-250 aircraft but did not succeed in the mass production stage. The development of the N-219 aircraft is currently in the certification process and as the Type Certificate (TC) Holder of the CN-235 aircraft. However, along with the development of Fix Wing aircraft, PT DI also continues to rely on foreign aerospace industries, especially Engines, Propellers, avionics components, even for raw materials such as composite materials. According to Silmy Karim[1], the independence of the defense industry is divided into independence in the purchase, self-reliance in use, independence in caring and independence in making/producing, and the highest level of independence is self-sufficiency in production. Referring to this opinion, PT. DI does not say that we cannot independently determine the level of independence of PT. DI and the target level of independence to be achieved. Discussion of the defense industry model can be made through a Modern Defense Industry. Richard A. Bitzinger[2] states that each country prefers cooperation with other countries in establishing the defense industry to reduce huge costs it.

The development of the defense industry also relies heavily on the government's role in determining defense policies and the needs of defense equipment, defense industry policymakers and users as well as regulators. Discussion on the role of government can be approached with the theory of military-industrial complex[3,4]. A military industrial complex term was first used by US President Dwight D. Eisenhower in his farewell address on January 17, 1961. Eisenhower warned that the United States should "guard against the mastery of influence by military-industrial complex", which consists of members of Congress from districts with military industry, the Department of Defense and the private military industry (e.g., Boeing, Lockheed Martin, and Northrop Grumman).

The implementation of the research and development of the defense industry cannot be separated from the role of the three industry pillars (government, academia and the industry itself, hereafter known as the triple helix). Marina Ranga and Henry Etzkowitz[5] explain the relationship and function of the third component, the relationship among the three described in the statist model, Laissez Faire Model, and Balanced Model.

Implementation of the Triple Helix Model

Studies on the defense industry, the triple helix, and industrial cluster are not a new issue because many researchers or authors have researched these issues. Research on the defense industry was undertaken by Sri Hartati and Ade Muhammad[6]. The aims of the study are to determine the condition of the Indonesian defense industry system and analyze the application models of Indonesian defense needs. The results indicate that there are several models of the defense industry, namely a model system autarchy defense industry, niche production models and also the global supply chain. The Indonesian model employs the realization of the global supply chain, but in the provision of the defense industry, defense industry systems and technology models were supplied from the civilian production.

As for the triple helix studies that have been done by Loet Leydesdorff[7], this paper discusses the development of the dynamic between university, industry, and government. The relationship between industry and universities are more focused on recent research and development (R & D), while the government has a role to make the exchange of information between the investment in industrial policy, and intervention balanced at a structural level. This development is expected to be a success as long as it can anticipate or follow technological trends.

Based on the phenomenon of the Indonesian defense industry, especially PT. DI with all its advantages and disadvantages, the theories that have been presented and a number of previous studies, the author is interested in conducting research on the Indonesian defense industry model associated with the involvement of the three main pillars of the industry. This study is expected to obtain a design that can be taken into consideration in making a model of the defense industry in order to realize the independence of the Indonesian defense industry.

Literature Review

Discussing the importance of the aerospace defense industry is closely related to Air Power because it is a major force to win the war and to

carry out the national will. This is in line with what President Sukarno stated on the fifth anniversary of the Air Force on 9 April 1951, "Control the air to carry out the national will because a national force in the air is a decisive factor in modern warfare. Also, if we want to stand with equal height to the international forces, we must have an excellent army as well".

The defense industry is part of the element of air power. According to Westenhoff[8], there are 15 constituent elements of Air Power, one of which is Industry Potential (Strategic Industries). Westenhoff[8] suggests that a state may have every element of air power but may not be likely to flourish if the government does not have a strong commitment to ensuring the future development of aerospace. Attitudes and actions of the government will fully determine the air force posture, which in turn will affect the efficiency of the formation of civil air as well as industrial and aeronautical facilities. According to Westenhoff[8] , the elements that make Air Power consist of military aerospace strength, air force civil, industrial and aeronautical facilities. Air Power is the availability of tools required to support equipment as well as facilities such as airfields, aircraft, flight crew, aircraft mechanics, operators, aircraft designers, and aircraft manufacturers and aircraft parts needed. PT. DI as a strategic defense industry has a role as a power of the element in producing defense equipment, especially air force defense[9].

