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REINFORCEMENT STRATEGY—ENHANCING THE INTERNATIONAL  
COMPETITIVENESS OF THE KOREAN NATIONAL DEFENSE  
INDUSTRY**

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# Defense Acquisition Policy and Defense Industrial Base Reinforcement Strategy—Enhancing the International Competitiveness of the Korean National Defense Industry

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Dr. Lee has wide research and development experiences in the field of army weapons and has prescribed many technological solutions and policy decisions in that field. He won the Gold Medal of Defense Science Award from the ADD for his contribution on the turret drive and control system of the Main Battle Vehicle. He has published more than 130 research papers on defense research and development. Recently, he has been interested in defense acquisition policy and international competitiveness.

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## Abstract

With the rapid evolution of the global defense management environment, an innovative strategy to reinforce the international competitiveness of the National Defense Industry (NDI) through competitiveness analysis is required. Thus, it is necessary to develop appropriate models for analyzing the Korean NDI and to conduct competitiveness analysis by using the developed model.

For the purpose of analyzing the international competitiveness of the Korean NDI, the researcher reviews the characteristics and problems for various existing models and the competitiveness analysis results for other civil industries. He then compares the attributes of the NDI with civil industries and analyzes the critical technology competitiveness of the NDI for major nations. In addition, he examines the defense policies under the worldwide reform of the defense management environment and the global change of the international defense market.

The researcher develops the Pentagon-Defense 8 Factors (P-D8F) model, a proposed optimum analysis model for the NDI, by applying the results of the analysis for various existing models while considering the unique characteristics of the NDI. He then analyzes the international competitiveness of the Korean NDI by using the P-D8F model, and derives the reinforcement strategy to enhance the global competitiveness for the Korean NDI. Finally, he suggests a possible defense acquisition policy to promote the desired technological innovation and to improve the management environment effectively.



**Keywords:** National Defense Industry (NDI), International Competitiveness, Industrial Cluster, Pentagon-Defense 8 Factors (P-D8F) Model, Defense Acquisition Policy, Technology Innovation

## Introduction

Since the cessation of the Cold War, most nations have focused their energies on enhancing their economic and technological powers instead of on reinforcing their military power. In particular, the powerful military nations—such as the US, France and Russia—steadily carry out various projects, transforming military companies into civil companies. They have also effectively accomplished the military transformation based on the Effect-based Operation (EBO) to transform the defense industrial base (DoD, 2003).

With the rapid transition of the global defense management environment, along with the reinforcement of the WTO system and the increase of global competition, the NDI can't be maintained by the long-sustained government control and support anymore. Many defense companies try to make a good profit and survive in the global environment. For the past 40 years, the government in Korea has played a leading role in producing and supplying military materiel. The NDI has been promoted strongly by government initiatives, but the most advanced military materiel hasn't been researched or developed with domestic technology, capabilities and resources. The critical military technologies haven't been acquired yet, and the international competitiveness of the Korean NDI is very low in comparison with that of developed countries. Therefore, Korean companies don't have the capabilities to research and develop the most advanced weapons to be competitive internationally (Lee, 2007).

For these reasons, a great deal of extensive research must be conducted in an effort to discover the proper strategy to strengthen the international competitiveness of the NDI. However, due to the lack of a competitiveness analysis model, there haven't been any considerable efforts to research or to develop the systematic improvement methodologies to solve the above-mentioned problems. To overcome these problems effectively, an original analysis model, which fully takes into account the defense characteristics based on the civil industries model, is required. Thus, the researcher has developed an innovative analytic strategy for promoting the international competitiveness of the NDI.

The purposes of this study are as follows. The first purpose is to develop and validate the optimum analysis model for the Korean NDI, based on the analytic results for various existing models and the consideration of the NDI's unique characteristics. The second purpose is to analyze and review the international competitiveness of the Korean NDI and to compare it with the competitiveness of the NDIs in other major nations by applying the proposed model. The final objective is to suggest the reinforcement strategy that may enhance the global competitiveness of the Korean NDI.

