

# On the Development of the Korean Defence Industry

YOO, HONG MO

*44th Session, Advanced Center for Administrative Development  
Graduate School of Public Administration,  
Seoul National University*

## Introduction

The Korean defense industry gained significant results since it had been launched in the 1970's with strong support of the government. However, in the early 1980's, as the international and domestic security environment underwent changes after the Cold War and economic growth became an urgent national objective, the civilian industry began to take priority over the defense industry. Accordingly, the Korean defense industry suffered a deep depression in the middle of 1980's and this trend has continued into the 1990's.

Although some people have raised voices about the importance of reviving the defense industry, it still not perceived as an urgent part of the nation to be re-activated. Generally, the defense industry lacks political and systematic support.

In this connection, the general status of the Korean defense industry needs to be reviewed and whether it has the potential power and flexibility to effectively encounter the changing international security environment should be assessed. This paper reviews the weak points of the Korean defense industry and suggests desirable directions for its development.

## Defense Industry in General

The defense industry is composed of research and development (R&D) and pro-

duction of military equipments and materials. The "production" includes manufacturing, processing, assembly, maintenance, reproduction, improvement, and remodeling. Defense industry in a broad concept develops or produces the material, machinery and tools(including weapons and equipments) that are used directly or indirectly for national defense. Defense industry in a narrow concept is to develop or produce the machinery and tools(including weapons and equipment) that are used directly for national defense and are important elements in building up military force. This paper concerns the defense industry in a narrow concept.

There are several characteristics of the defense industry that make it different from the civilian industry. In the defense industry, production quantity is limited since the government is the only customer in most cases. It also requires highly complex technologies and the products need to be highly precise. The recovery of investment requires a long time span and the life span of technology is very short. Operational capabilities and fielding in due time are more important factors than price. Furthermore, production facilities cannot be removed freely in preparation for emergencies and intensive security measures are required in the defense industry.

The defense industry is sort of a complex industry that has many sub-structures and related industries. In this sense, large enterprises are suitable for the defense industry since it often needs huge amount of capital and facility investments. In addition, R&D plays important roles because of the complex advanced technology requirements.

Generally, despite low productivity and operation rate, the defense industry has many positive effects. The defense industry has linkage effects on its related industries. Backward linkage effects occur when a defense enterprise expands its own capability to supply resources and production means by itself. Forward linkage effects take place when new industries are established, which usually bring about large effects in the areas of machinery, metal, non-iron metal, and electronics.

The defense industry usually leads the civilian industry in enhancing the general industrial technology level. Development of the defense industry also improves the balance of trade by the import-replacement effect and the export of military equipments. However, one must have in mind the fact that the importance of the defense industry cannot be counted in terms of economic effects and values, since it is essential to achieve the self-defense of the country.

## The International Defense Industry Environment

The post Cold War era is a period of transition in which the old form has faded out, but a new form has not yet emerged. As the bipolar stand-off ended, global arms reduction has become a dominant feature of the international security environment. However, nationalism, regional and ethnic antagonisms and conflicts within and/or between states have become sources of threat. Also, the proliferation of weapons of mass destruction has become a threat to the international security<sup>1)</sup>)

In such an international security environment, the international defense industry is experiencing a severe change. The global arms reduction resulted in the reduction of international arms sales. The amount of global arms sales in the 1990's is expected to be reduced to half of the level of the 1980's<sup>2)</sup>). Defense industries cannot avoid overall structural reforms such as down-sizing, merging or consolidation.

As the down-sizing of armed forces becomes inevitable, major powers seek to offset this quantity reduction by quality enhancement. As pursuing technology intensive and qualitative armed forces, major powers and defense industries are making efforts to maintain their own technology superiority with advanced weapon systems. Accordingly, significant weight is given to technology accumulation through R&D. Investments on R&D have increased while budgets on other parts of military forces have been reduced. Additionally, protection of military technology is being reinforced since the success and failures of defense industries depend on how one can maintain technology superiority.

On the other hand, opportunity of technology cooperation and transfer may increase as the exploitation of new markets becomes inevitable. Also, joint R&D or technology cooperation between countries may become more necessary to reduce the risk of R&D investment and to save the cost of independent R&D. In such an international defense industry environment, it is urgent to build up a defense industry based on the power of science and technology.