Realizing the power of a strong Air Power needs the support of the independence of the defense industry. According to Parker[10] independence means confidence in one's own ideas, independence with regard to getting things through. Self-reliance is also associated with a certain level of fiscal competence so that the strength or coordination will never happen amid efforts to achieve the goals. The independence means the absence of doubt in setting goals and not hindered by the failure. Self-reliance in the defense industry is important for the independence of the country because in that way it has the freedom to determine the posture and defense strategy. This is in line with what was presented by Silmy Karim[1].

Furthermore, I Wayan Midhio, Rector of the University of Defense in his presentation entitled "Opportunities and Challenges in the Perspective of National Defense" describes the stages of the independence of defense and security in the following figure.

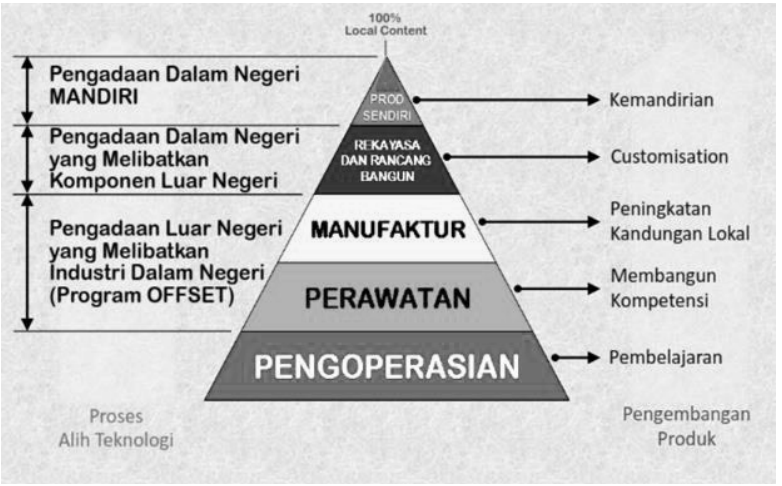

Figure 1 – Phasing of Self-Reliance Defense and Security

The figure above illustrates that the independence process begins when the defense of the operation continues treatments until one's own production previously located manufacturing process and engineering design emerge. As for the technology transfer, the process is carried out according to three stages:

a. Offset procurement program abroad involving the domestic industry at the level of care and manufacturing.
b. Domestic procurement involving overseas at the level of engineering and design.
c. Domestic procurement independently on its own production levels or 100% local content.

Referring to the explanation above, the independence of the defense industry is a condition in which the defense industry can meet the needs of defense in Indonesia along with the freedom of its own ideas that can lead to its conclusion. Attainment of independence is not easy and takes a long time, whereas the demand for defense equipment to the defense can not wait for a long time.

Defense industry development is inseparable from the role of government in determining defense policy and defense equipment at the same time as the defense industry policy, with a high complexity known by the military industrial complex[11,12]. In Pavelec[3], US President Dwight D. Eisenhower in his farewell address on January 17, 1961 warned that the United States should "Keep yourself to mastering the

influence by the military-industrial complex," which consists of members of Congress from districts with industry military, Department of Defense and the private military industry (e.g., Boeing, Lockheed Martin, and Northrop Grumman). The role of government and parliament on the military-industrial complex as an institution which sets monetary policy and the needs of defense equipment, the role of the military as the user specifies the respective items along with the corresponding specifications, while the industry is a part that meets those needs. Military industrial complex sometimes covers the entire contract and the flow of money and resources between individuals, companies, and institutions of defense contractors, the Pentagon, Congress and the executive branch. Eisenhower believed that the military industrial complex tends to promote policies that may not be in the best interests of the country and the executive branch.

The government has a very important role in determining the policy for establishing the independence of the defense industry. According to Marzah[13], there are six government policies in building industrial independence, better known by Marzah[13], six common policies. They are:

1. improving coordination between the government and the defense industry
2. encouraging and supporting research and development
3. supporting the global comparative advantage
4. helping companies access global supply chain
5. creating a pro-competitive environment
6. offsetting policy

These indicate that the government/parliament determine the monetary policy and the national security while the military as a user also determines the weapons and industrial needs as executor that produce war equipment.