## Development of International Competitiveness Analysis Model for the Korean National Defense Industry

### 1. Characteristics of the Korean National Defense Industry

The Korean NDI has several different characteristics than do other civil industries or the NDIs of developed countries. First, the NDI is a government-dependant industry contributing to national security and showing monopolistic and oligopolistic characteristics under government



control and support. Second, the NDI is an industry that contributes and enhances the national military power and fosters the national economy. Therefore, its economical efficiency isn't considered, and one-sided investment is mandated by government policy. As a result of this policy, high national economic growth is unintentionally achieved in the confined fields of the shipbuilding, aviation, and automobile industries. Third, the military authorities require the military materiel with the best quality rather than at the lowest cost. And the government controls the demand and supply within the scope of the defense budget and the quantity of each service's request. The law of supply and demand does not work in the NDI. There is always a balance of supply and demand in the market. Finally, excessive plant investment and the long-term diversion of capital from the defense industry are required. Thus, the operating rate is very low, and the quantity is unstable and limited depending upon the government policy and the surrounding environment. It's hard to estimate demand for just 5-plus years.

## 2. Korean Acquisition Process of Defense Materiel

In 2006, the restructuring of the entire acquisition system in Korea was completed. One of the goals of this was to redirect the government acquisition policy to *Defense Reform 2020* (MND, 2005), stressing self-reliant defense based on the Korea-US alliance. Other goals were to pursue the transformation for Technological Forces and to effectively increase the investment in the defense R&D (research and development) budget (6.5% average). The guidelines for this key acquisition reform were to: require transparency, increase efficiency, secure expertise and professionals, enhance competitiveness, and strengthen international cooperation.

Acquisition flow has been reorganized, as shown in Figure 1. Formerly, requirement and procurement were driven by the services (JCS, Army, Navy, and Air Force). The acquisition organizations such as MND (Ministry of national Defense), DPA (Defense Procurement Agency), PMOs (Army-Navy-Air Force Project Management Office), T&EO (Test and Evaluation Office), DQAA (Defense Quality Assurance Agency), and ADD (Agency for Defense Development) weren't well connected organically. The PPBEES (planning, programming, budgeting, execution, and evaluation system) did not work continuously and systematically during the lifecycle of materiel acquisition. The ADD, along with other organizations, used to be at the center of acquisition. Presently, requirements come from services. But the DAPA (Defense Acquisition Program Administration)—into which 8 organizations related to defense acquisition have merged—is now at the center of acquisition, while the ADD has remained at the center of R&D activities.

Figure 2 shows the acquisition process—including the system development flow, which is somewhat similar to that in the US. Requirements come from the services and the MND. After preliminary studies, the DAPA decides the mode of development. Figure 2 also shows the flow of system development from S&T to deployment. Preliminary studies are dedicated to concept development, alternative analysis and interoperability analysis to establish acquisition trade-offs. The exploratory development phase is composed of concept exploration and technology development stages; engineering efforts are dedicated to authorizing the operational concepts and required capabilities and to eliminating technical risks before a program enters the system development phase. The system development phase is composed of system integration and system demonstration stages. Constructive and virtual simulation models are utilized for design and system verification. System and subsystem performance analysis tools are used for verifying that designs are compliant with the requirements (DAPA, 2007).

The DAPA organization is shown in Figure 3. The Commissioner (at the Vice Minister level) is the head of DAPA. At the next lower level, the Vice Commissioner oversees Acquisition



Planning, Defense Industry Promotion, Analysis/T&E, and Policy & Public Relation Management Bureaus. There is also the Program Management Agency, which controls several programs with the help of IPTs.

