The National Science & Technology For Strategic Industries In The Field Of Defence And Security

Dicky R. Munaf[1], Retno Windari[2]

[1]*Associate Professor at the Research Group on Humanity and National Resilience at Institut Teknologi Bandung Indonesia and Secretary of Chief Executive Indonesia Coast Guard*
[2] *Consultant at Indonesia Coast Guard*

ABSTRACT: *As one of the three unconventional assets today, S&T plays an important role in the development of economic policy, national credibility. The study examines the importance of science and technology (S&T) in the development of a nation as well as the effort to enhance its capabilities in the field of defence and security. It become one of many efforts in enhancing capabilities of the state and nation of Indonesia.The effort is made by designing and implementing several development programs through an AKPOHAN's scenario, which accurately calculates science and technology development. An institutional strategy is required in supporting the development, encompasses the assessment and prediction of future technologies as well as planning of science and technology for Defence and Security.*
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I.   INTRODUCTION

Competition among nations exists and can not be avoided, and is determined by competition in securing science and technology (S&T) — as one of the three unconventional assets today. A government may not develop its economic policy without considering the aspect of S&T as its advocacy. In order to pursue national interests in the globalization phenomena as well as its ambivalence, the role of S&T is very important whether it serves as economic or scientific asset. Empirical evidence validates that S&T is not only able to change the socio-economic parameter but also influence the socio-economic structure, trade interaction pattern, and people's life dynamism.

Further, S&T in many countries enables the nation's credibility to ascend. For example, India with software industry, Malaysia with multimedia, the USA with space exploration, etc. Empirically, S&T directly enhances quality of economic metabolism of a country through the rise of production efficiency, quality, and others. In other words, a competition power of the nation does rise like the Scandinavian countries with their cellular phone industry.

Also empirically, the competition power achievement of a nation proves to be influenced by the nation's motivation which represents development of geopolitic and geostrategy of the nation. When such phenomena are observed, of course it can not be separated from the national strength of a nation where the strength is much influenced by the ability of defence and security it has. This article is to specifically discuss about goals of the national S&T that are able to support strategic industries in field of defence and security.

II.   Globalization Phenomena And S&T's Development Change

Before carrying on the discussion on the substance of this article, it is better to understand the phenomena that currently prevail in international world i.e. **Globalization Ambivalence** phenomena which feature the challenge of harmonization to Democracy and Security as expressed by Musa Jega Ibrahim at theconference on *Economic for the Future* on September 2003. The globalization ambivalence indicates an existence of a paradox between <u>illusion of world unity</u> and <u>basic instinct propaganda of world domination.</u> The illusion mainly advocates global multiculturalism harmony through interconnectivity system of world's nations which is then forming a global society.

On the other hand, the propaganda for world domination is shown in economic tribalism that leads to the world's colonizing through domination on human living sources. [1]

The world's colonizing process poses a threat with new and modem dimensions, such as business intelligence in multinational companies, transnational crime, cyber crime etc., including contra-colonizing in forms of terrorism, separatism, and others, all of which use latest technology in achieving targets set by the colonizing or contra-colonizing practitioners. To keep with such phenomena will not only require ways of solving the prevailing problems, but more importantly is sets of hardware and software that can be used to turn the

colonizing-conflict out.

To understand more deeply about hardware and software as they are rapidly expanding, an attempt is made to examine the acceleration and orientation of future technology which will change human civilization. There are eight types of technology that are mostly potentially used in such colonizing process, namely: Biointeractive Materials, Cognitronics, Genotyping, Molecular Manufacturing, Quantum Nucleonic, Biofuel Plant, Bionic, and Combinational Science, as explained below: [2]

1. Biointeractive Materials

Biointeractive Materials generation is basically a high-tech sensor for bio-system.This bio-sensor, which is micro (even nano) in size with the size of micro (even nano) is placed under people's bodylayers, animals or plants. The sensor looks into health and even proactively takesaction to solve problems in spots it is located. The biointeractive material is also located inside a body. A number of corporations are currently preparing to undergo clinical testing on crystal structure with nanometer scale (billionth) to form synthetic bones.