Realizing the independence of the defense industry needs huge costs and a lot of time. Richard A. Bitzinger[2] states that establishing the defense industry in each country prefers cooperation with other countries than independently to reduce high-cost development. It is not out of the trend of budget-tightening policies which increase research and development costs (research and development) as well as the intensity of market competition. This makes the new defense equipment a necessary process for research and development (research and development) which require a huge cost and much time. Therefore, the

early sales of defense equipment would be expensive to be able to cover the costs incurred. When it could be marketed to other countries or carry out mass production, that's when the selling price could be lower with the same product made in another country[14].

Implementation of the Triple Helix Model

According to Marzah[13], Indonesia Economic defense industry shows three main models, namely the defense industry autarky, niche-production, and global supply chain models.

a. Autarky model. The model is applied by a country that has ambitions to gain independence of defense. Self-reliance defense is measured from:
    1. the capacity of countries to master the technology needed to make the military weapon systems;
    2. national financial capacity to finance the production of weapons systems;
    3. national industrial capacity to produce weapon systems in the country.

    Autarky model will be achieved if a country is able to have a minimum of 70% of the capacity of technology, finance, and production of weapons systems. This model is an ideal model for building military strength aerospace through the national defense industry. It can only be achieved by the countries which have the status or ambition to become a major world power (great power).
b. Niche-Production Model. The model is applied by countries that seek to reduce weapons' dependence on foreign manufacturers to develop national capacity for mastering the main military technology. Mastery of military technology is especially geared to help the country to develop eight types of conventional weapons. To implement this model, the state must have a commitment to invest the defense industrial sector by seeking to obtain military technology transfer from an established arms manufacturer. This strategy, for example, is effectively carried out by South Korea to develop surface warships, submarines, tanks, and fighter planes.
c. Global Supply Chain Model. This model tends to be applied by countries that have already had an established base of military technology but have not had great access to the international arms market. Lack of access makes these countries undergo the process of rationalization of arms production by integrating the production of weapons into a consortium of the global defense

industry. This rationalization is implemented through three main methods:

1. the creation of an industry consortium of weapons in a regional or global level;
2. the mobilization of financial resources from the private sector to finance cross-border investment into the defense industrial sector; and
3. the deployment of military technology from a major arms manufacturer to members of the consortium.

The development of the defense industry and other industries is inseparable from the role of the three pillars, namely the government, industry, and academia, which is better known as the triple helix concept. Triple helix theory was first introduced in the 90s with the publication of journals by Marzah[13], entitled "The Triple Helix—University-Industry-Government Relations: A Laboratory for Knowledge-Based Economic Development." Triple helix theory describes the relationship model between the three components, namely industrial university, industry and government interact with retaining its identity in accordance with their respective interests. An association between these components is further illustrated in the following configuration[15]:

a. Statist model. Components of the academy and the industry do not collaborate and cooperate, but the government is very dominant and controls the other two components.

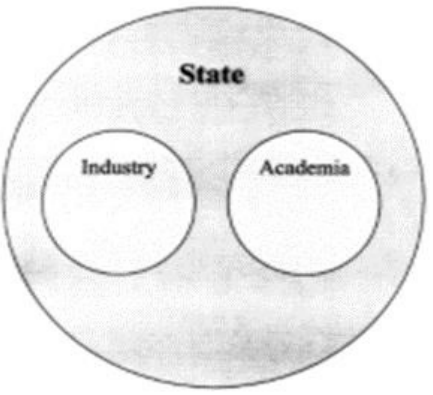

Figure 2. Statist model[5]

b. Model Laissez Faire. Model components of the triple helix are in an environment that is separated from one another but is still in touch with each other reciprocally.

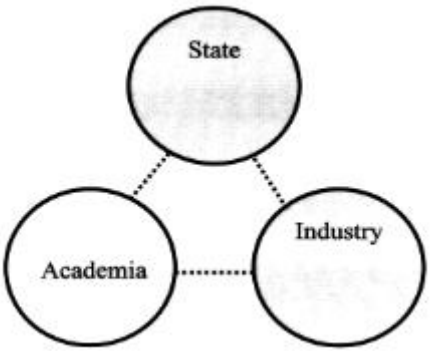

Figure 3. Laissez Faire Model[5]

c. Balanced Model. Model respective components influence each other and work together and collaborate in such a way that in certain fields they intersect with one another.