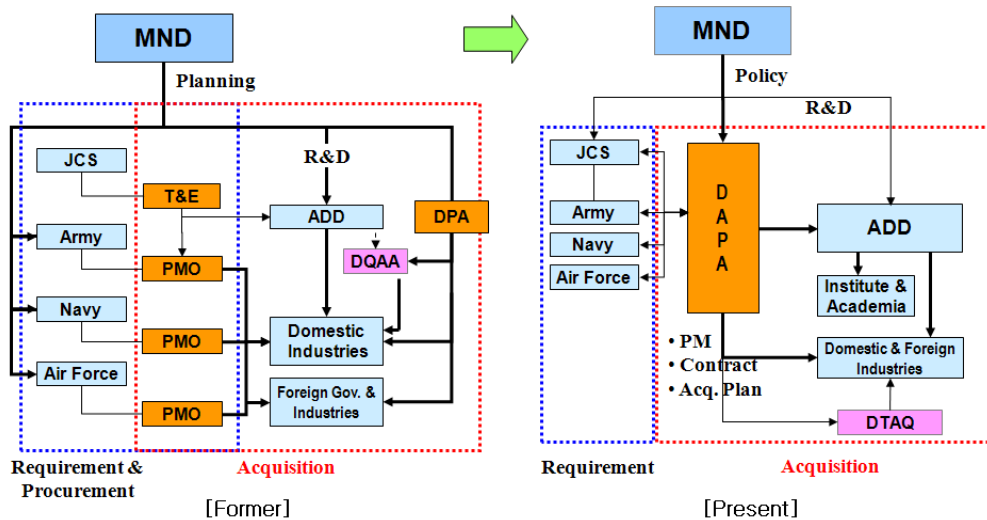


Figure 1. Key Thrusts for Acquisition Reform (Reorganization)

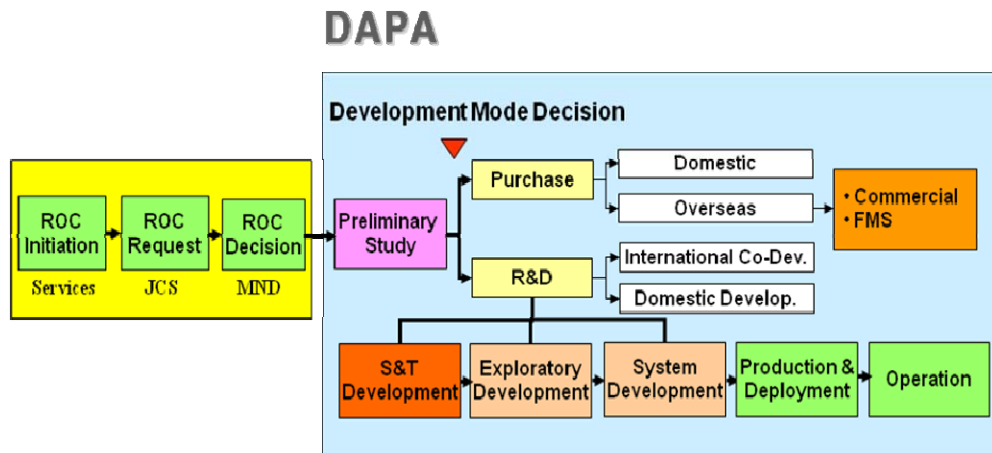


Figure 2. Acquisition Process, Including System Development Flow



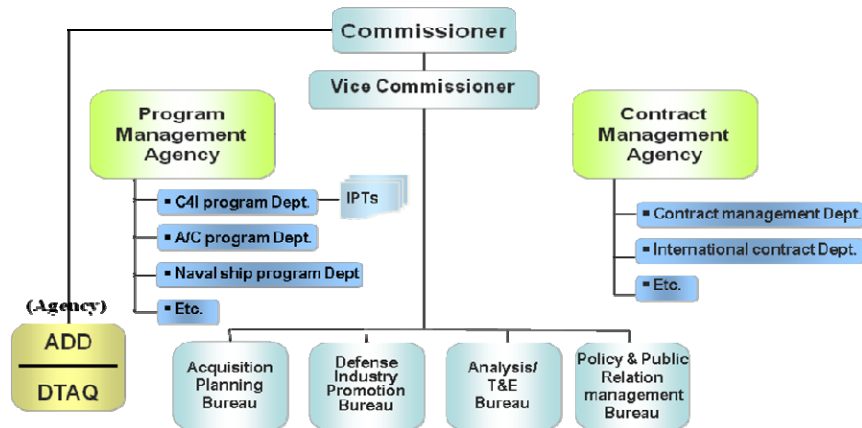


Figure 3. Organization of Defense Acquisition Program Administration (DAPA)