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1) Seo, Woo-Duck, 'Reinforced International Export Control and Development of Defense Industry', The Korean Defense Industry Society Bulletin No. 3, 1996. 6.

2) Lee, Ho-Seok, 'Status of the International Defense Industry Market', The Korean Defense Industry Society Bulletin No. 2, Dec. 1995.

## Progress of the Korean Defense Industry

The Korean defense industry began in the early 1970's with real earnest under the necessity of self-defense. Around late 1960's and early 1970's, the gap between the military forces of North Korea and the Republic of Korea was widening along with increasing armed provocations by North Korea. At the same time, the traditional security policy of the USA towards the Korean Peninsula was about to change.

Under such a security environment, the late President Park set out a resolute plan for the development of the defense industry and provided extensive and comprehensive support in regard to policy and system. The Agency for Defense Development (ADD) was established in 1970; the special law for the development of defense industry was established in 1973; and the defense tax system was newly introduced. Defense R&D investments increased dramatically from 0.2% of the defense budget in 1971 to 5.1% in 1976. On the back of such a strong drive, the Korean defense industry made a significant achievement in a short time span, where Korea was able to attain self-sufficiency in most of the conventional basic weapon systems.

However, the security environment on the Korean Peninsula began to be stabilized in the early 1980's as shown in the cancellation of the withdrawal of USFK from the Korean Peninsula. Furthermore, as the civilian industry began to lead the national economy, concerns about the defense industry decreased. Several supportive policies and systems concerning the defense industry were abolished, including the removal of the Committee on the Promotion of Defense Industry and the termination of the Finance Support Policy for defense industry.

The weight of the acquisition policy shifted from R&D to overseas procurement. In addition, since the domestic demands of conventional basic weapon systems had been generally satisfied, the operation rates of the defense industry dropped significantly. The depression begun in the 1980's still lasts into the 1990's.

## Contributions of the Korean Defense Industry

Even though the Korean defense industry has been suffering a deep depression, it has made significant contributions in narrowing the gap between the South and North in terms of military strength. It has also greatly enhanced self-reliant logistics support capabilities. In addition, it has played an important role in leading the development of the civilian industry through linkage effects and made contributions

to higher employment rate and fostering of skilled technical manpower. Trade imbalance could be improved by import substitute effects. Above all, the contribution of the successful defense industry has been in inspiring national pride and self-confidence for autonomous defense.

## Present Status of the Korean Defense Industry

Currently, there are 83 authorized and registered defense companies in Korea. They produce a total of 319 items of defense materials and equipment. About 40% of the Korean defense industry is occupied by large enterprises with a capital of more than about 50 million dollars<sup>3)</sup>. Medium sized companies with a capital of 1 to 50 million dollars occupy another 40%. About 20% is occupied by small sized companies with a capital of less than 1 million dollars. The total contract amount of the top ten Korean defense companies occupy 70% of the entire defense procurement contract, which means that the Korean defense industry is heavily reliant on large enterprises.

<Table 1> Defense Industries and Defense Materials(as of 1996)<sup>4)</sup>

items	total	guns	munitions	vehicles	Communi- cation/ Electronics	Ships	Aircrafts /Missiles	Others
Defense Industries	83	14	10	12	13	5	7	22
Defense Materials	319	41	92	33	78	18	18	39

The gross product of the defense industry is 0.7% of GNP. Export of the defense industry is less than 0.1% of the total national export. As can be seen, the defense industry does not carry much weight in the national economy. The average operation rate of the defense industry in 1996 was 56.7%, which was about 10% less compared to that of ten years before. On the contrary, the civilian industry maintained an operation rate of 83% in 1996.

3) Chung, In-Soo, 'A research on the Rearing-up of Korean Defense Industry According to the Changes of Security Environment', The Korean Defense College, Nov, 1994.

4) '96-'97 Korean Defense White Paper, Oct. 1996.

<Table 2> Operation Rates of Defense Industry<sup>5)</sup>

Unit : %

Classification	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93
Company Total	66.1	69.3	77.6	81.5	72.3	68.3	66.6	63.3	61.8	64.2
Defense Section	66.4	69.0	77.8	75.5	65.3	58.3	55.6	56.9	59.8	54.2

## Technology Level of the Korean Defense Industry

In general, Korea is relatively strong in the manufacturing and processing of hardwares, including the semi-conductor industry, while it is still weak in the area of advanced technology, including the software industry. This is due to the general weaknesses in basic science and technology. The overall technology capability of the civilian industry is around 50% of the developed countries.