Today, a number of biointeractive materials have been successfully made, smart shirt, for example, produced by Sensatex, a New York based company, integrating biosensor into T-Shirts for monitoring crucial moments such as heart beats and body temperature, and transfer the data to a laptop with wireless transceiver. Even in military, scientists in MIT (Massachusetts Institute of Technology) are designing battle suits that can change colour to create a camouflage while flying or fixing targets in order to avoid chemical and biological weapons.

2. Biofuel Production Plants

The reserve of fossil fuel is getting smaller and is running out at an alarming rate. To anticipate this, scientists will substitute it with biofuel production plants. Through innovations, the fuel is produced with plants which are genetically engineered.

3. Bionic

Another technology development is the improvement of human structure and body potency. With innovations, artificial systems are made to replace rotten, decayed, or lost parts of body. It serves to discover a power implanter which is smaller in size and can stay longer, and crafts a micro chip that can be integrated into the body's layers in a safe way. An example of this technology is defibrillator implant, prosthetic limbs, and being currently developed is polymer-based materials.

4. Cognitronics

In the future, human brains will be developed as interface (cognitronics). The aim is to perform telekinesis (moving things from remote area) with the help of a computer. Such a technology is one of science fiction's study objects which is not impossible to realize.This device can even convert the brain's electric signals into commands to move the computer's cursor. This will be the first cognitoric application that enables disabled patients to recover their basic ability.

5. Genotyping

DNA structure becomes the most personal thing through genotyping technology in grouping people according to their genetic aspects. It is meant to map in the best way the order of human genome and one by one accurately. The genotyping is to describe relations between DNA, human genetic code source, and other specific things that transform humans as unique creatures. Basic genome as the blue print of DNA being possessed by all humans have been mapped. The reason is to understand what exactly each gen is doing.
Today, researchers are making efforts to isolate each gene that plays a role in determining physical characters, endurance, and resistance to sickness.

6. Combinatorial Science

This is an attempt to optimize research and development results by forming Combinatorial Science. It is meant to combine statistical analysis and calculation capabilities as an effort to shorten research periods. Besides, it looks for ways on how to develop wares that can organize big amounts of data content as indicated by today's

development of super computer for Chemical Computation with a speed of 1 Zetta flops (1 zetta = 1 trillion — trillion floating point operation per second).3

7. Molecular Manufacturing

In the future, immediate supply of material that suits demand via innovative Molecular Manufacturing technology (molecular fabrication) will exist by constructing complex structures, atom by atom. This will be realized with a number of molecular machines that are able to manipulate atoms, just like Lego blocks. In fact, the idea of a device molecule is old as the chemical science, that is how to device everything from the most basic element.
Some researchers believe that the best way to start formulating molecules is to develop an assembler which can produce duplication of its own. The super-mini military robot will assemble atoms to create a material that physics law validates. Although scientists have positioned every atom on one surface, no one is able to advance to its assembly. However, a carbon nanotube structure - the synthesis of stain, has shown happy signals to a dream for devicing molecules.

8. Quantum Nucleonic

Quantum Nucleonic technology is an attempt to gain nuclear energy source that is portable, safe, and pollutant-free. It is intended to exploit the quantum nucleonic outside the laboratory. Such a technology allows us to search for ways on how to garner energy up from an atom nucleus - a most powerful electromagnetic structure in an atom — without fission or fusion.

All of the examples above are human intellectual works that can be used in a positive or negative way, so the problems remain at human morality in general. In the context of nationality, the problem evolves as civic morality - a way of thinking and acting of a nation to safeguard its sovereignty and individuality in interacting with other nations.

Civic morality as nation's basis of geopolitics and geostrategy that refers to the effort of reinforcing a nation's power in safeguarding its nationalism as a sovereign entity and in active participation in relationship with the world as the aim of reaching its national goals. By doing so, while the Globalization Ambivalence contains a paradox of unity illusion and basic instinct to colonize, there still room to settle any conflict which may arise out of the multicultural harmony effects if we can establish Civic Morality in geopolitics in order to influence all policies in the national development sectors.