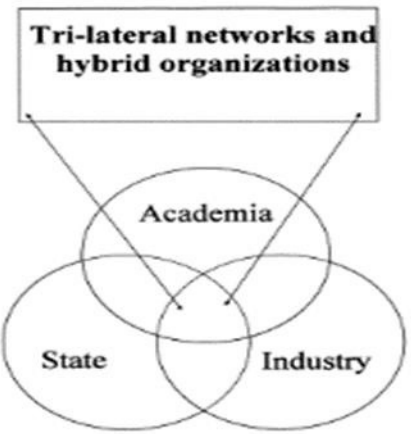

Figure 4. Balanced Model[5]

Richard A. Bitzinger[2] state that the model of the triple helix is a form of innovation systems from academia (universities) based on knowledge (knowledge-based innovation system) in order to develop a pat-

tern of interaction between institutions without leaving the basic purpose of knowledge itself. Triple helix models can also be stated that an educational institution (university) can have a major role in the form of innovation in a knowledge-based society (knowledge-based society); the university is considered as organizers of regional innovation in a society [2]

Triple helix explanation above shows the development of the industry, one of which depends on how the relationship between the government, academia (universities) and industry are, in this case, each retaining identity and purpose in accordance with the interests of each.

Research Method

The research was conducted to determine the role and relationship of three pillars in the development of the industry, namely the government, universities, and industry. Qualitative research is used to see the role of the three pillars of industry in the aerospace defense industry development with the implementation of the triple concept. Primary data were obtained from interviews with interviewees selected by purposive sampling. The interviewees are experts in the field of defense policy and aerospace defense industry.

Discussion

Results of research previously presented were analyzed by using the relevant theories. The analysis is expected to obtain an overview of the implementation of the triple helix in the aerospace defense industry development in Indonesia.

Independent Defense Policy and Defense Industry

National defense and security become major factors in maintaining and protecting the sovereignty from threats which can also affect the administration of certain countries. A country's management will rise and go through a significant correlation between the creation of a conducive security condition and equitable prosperity. Indications of increased security climate can be seen in the establishment of resilient national defense and security systems supported by adequate budget allocations and legislation that set out the responsibilities of each relevant institutions, as well as modern defense equipment.

Awareness of the importance of defense and security is further embodied through defense policies, which include the state of the defense

posture. The development policy of national defense to the minimum essential force (minimum essential force) becomes a high priority at the main components through the development of systems, personnel, facilities, and materials through modernization of the main tools of weapons systems (defense equipment). Development of national defense use concept-based defense budget capability (capability-based defense) while considering the threats faced and the development trend of the strategic environment. Increased military capabilities are implemented through the maintenance of defense equipment[16].

Fulfillment Air Force defense equipment would require the involvement of the aerospace defense industry. This is proposed by Westenhoff[8], who states that the element of Air Power consists of 15 components, one of which is a potential industry. An ideal condition when defense equipment needs can be met independently by the domestic defense industry that provides the flexibility to be able to determine the strength of its own security and defense capabilities without relying on other countries, as described by Silmy Karim[1] and the respondents. Silmy Karim[1] states that if Indonesia is able to make defense equipment by itself, it will be freer to realize the development plans of defense. As a commitment to increase the independence of the national defense industry, meeting the needs of defense equipment DoD/ Army pursued to make the most of the ability of the national defense industry. This step is an attempt to minimize dependence on military defense equipment from foreign products which are prone to the embargo. In order to support the policy of increasing the role of the national defense industry, government regulation and derivatives in the form of implementing regulations ranging from planning, assessment, implementation and monitoring and evaluation as a legal basis have been established.

Self-reliance in defense and security will ultimately reduce dependence on foreign countries, save and guarantee the defense equipment procurement costs and security. Realizing it needs the support of government policy and legislative improving the utilization and development of strategic industrial products Indonesia. This support was accompanied by the regulation on the use of the products of the defense industry. The resulting regulations also give the greatest possible utilization of the provisions of SOE product not only among governments but among other private needs. Other efforts in terms of capital and industrial production defense are included in the state budget as well

as promote good relations with foreign countries in order to develop the technology and industry to meet domestic demands.