The technology level of the defense industry is similar to that of the civilian industry. Korea's defense industry is relatively strong in the conventional weapon systems area such as munitions, maneuvering equipment and firing systems. However, it is still weak in the field of advanced precision weapon systems such as aircraft, missiles and communication and electronic systems. The overall technology capability of the Korean defense industry is estimated to be about 60% of that of advanced countries.

<Table 3> Technology Levels of Korean Defense Industry<sup>6)</sup>

area	Fire Power/ Munitions	Vehicles/ Engineering	Ships	Aircraft/ missiles	Electronics	Others
Level	70	70	65	60	60	50

\* Average of G7 except USA is 100

The Korean defense industry primarily lacks high capability R&D manpower. Investments in defense R&D make up approximately 3% of the defense budget, which is relatively low compared to over 10% in most developed countries.

The depression of the Korean defense industry may be ascribed mainly to weak technological capabilities. The Korean defense industry has not paid enough atten-

5) The Analysis on the Management of Korean Defense Industries, The Korean Defense Industry Promotion Council, Aug. 1994.

6) Cho, Nam-Hae, Master's Degree Thesis, The Korean Defense College, 1993.

tion to nor invested in the core technologies. It spent most of its capacity in the development of weapon systems. The core technologies or parts that were required to make these weapon systems were chosen to be purchased from abroad rather than to be domestically developed.

The uncertainty of the military procurement plan has also been a source of the depression. Steady and planned procurement of weapon systems is needed for the stable operation of an industry. Other factors of depression include the poor mid and long term policies and strategies, insufficient interrelationships among the industries, universities and research institutions, insufficient linkages between military technologies and civilian technologies, poor development of dual-use technologies, preponderance of one country in international military technology cooperation, and insufficient support in regard to policy

## **Suggestions for the Development of the Korean Defense Industry**

### **1. Revitalization of Defense R&D**

There are two ways of technology development. One is the top-down approach and the other is the bottom-up approach. The top-down approach is to begin development of a weapon system along with the development of the related core technologies. The bottom-up approach is to develop and secure core technologies necessary for a weapon system first, and then develop the weapon system.

In the past, most of the weapon system developments were top-down approaches. With this approach, development of a weapon system often began without obtaining the core technologies which were absolutely necessary for the successful development of the weapon system.

Considering the failure and limits that the Korean Defense Industry experienced in undertaking weapon system development without having core technology in hand, higher priority should be put on the core technology over the system itself. With poor core technology, one must face a limit in the research and development of weapon system in the long run. With this regard, priority of investment should be given to the research and development of core technology and parts.

In order to revitalize defense R&D, the foundation of the basic defense science and technology must be reinforced. The basic defense science and technology can be

effectively developed by expanding the university defense research programs. This program will make a significant contribution to the enhancement of the defense science and technology level in the long term.

Specialized Research Centers<sup>7)</sup> established at several top-ranking universities need to be enlarged. There are five authorized Specialized Research Centers in five research areas. The Specialized Research Center system provides the universities stable research opportunities and environments for a given research field for a relatively long period of time. Enabling concentrated and specialized R&D to the specific field is a good feature of this system.

## 2. Increase of Science and Technology Manpower

To enhance defense science and technology, it is important to have scientific ways of thinking and understanding, i.e., scientific mind. The enlargement of the basis of science and technology is required. This can be achieved by the enlargement of science and engineering programs in the military academies, the curriculum and level of education in the Military Science and Technology College, and the appointment of science and technology manpower to high positions in the MND (Ministry of National Defense). Also it will be desirable to appoint civilian scientists to posts in MND. Investments should be increased to acquire quality researchers and to provide them with a sound environment for research and development.

## 3. Strengthening R&D Capability of Industries

Industry-lead R&D for weapon systems is not so active, occupying only about one third of the all weapon system developments. Industries heavily rely on the ADD for weapon system developments and have a poor technology base.