III. Strategic Industries In Field Of Defence And Security.

To refer to the essence of the nation's competition power which can not be separated from a nation's ability to perform democracy and security harmonization, then the national industries for defence and security sector is imperative to develop so as to keep the sustainability of operational effectiveness by state officials in anticipating strategicenvironment change. As a matter of fact, the national capacity of defence and security sector had its orientation towards strategic industries in early 80's, in which the meaning of "strategic" was focused on the potentialroles in:

a). theefforts to alleviate dependence on imports which tends to be sensitive in geo-politic and geo-economic dynamics.
b). theefforts to develop Human Resources and S&T which are oriented to encourage creativity in defence and security infrastructure production.
c). thecommercial prospects in the future, although commercial flexibility is low in short term. It means that, if in short term the submission to market mechanism was not realized then public sector needs to be involved to undertake.

Strategic industries have not yet developed as expected, especially those dealing with support for defence and security sectors; however, the investment was interfered by the public sector. Therefore, the internal and external regulation aimed at supporting the sense of strategic is not optimal, such as regulation in taxation, material procurement, export, S&T, and regulation of others. This has caused lack of support in the use of home products even though some strategic industries, technically, are indicated to have offered product excellence, as follows[4]

a) PT. IPTN (Nusantara Aircraft Industries)

Serving as an aerospace and weapon systems (rocket and torpedo) industry with a mission to be a centre of excellence for the aerospace industry, this industry has been able to produce both fixed and rotary wing aircrafts for civil or military version. For military version, CN 212 and CN 235 are modified for maritime patrol, air patrol and carrier. To meet the needs, military carrier aircrafts with a capacity of up to one ton and light battle aircrafts are currently developed. A number of helicopters have also been produced, including NBO 105, NBELL-412 and Super Puma for patrol carrier, observer and light battle helicopter armed with cannons, missiles and so on. There are also helicopters especially designed for combat version and carrier version up to 1 Ru.
For defence and security system, land/air FEAR 2,75 and SUT torpedos have already been produced, and rockets with cruising capability of 50 to 700 km are under development, also to be developed short-cruising missiles. For monitoring purposes, included in the development is remote sensing via satellite and a monitoring system which is fixed on aircraft (like AWACS). For maintenance and service, the defence and security facilities for aircrafts and helicopters are expanded to depot level.

b) PT. PAL INDONESIA (Shipyard building Industries)
Serving as a sea transportation industry with a mission as a supporter to the existence of the archipelagic insight and centre of excellence for shipbuilding technology, this industry has been able to produce fast patrol boats (FPB 57, FPB 25) and jetfoils. With its low-cost corvette and frigate programs, the industry designs battle ships for the navy to meet the need of the Indonesian Navy, coming in development is fast patrol boats with up to 400 and 600 tons, frigate ships to 2500 tons. With support ships with discplacements up to 5000 tons, 10,000 tons, and 30,000 tons, submarines up to 1,200 tons including integration and service, the defence and security facilities are developed to depot level with 5,000 tons.

c) PT. PINDAD
Serving as a light weapon and ammunition and machine tool industry with a mission as centre of excellence for weapons and ammunitions, this industry has successfully developed SS-1 type (FNC modification), revolvers, small caliber ammunition with various sizes and large caliber ammunition. In line with support to self-capability in managing the state's defence and security, there will be a production for tactical vehicles and combat vehicles that weigh up to 4 tons, MKB (GMO & MO up to 81,120 m; Murat up to 155 mm), machine guns and cannons up to 155 mm).

d) PT. DAHANA (Explosive Material and Propellant Industries)
In line with the government policy, this industry has been transformed into an enterprise so that it can be developed as an integrated explosive material and propellant industry in producing explosive materials for military and commercial industry. Its mission is to be the centre of excellence for explosive materials and propellant technology.

e) PT. KRAKATAU STEEL
This industry is directed to become a backbone of the national steel industry whose products can be utilized as materials for the Indonesian navy's war ships, tactical vehicles and combat vehicles, light weapons & SMB, as well as bridges for military.

f) PT. INKA (railway industries)
This industry is acting as the centre of excellence for railway technology. For military needs, it can produce tactical vehicles and combat vehicles as well as supply containers.