### 3. International Competitiveness Analysis Model for the Korean National Defense Industry

The existing civil competitiveness models (Porter, 1998) are insufficient for analyzing the Korean NDI because of its different characteristics. The rule of market economy doesn't work, as the operations of most firms are under the government's control. In the NDI, the economy system is governed rather by the government-initiated economy than the private-initiated economy. The sole consumer is the government, and the NDI's supply and the government's demand always meet in the market. Government programs, instead of the mechanisms of market economy, decide demand.

As for Korea, all competitiveness factors in the NDI are dictated by the government's intention and policy. The foreign policy and international relations of the major powerful nations, such as the US, China, and other surrounding nations, are also important factors with which to analyze the competitiveness of the NDI. And chance is important because it creates discontinuities and plays its role partly by altering conditions in the competitiveness models. These characteristics must be considered as the optimized models are built (Lee, 2000).

By applying the analysis results for various existing models and considering the unique characteristics of the Korean NDI, the researcher was able to develop the optimum analysis model for the Korean NDI. In case of the Korean NDI, 5 determinants to achieve the national competitive advantages among the nations exist: factor conditions, the strategy and rivalry among the firms, related and supporting industries, demand conditions, and the government defense policy. And 3 influencers of true competitiveness are: the industrial cluster, the defense policy and the relations of foreign nations, and chance.

Figure 4 shows the Pentagon-Defense 8 Factors Model (P-D8F)—with 5 determinants and 3 influencers for competitiveness of the Korean NDI. The factors of the national competitive advantage according to determinants and influencers are shown in Table 1.

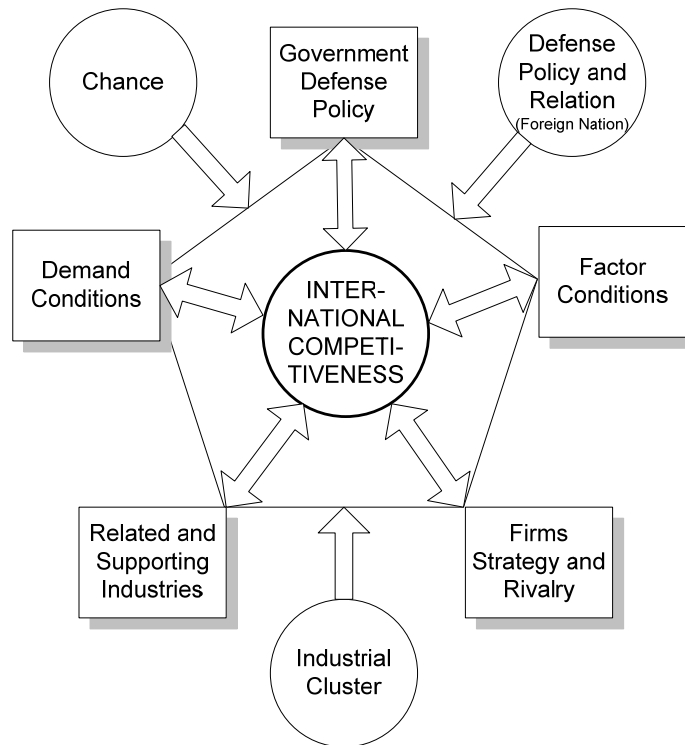


Figure 4. The Pentagon-Defense 8 Factors Model for the Korean NDI

Table 1. Determinants and Influencers of Pentagon-Defense 8 Factors Model for the Korean NDI