Based on the opinions of respondents and observations, it is found that there are no currently independent Indonesian defense industries including the aerospace defense industry. However, it is necessary to address how the independence of the defense industry looks like. According to Silmy Karim[1], independence is divided into four stages, namely self-sufficient in the purchase, independent of use, self-maintaining and self-sufficient in production. Referring to the opinion, further analysis of the degree of independence of the Indonesian defense industry today can be elaborated as follows:

a. Independently in Purchase. Indonesian aerospace defense, in general,, has the independence in the purchase because Indonesia implements a free and active foreign policy that does not take sides on any "block". However, if in certain conditions independence has not been achieved, for example, when Indonesia decides to buy the Sukhoi aircraft from Russia and at the same time America tries to put pressure on Indonesia to cancel the purchase.
b. Operate independence. After being able to buy the weapons system it is expected that we have the independence to operate. However, Indonesia has a poor experience in this case when buying a Hawk 100/200 aircraft, which should not operate to confront the separatist movement or GAM at the time.
c. Caring independence. Up to this time to care for the Air Force defense equipment independently is carried by a maintenance depot or on certain aircraft MRO in the country which is carried out by the aircraft include the Boeing 737-200, Boeing 737-400 / 500, CN-235 and US Helicopter / NAS 332 Super Puma. However, there are some planes carrying out maintenance on Foreign Affairs.
d. Producing independence. At this stage, all the needs of defense equipment would be expected to be produced. The current state of defense equipment fulfillment Indonesia still relies heavily on overseas products. Even if there is a product in the country such as the CN-235 aircraft, most components are obtained from the aerospace industry abroad. However, it is realized that achieving full self-sufficiency is entirely impossible.

Furthermore, according to Richard A. Bitzinger[2] to realize the defense industry independent 100% takes very long and is one that is not possible so that if the defense industry can at least produce 25% of the components independently of defense equipment produced then we can say we have been independent. Furthermore, a relevant matter that the initial target of KKIP to realize the independence of the defense industry is to realize independence in nurturing and caring for defense equipment.

Statement or opinion stating that embody an independent defense industry in terms of production is one that is not possible, in line with the theory of Modern Defense Industry. According to Richard A. Bitzinger[2], building a defense industry in each country prefers cooperation with other countries. Furthermore, Richard A. Bitzinger[2] shows the three main models namely the defense industry with autarky models, niche-production and global supply chain models. Referring to the above results the appropriate models for the Indonesian aerospace defense industry that is global supply chain models and is in accordance also with the views expressed by respondents in the defense ministry and PT DI. The global supply chain models allow Indonesia to make the process of rationalization of arms production by integrating the production of weapons into a consortium of the global defense industry. This rationalization is done by three main methods:

a. the creation of an industry consortium of weapons in a regional or global level;
b. the mobilization of financial resources from the private sector to finance cross-border investment into the defense industrial sector; and
c. The deployment of military technology from a major arms manufacturer to members of the consortium.

Government Policy on Defense Industry Aerospace and Military Industrial Complex

It has been explained in Act No. 16 of 2012 that the government is one of the main components in the three pillars of the defense industry. The role of the government is a vital pillar of the defense industry as the government is the regulator and integrator. The government in carrying out their functions defense sector has been implementing policies in various fields. The Indonesian government has implemented a policy on the defense industry in line with Richard A. Bitzinger[2]

six common policies, some of the policies implemented by the government of Indonesia, among others:

1. improve coordination between governments and defense industries;
2. support defense research activities;
3. help domestic enterprises to access global supply chains;
4. offset policy;
5. human resource development (not six common policies)

The government should also carefully consider the possibility of negative effects arising from the measures taken. The possibility of this negative effects has been predicted by the US President Dwight D. Eisenhower in his farewell. They include:

a. The risk of corruption. When the government appoints an industry to take care of all the business of the defense industry, the strength of this kind can lead to corruption. The government must have checks and balances to minimize risk. The government provides subsidies to certain domestic defense industry to improve competitiveness and protect them from global competition; subsidies in various forms, such as large budgets for research and development. The government should have procedures to identify potential corruption and take appropriate measures to minimize the risk of corruption that destroys not only the defense industry but also the security of the state.
b. Strategic issues of dependence on other countries. The purpose of the government adopting policies to promote and maintain the defense industry is often aimed at achieving self-sufficiency, but the benefits and costs of policies should be taken into consideration. This is because the high costs incurred for policies that encourage self-sufficiency often do not produce the desired benefits of sustainable defense industry to compete globally.