g) PT. INTI (Telecommunication Industries)
Serving as a telecommunication and informatics industry which produces various equipments, including equipments for military like HP Radios (for land use, etc.), digital microwaves, and packsanet. In fulfilling the need for the electronic communication equipments (alkomlek) in the future, this industry has developed military alkomtel with security system, pemika (ECM, ESM and ECCM), as well as communication satellites and monitoring satellites.

h) PT. LEN INDUSTRI
Serving as a professional industry in electronic equipment and component which can support the autonomy of electronic industries in the country. In the field of defence and security, it can produce radars, control systems,

K31 equipments and avionics. The industry currently develops military electronic equipments such as powerful controlradar for field monitoring, K31 software systems, control equipments for missiles, cannons and multi-rocket launchers, optronic monitoring equipment, and defence and security facilities for alkomtel to depot level.

i) PT. BARATA

This company serves the industry in the fields of heavy equipments, steel constructions, machineries and casting, having potential in manufacturing many types of ALBERZI for the benefits of defence and security, such as tractors, bulldozers, cranes, bailey bridges, panton bridges, and so on. It can also produce components for tactical and combat vehicles.

j) PT. BOMA BISMA INDRA

This is an industry for machineries (diesel engine), constructions, factory tools and engineering, which is able to act as a supporter to the state's defence and security in producing military equipments such as bailey bridges, panton bridges, hangars and bunkers, prime movers for tactical and combat vehicles and it is also potential as the defence and security facilities for tactical and combat vehicles.

Continuous efforts have been made by the government as underlined in 19992004's National Guideline (Chapter IV, point 1) that the development of defence and security gets its support from sufficient infrastructures, which can mean the use of domestic instruments and equipments as much as possible. In the context of the use of domestic products, it should consider that the products have deterrent effects in raising image that the National Military and the Indonesian Police perform adequately according to the National Development Program (PROPENAS) (Chapter Xl, point C.1).

In addition to the existing strategic industries, at present there have actually been productions by other industries that have a connection with the defence sector, especially in five fields outlined below:

a) Field of Agriculture and Food

This field has produced comfort food to be used in boats and rafts for rescue, to be produced by PT. Surya Segara, for an emergency condition. It can help personnel on duty to meet their calorie needs.

b) Field of Sea, Land and Space

Having examined the research and development results by Government'sNon-Department Agencies on Research and Technology (LPND Ristek), programs such as survey and mapping, development in maritime and shipbuilding industry, in remote sensing, navigation and geographic information system satellite, in space technology, have basically been able to be produced by national industries.

c) Field of Transportation and Logistics

One of the national industries that also produce support equipment for defence and security is PT. Telaga Herang,which is able to produce hovercrafts.

d) Field of Manufacturing

In this field, many components and equipments can be produced by the national industries for supporting defence and security sector including the procurement of heavy tools, such as by PT. Pupuk Kaltim in Bontang.

e) Field of Information and Electronics

ITB has developed wargame simulators and has had experience to develop them in cooperation with the Indonesian Navy; and ITS has been able to emonstrate a commercial radar for defence purposes. Considering that this field can support some aspects such as military and space support equipment, innovations to produce various products should be promoted to achieve excellence

The emergence of the national industry participations in developing products that have connection with the suitability to defence and security sector does need encouragement through regulations, for example taxation, investment and S&T aspects. This is imperative since strategic industries are highly potential in developing defence and security sector compared with support industries which always need markets for their products.

Having learned the existing capacity of the national industries and the situation ofprocurements and the dependence on import products, according to the National Guidelines (GBHN), the government needs to focus on defence and security development that is supported by industries which can assure preparedness and accuracy of products in the field of defence and security, mainly ammunition, maintenance capability and capability for immediate modification to equipment that possibly happen during wars.