Determinants and Influencers		Factors for National Competitiveness Advantage
Determinants	<b>Factor Conditions</b>	<ul style="list-style-type: none"> <li>• Human, physical, knowledge, and capital resources</li> <li>• Infrastructure</li> <li>• Mechanisms creating competitive advantage</li> </ul>
	<b>Demand Conditions</b>	<ul style="list-style-type: none"> <li>• Demand size and pattern of growth</li> <li>• Internationalization of domestic demand</li> <li>• Home demand composition</li> </ul>
	<b>Related and Supporting Industries</b>	<ul style="list-style-type: none"> <li>• Presence of internationally competitive supplier and related industry</li> <li>• Competitive advantage of supplier and related industry</li> </ul>
	<b>Firms Strategy and Rivalry</b>	<ul style="list-style-type: none"> <li>• Management strategy and structure of domestic firms</li> <li>• Vision, goals, and leadership</li> <li>• Rivalry among existing competitors and threat of a new entrant</li> </ul>
	<b>Government Defense Policy</b>	<ul style="list-style-type: none"> <li>• Policies toward defense acquisition and capital market</li> <li>• Product standard and regulation</li> <li>• Capital market regulation, tax policy, and antitrust law</li> </ul>
<b>Influencers</b>	<b>Industrial Cluster</b>	<ul style="list-style-type: none"> <li>• Presence of industrial park and complex, high-technology park, and evolutionary process of cluster</li> <li>• Existence of cluster for several industries</li> </ul>

<b>Defense Policy and Relation (Foreign Nation)</b>	<ul style="list-style-type: none"> <li>· Political decision by foreign government</li> <li>· Variations of international defense environment and military expenditure</li> <li>· Regulations of arms export and technology transfer</li> </ul>
<b>Chance</b>	<ul style="list-style-type: none"> <li>· Invention, technology innovation, and oil shock</li> <li>· Significant shift in world financial market</li> <li>· International dispute and regional war</li> </ul>

## International Competitiveness Analysis of the Korean National Defense Industry Using the Pentagon-Defense 8 Factors Model

### 1. Factor Conditions

In 2007, the Korean NDI was composed of 88 companies producing diverse systems and components of 10 fields of defense materiel. Yet, they show very low operating rates of 50% to 60%, low profit margins of 8.1%, and very low revenue per capita of \$240 million (KDIA, 2007). All data hardly come up to those of Korean civil industries and foreign countries. The international competitiveness of the Korean NDI in the world market is very weak. The continuous-growth strategy must be propelled by defense reform and self-reliant cooperation.

**Table 2. Variations of Operating Rate for the Korean NDI**

Year	1990	1992	1994	1996	1998	2002	2003	2004	2005	2006
Operating Rate (%)	58.2	59.8	56.1	55.7	57.4	54.5	57.3	56.1	57.8	60.6

**Table 3. Productivity & Technology Capability for the Korean NDI in 2005**

Item	Return On Equity (%)	Revenue Per Capita (\$M)	Operating Rate (%)	Tech. Level (%)
Figures	8.1	240	57.8	67
Remarks (civil industries)	12.2	500	79.8	80

Table 4 shows the variations of full-time employees of the Korean NDI. Since 2000, the number of total employees of the NDI has been decreasing gradually due to factory automation and reduction in demand for conventional weapons. Furthermore, expert research engineers are no more than 2,000, 10% of full-time NDI employees. In addition, the number of Korean defense R&D employees in the government—including the associated Institutes and Agency—is just 4,000, quite small compared to 200,000 of the US, 25,000 of Germany, and 18,000 of Taiwan. Lacking expert manpower, the technical level of the NDI can't improve and is still far from that of developed countries.

**Table 4. Variations of Full-time Employees for the Korean NDI**

Year	1988	1991	1996	2002	2003	2004	2005	2006
Number	23,418	27,794	29,640	23,179	23,184	23,007	22,226	20,912

According to the US *Military Critical Technologies List (MTCL)*, which shows country-by-country estimates of the general status of technological capabilities, Korea doesn't retain the critical technologies of Aeronautics Systems, Energy Systems, Sensor and Laser, and Space Systems. On the other hand, Korea's technology levels of Information Systems, Materials, and Nuclear Systems come more or less close to those of the developed countries (DoD, 2004). In this regard, the Korean government tries to enhance its defense technology competitiveness through technology interactions (spin-off and spin-on) with commercial sectors, and lay-out schemes fostering the high technology areas strategically.