R&D requirements need to actively be create to stimulate industry-lead R&D. R&D requirements can be created by attempting domestic production of parts and components, product improvement of weapon system, or development of dual-use

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7) There are five Specialized University Research Centers in the area of: Automatic Control (Seoul National University); Underwater Acoustics (Seoul National University); Electro-Optics (Po-Hang Institute of Technology); Electromagnetic (KAIST); and Weapon System Concept Study (Military Science College).



items.

Additionally, R&D functions and capabilities of industries need to be reinforced. Defense industries used to make proto-types for weapon system development at the request of the ADD. Defense industries should have their own capability of R&D. Industry-invested R&D has been made convenient to carry out in the revised Weapon System Acquisition Management Regulation. In the long run, the defense industry should have such a system where the industry takes the initiative of development, production and maintenance of a weapon system, i.e., the full life cycle of a weapon system.

#### **4. Increase R&D for Dual-Use technology**

Dual-use technology is technology that is used commonly in both the defense industry and the civilian industry or that can be transferred to each other. The transfer of military technology into civilian use is called a technology spin-off, while application of civilian technology for military purpose is technology spin-on. Technology spin-up is to develop a technology to apply to both areas.

Whether spin-off, spin-on or spin-up, development of dual-use items serves two ends: build-up of military strength; and growth of national economy through the prevention of duplicated investments. Picking-up and developing dual-use technology will make a good contribution to activating of industry-invested R&D and rearing up of the defense industry.

#### **5. Promotion of Product Improvement**

Developing a new weapon system takes too much time and money. Furthermore, its risk of failure is high. These weakness of R&D can be complemented by product improvement.

Product Improvement requires relatively short period of time and small amounts of money since its object is usually a part or a component of a system. The risk of failure is low and the stability of investment is high since it applies new technology to the part of the system which has already been developed. It is possible to create continuous need for improvements with small amount of investment since it improves weapon systems in operation in the field. Product Improvement is a powerful and effective means of acquiring weapon systems with minimum costs and time.

Thus, Product Improvement should take priority of investment over other acquisition means. The second priority of investment should be given to the modification of commercial equipment for military use. The third option is R&D of a new weapon system. It is desirable to set up such a priority system in regulations to systematically support the Product Improvement.

## **6. Enlargement of International Cooperations**

When independent R&D and production of weapon systems are difficult in a limited market, international division of work, technical cooperation or cost sharing are effective and economic approaches. International cooperation is required not only for a economic acquisition of weapon systems but also for weapon exports and military technology cooperations.

The international cooperation of the Korean defense industry has been concentrated to the USA. The degree of freedom for diverse international cooperation has been highly restricted. Korea needs to diversify its international cooperation partners. Especially, the Korean defense industry should make great efforts to diversify its weapon system export market, including South—East Asia.

## **7. Rearing and Supporting the Defense Industry in Terms of Policy and System**

Appropriate and stable production requirement need to be provided to maintain production lines and to increase the operation rate of the defense industry. Appropriate level of production activities should be maintained by adjusting the fielding schedule and procurement amount in the mass production stage. A scientific way of raising production requirement should be developed and the procurement amount need to be arranged according to the mid and long term plan to properly maintain production lines.

Enlargement of policy—level financial support should be favorably considered. Support by the defense industry development fund also need to be increased. The export financial support for defense industries should be enlarged by providing export—import bank loans for the export of defense equipment and materials.

The customs tariff law should be revised to extend the tariff exemption period. The governmental system for defense industry development needs to be upgraded to

strengthen the defense industry policy drive. The cost accounting system needs to be improved. R&D costs for development of technology should be included in the cost accounting. Other outside factors such as price change or foreign exchange rate must be accounted for also.

## Conclusion

Future wars will be characterized as science and technology warfare. Future wars will require intelligence and electronic capabilities, precision targeting capability, and integrated battle field operation capability. Weapon systems in future wars should have these capabilities. These capabilities require advanced science and technology. In this connection, the importance of R&D to enhance military science and technology will be greatly increased in the future.

The military science and technology and the defense industry capability that enable development and operation of advanced weapon systems are directly related to the national security. The defense industry is an absolute element of achieving self-reliant defense. The measures and directions suggested in this paper will serve to re-activate the Korean defense industry. However, one should keep in mind that the measures will bear good fruits only when implemented with real earnest. Development of the defense industry requires the combined efforts of the military, the industry and the scientific community.