In this context, proposed are four types of industry capabilities which are immediately in need and can use

the infrastructure of strategic industry and support industry, namely: [4]
1.   software for wargame simulators (to minimize the use of field training ammunitions)
2.   Data Management and Intelligence (to protect information)
3.   Equipment for Command and Control System (to accelerate movements)
Capability to prepare and maintain existing equipment.
To accelerate the establishment of support from industries to gainsuchcapabilities, proposed are two types of support industries to be placed as a priority in supporting strategic industries, namely: [4]

1. Steel Industry

The development of defence and security industry is determined by two main industries, namely steel industry as components for weapons, technical, and war equipment; and informatics and electronic industry.
In field of steel industry, PT. Krakatau Steel is one of the biggest steel manufacturer for steel products in Indonesia. It is also the biggest one in Southeast Asia with export orientation to Japan, USA, England, developing countries like China, Middle East and it also meets domestic need.
Each year, this industry produces 60% of Indonesian total products and places Indonesia as the leader in supplyingthe world's need for steel. Its main productsare steel billet, steel lab, hot rolled steel coil, strip, plate, cold rolled steel coil and sheet, reinforcing bar, cable, and others. At present it is supported by nine units of factories, namely direct reduction plant, slab steel plant, strip mill, cold rolling mill, billet steel plant and wired rod mill.
Several other national steel industries that produce industry equipments with the use of iron and steel components up to the year 2000, according to data from BPS, numbering 103 industries with 42% of the components come from domestic-owned companies (PMDN) and 15% from foreign-owned companies (PMA). The rest come from joint companies.
With the assets and facilities owned and supported by capable human resources, national steel industries can be a highly potential asset in developing the national defence industry.

2. Information and Microelectronics Industry

Information and microelectronic are two fields that are partucularly influential to the technological level of defence and security systems. With such a big domination of technology in these fields, the most developed society are so called information society. The main characteristic of this industry is the high cost for production development and low cost for production.
Considering that the information and microelectronic are fields that support various aspects including military and space equipment, the topics in developing them should guarantee the existence of a capability.
Some considerations that need attention in developing information and microelectronic industry include:

1.   Information technology and microelectronic should be developed for the Indonesian infrastructure development and promotedin such a way that Indonesia will be able to face the competition in achieving its national benefits, including defence and security benefits.

2.   Enhancing the electronic sector has made the non-oil and gas sector as the secondbiggest foreign exchange gainer in Indonesia. hence, information technology and electronic programs need to be directed to support the strategy of industry and international trade of Indonesia and for the benefits of defence and security, especially in the application of Cognitronics and Combinatorial Science.
In attemptingto establish such a synergy, proposed here isthe formulationof support strategy which is not less important to help enhance defence and security industry.

1.   Policy on support industry is the existence of established defence and security industry, with product distributions as follows:

No	Industry	Products		Incentives
		Def & Sec	Commercial	
1	Strategic	60%	40%	- Policy of domestic procurements - Policy of tax
2	Support	10%	90%	- Policy of tax - Policy of commercial product export

2.   Policy on support from science and technology sector with finance allocation to encourage creativity and innovation of products that have connection with defence and security industry, mainly in the fields of :
- Health and Biotechnology
- New Materials
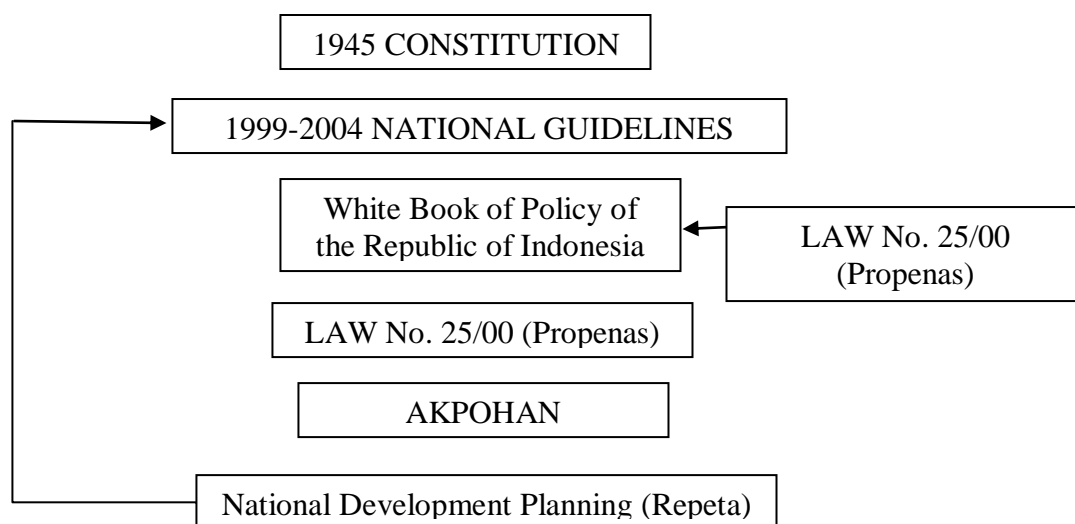- Manufacture, including micro satellite and maintenance