Triple Helix at Aerospace Defense Industry

Triple Helix is a model of the relationship between the three pillars in industries, namely universities, industry, and government to interact with bilateral or trilateral in which each institution retains its independence identity in accordance with its respective interests. The results showed the government had a very dominant role in the development of the defense industry. Maturing government policy on defense to allow the implemented cooperation between the government, the de-

fense industry, and university (academic) requires research and development and human resources in a triple helix concept.

It has been stated in Act No. 16 of 2012 that one of the government's role is to integrate government agencies and private R & D by the defense industry and the government. But in fact, there are egoisms of individual research organizations, and they are not yet integrated. For example, ITB Pustekhan state there is a body of defense technology development center, as well as in BPPT there is a similar agency. In addition to the problems of egoism and unintegrated research organizations, there are also issues of R & D such as the minimal budget. To overcome these problems, R & D and research organizations need to be integrated.

Human resources are also one component that can be integrated by cooperation between the three institutions and the stretcher. The Air Force in addition to the industry also cooperates with educational institutions engaged in the field of aeronautics, especially the ITB. Many officers from various corps of the Air Force have been assigned to study at the school so that later on, they can utilize their expertise in the development of both internal Air Force aircraft as well as in projects in cooperation with PT. IN. As some Air Force personnel, PT DI also get the opportunity to attend classes in ITB especially now under the development of consortium KFX-IFX.

Furthermore, the cooperation between the three institutions can be illustrated by the following figure:

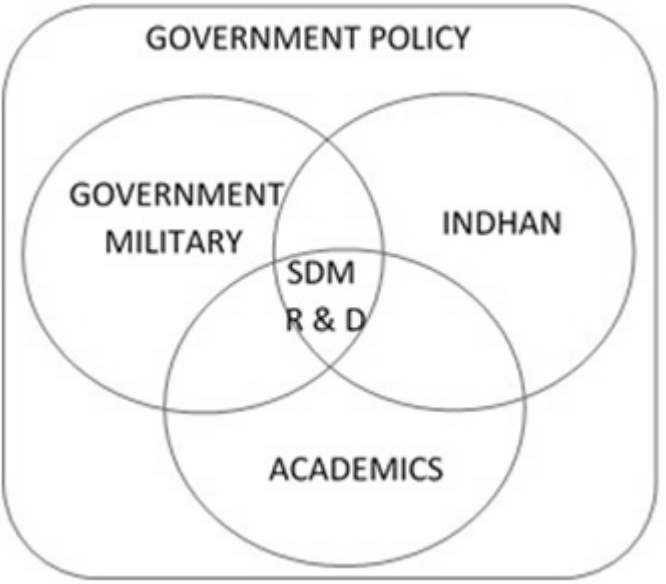

Figure 5. Triple Helix Model

Conclusion

Realizing a strong defense and security would require a strong military force backed by defense equipment. Meeting the needs of defense equipment can be done in several ways, one of which is through the independence of the defense industry. The independence of the defense industry is an ideal condition to meet the needs of the state of defense equipment. This thinking becomes the basis for the establishment of the Law of the Republic of Indonesia Number 16 the Year 2012 on the Defense Industry. The procurement of major weapons systems (defense equipment) is still obtained from abroad. For example, the Air Force weapon systems for fighter aircraft and radar come from the procurement or foreign products.

In order to realize the independence of the defense industry, the government has issued several policies: 1) improving coordination between governments and defense industries; 2) supporting defense research activities; 3) assisting companies in the country to be able to access global supply chains; 4) offsetting policy; 5) securing human resource development. However, this policy may lead to the risks of corruption and dependence on other countries.

Efforts to achieve independence also have a problem related to the synergies and integration of government institutions, academia, and industry in the implementation of R & D and human resource development. Therefore, to overcome this, we need to apply the concept of the triple helix.

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