The defense R&D budget is about \$1,060 million. That was 4.7% of the defense budget of \$22,513 million and 14.1% of the defense materiel improvement budget of \$7,499 million in 2006 (MND, 2007). It is gradually increasing every year, but the defense R&D budget in 2005 (\$740 million) was quite small compared to major nations—\$82,250 million in the US, \$4,690 million in the UK, and \$4,850 million in France (SIPRI, 2006). The Defense budget in 2006 national GDP is still low; just 2.6% compared with the US, 3.7%, China, 3.9%, and Russia, 4.9% (Hackett, 2007). The defense budget versus the GDP and the defense R&D budget versus the defense budget have to be increased gradually up to developed countries' levels.

**Table 5. Variations of Defense Budget and Defense R&D Budget**

Year	1990	1992	1996	1998	2002	2003	2004	2005	2006
Defense Budget (\$M)	6,608	8,309	12,243	13,800	16,364	17,515	18,941	20,823	22,513
Defense R&D Budget (\$M)	143	235	374	479	723	739	797	929	1,060
Rate (%)	2.1	2.8	3.1	3.5	4.4	4.2	4.2	4.5	4.7

**Table 6. Defense R&D Budget for Major Nations (2005)**  
(at constant 2003 prices)

Country	US	UK	France	Italy	Japan	Russia	Korea
Defense Budget (\$100M)	4,782	483	462	272	421	210	162
Defense R&D Budget (\$100M)	822.5	46.9	48.5	6.8	15.2	23.7	7.4
Rate (%)	17.2	9.7	10.5	2.5	3.6	11.3	4.5

## 2. Demand Conditions

Demand is decided within the scope of requirements of the services and the defense budget. It is difficult for the NDI to estimate the demand for even 5 years. The materiel improvement programs of the Armed Forces are established by the MND and the DAPA through a 5-year, mid-term plan. However, the procurement budget is finally set with the adjustment and deliberation of the government (Ministry of Strategy and Finance) and the National Assembly annually. Therefore, it quite restricts the NDI from establishing a mid- and long-term management plan.

Recently, Korean domestic demand for defense materiel has been limited because services want the cutting-edge weapon systems, yet the NDI lacks critical technologies. Industry promotion is restricted due to the insufficient domestic demand, and the creation of a new market is ineffective. The core technology level compared to that in leading countries is 67% in 2004; most areas of cutting-edge technology are even more vulnerable.

Table 7 shows the variations of gross sales of the Korean NDI. Total sales in 2006 reached \$5,452 million—45 times greater than the total sales in 1988, \$120 million. But, the growth rate of total sales (2.5%) is very low compared with the 6.3% of civil industries in 2006. The operating income increases to \$267 million—4 times greater than the \$61 million in 1988. On the other hand, the operating profit margin of 4.9% reaches 5.3% of civil industries, while the ordinary profit margin of 3.0% is lower than 5.7% of civil industries.

**Table 7. Variations of Gross Sales for the Korean NDI**

Year	2001	2002	2003	2004	2005	2006
Total Sales (\$M)	3,705	4,366	4,269	4,644	5,317	5,452
Growth Rate (%)	11.1	17.8	-2.3	8.8	14.5	2.5
Operating Income (\$M)	221	151	154	141	250	267
Ordinary Income (\$M)	-115	25	56	86	149	163

The export of defense materiel by the NDI alone is difficult. To make it possible, the cooperation of the government, military, and the NDI is required. As for the exports of defense materiel, the training and education programs and logistics are transferred to the purchasing country. The establishment of the export marketing strategy by the NDI is restricted because customers are foreign governments.