3.   Policy on career path for Military and Police personnel who are in charge of logistics. This is important so as not to position military and police personnel only as RECEIVERs.

IV.   Agenda Of Capability Achievement Of Defence & Security Posture

Looking at the national wish of today, one of the main aspects in achieving the national defence and security posture is the establishment of an *Agenda of Capability Achievement of Defence & Security Posture (AKPOHAN).*The main targets are time, finance, human resources, equipment in achieving the capability and are supported by other development sectors. The establishment of the agenda is a must for answering various challenges and questions on the function, target and benefit of the Defence and Security Posture for state and nation. It will give a clear direction on what, how and when the Defence and Security Posture is carried out in this country.

AKPOHAN is meant to be used as a guideline in planning, application and development of national defence and security posture and it refers to the national paradigm that underlines the National Defence System.

Position of APOHAN is described hierarchically below

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            ┌─────────────────────────┐
            │    1945 CONSTITUTION     │
            └─────────────────────────┘

    ┌──►┌──────────────────────────────────┐
    │   │  1999-2004 NATIONAL GUIDELINES   │
    │   └──────────────────────────────────┘

    │      ┌──────────────────────┐     ┌──────────────────┐
    │      │ White Book of Policy │ ◄── │  LAW No. 25/00   │
    │      │ the Republic of      │     │   (Propenas)     │
    │      │ Indonesia            │     └──────────────────┘
    │      └──────────────────────┘

    │      ┌──────────────────────────┐
    │      │ LAW No. 25/00 (Propenas) │
    │      └──────────────────────────┘

    │         ┌───────────────┐
    │         │    AKPOHAN    │
    │         └───────────────┘

    └───┌──────────────────────────────────────────┐
        │ National Development Planning (Repeta)    │
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According to its essence and hierarchy, AKPOHAN is to set up flows of capacity development programs for the national defence posture in short term (3-5 year), medium(5-10 year) and long term (10-15) as well as planning and execution (road mapping) based on the strategic need mentioned in the Defence Policy White Book. The AKPOHAN will be able to formulate a strategy of procurement priority for infrastructure, human resource as well as integrated and sustainable strategy from time to time, including the finance allocation.

In general, programs in AKPOHAN exercise dual tracks. The first track is based on targets of fulfilling the need of the national short-term as underlined in six of the Gotong Royong Cabinet Policy; while the second track is devised to achieve excellence of National Defence Posture in global level. Both tracks are forming a unity and are referring to the White Book which was composed with the spirit of the Constitutions and TAP IV/MPR/1999 and Propenas. Main principles of defence ability is to carry out three roles, namely able to fight threat, to pledge national security, and to be active in keeping world's peace.

AKPOHAN is developed through approaches of three strata, namely institution, national, and international level. The institution approach covers analysis on capacity, policy and implementation of the defence posture achievement. At the national level, focus is made at execution and assessment of the National Defence Policy (White Book) and at any connection with policy of other sectors, such as industry, education, and others. At the international level it covers analysis of development, potency, and trend of global development, especially the increasing power of roles of Non Territorial Actors.

To achieve the above needs, we need to consider a classic problem of economy that is the unavailability of sufficient finance so the achievement should be made with priority from the view of urgency, material, and problem aspects and phased-execution in view of finance, time, and implementation aspects. Thus, the transfer of policy from White Book to AKPOHAN should follow two important processes, namely:

1.   Priority based on : national problem urgency, best added value process,support from other sectors, social basis in society and accessibility at national level.

2.   Phased-programs based on : finance, human resource, and time to implement program
Considering the limitation in finance and the lengthy time in achieving the defence posture, then the activities to develop defence will be carried out in three stages as follows:

1.   Short term stage (3-5 years)
During this course of time, activities for defence posture achievement are focused on dealing with various critical problems that nation faces (survival). In this stage 50% of allocated finance to exercise role as able to fight threat, 35% to pledge security, and 15% to keep world's peace.

2.   Medium term stage (5-10 years)
In this period of time, nation's critical problems are expected to have been overcome. Also expected the Gross National Products will have significantly increased so that able to serve finance for the national defence. The defence posture will emphasize on the increase of size, intensity, efficiency, and effectiveness of added value. Priority is aimed at sustaining national security assurance, while role as able fight threat and keeping with world's peace will go to next priority.

3.   Long term stage (I0-I5 years)
Entering into this stage the National Defence System is expected to have been smoothly operating and all support infrastructures been established and which are supported by stronghold of social and economic and law conditions. So in this moment, attention needs to be given to Social Security and Defence which places and prioritizes the keeping with world's peace aspect.
To ensure the operation and success of the National Defence's White Book also requires a policy regarding its support which covers five aspects:
•   Defence management
•   Education and training
•   Finance
•   Technology
•   Dissemination
AKPOHAN will be the last product in matrix form for the three roles. Defence ability and eight Defence Policy components, each of the clusters discusses five support aspects of defence policy. AKPOKAN contains three matrixes that describe the time span of achieving Survival (3-5 years); Serving Self-

security and Defence (5-10 years), and Social Security and Defence (I0-15 years).

Such regulation establishes that defence and security equipment industries should be also allowed to produce commercial products where the ration of product types affects the value of tax dispensation imposed on the industries.

V.   CONCLUSION

The explanations above have so far described various things in connection with an effort to enhance capabilities of national science and technology in the field of defence and security, as one of many efforts in enhancing capabilities of the state and nation of Indonesia — being affluent, able in self-fulfilling, and equal with other developed nations in world. The effort is made by designing and implementing several development programs through an AKPOHAN's scenario, which accurately calculates science and technology development.

As explained, the infrastructure that supports the creation process of new products and scienceand technology are located within separate sectors and scattered throughout the countryand operating under control of several state departments or private organizations. Therefore,theestablishment of synergy effect for these infrastructure components requires an institutional strategy by national institutions, which can carry out a general management at a national spectrum.

Some of the tasks the institutional strategy must carry out are: [5]

1. Assessment and Prediction of Future Technologies

a.   to examine technological change in a national and international level and to identify various trends so that technology forecasting can be exercised accurately for establishing S&T policy

b.   To assess technologies that currently or will develop from the view of micro or macro economy aspects and their implications to environment, socio-culture resources, politics-legal, and so on.

c.   To study technology anatomy and decompose it into sub-technologies and to study the use and the feasibility of such sub-technologies development to be useful products and derivative technologies.

2. Planning of Science and technology for Defence and Security

a.   To set up programs in the effort tomaster and producederivative technologies and new technologies, and establishing infrastructure and society to keep up with future technologies.

b.   To set up priority and focused technology which will be developed according to feasibility study and assessment.

c.   To set up a strategy for finance and incentives in developing various focused technologies.

d.   To set up strategy of human resource supply, including its education and training throughout phased-period of technology development, especially in defence and security sector.

BIBLIOGRAPHY

[1].   Suradinata, E. "Aspects of Industrial Regulation Which Should be Fixed and The Its Solutions for Developing Defense and Security Industry in Indonesia" Seminar for Building Industrial Regulation, ITB, Bandung, January 20, 2004. (In Bahasa Indonesia)

[2].   Sinar Harapan, July 15, 2002 (In Bahasa Indonesia)

[3].   Munaf, D.R, "Development and Implementation of Science and Technology"' Seminar in KSA XII Lemhannas, June 30, 2004. (In Bahasa Indonesia)

[4].   Munaf, D.R, "Suggestion for Building Defense and Security Industry", Documentfor Bappenas, July 10 2002. (In Bahasa Indonesia)

[5].   Besari, M.S, "National Research Agenda"' Research Laboratory of LAPI-ITB. (In Bahasa Indonesia)