The number of major conventional weapons being exported and imported is decreasing steadily, whereas the demand for advanced materiel systems is increasing gradually. In 2006, Korea's arms imports amounted to about \$600 million (the 9th largest in the world market), while Korean arms exports were numbered at about \$255 (the 20th largest, taking just 0.2% in the world market) (KDIA, 2007). In the period 2001 through 2005, Korean arms exports ranked the 17<sup>th</sup> largest (\$337 million), and arms import ranked the 9<sup>th</sup> largest (\$2,561 million) (SIPRI, 2006). Thus, this severe imbalance of the trade leads to the shrinking of the Korean NDI. Domestic development of advanced weapons must increase if the defense economy is to improve.

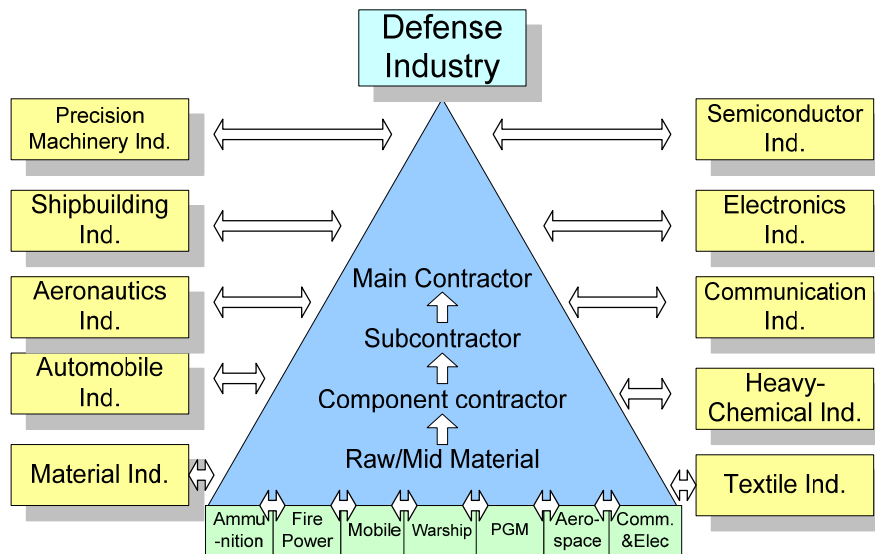
**Table 8. Variations of Arms Export Sales for the Korean NDI**

Year	1991	1995	1999	2001	2002	2003	2004	2005	2006
Export Sales (\$M)	90.6	77.0	196.6	237.2	143.9	240.6	417.8	262.3	255.2

### 3. Related and Supporting Industries

The Korean NDI is composed of 88 main companies, producing the 373 kinds of defense materiel. And 20 to 100 subcontractors work with these main contractors. There are also some defense-related organizations and civil-related industries that interconnect to develop and produce the defense materiel. The Korean NDI is classified into two structures with vertically and horizontally specialized relations. The pyramidal configuration of the Korean NDI is constructed with the vertical relations among main contractors, subcontractors, and components suppliers, and the horizontal relations among weapon industries producing particular weapons such as fire power, automobiles, aeronautics, warship, and missile systems, etc.

Figure 5 shows the pyramidal configurations of related and supporting industries for the Korean NDI. Generally, the vertical and horizontal structure of pyramidal configurations is the best solution to optimizing the effectiveness of the NDI. That is, when the lower members (such as material and component suppliers) are strong and solid, raw materials and components are supplied quickly and inexpensively. This structure has the advantage of maximizing technology development through competitive activities. Furthermore, interactions and exchanges among weapon systems industries in the horizontal structure can foster the competition of other weapon systems industries; likewise, interaction with civil industries can bring out critical technology innovation in civil industries.



**Figure 5. Pyramidal Configuration of Related and Supporting Industries for the Korean NDI**

#### **4. Firms Strategy and Rivalry**

Most Korean defense firms lack competitiveness due to the monopolistic and oligopolistic systems of the Korean NDI. Most defense acquisition programs are still classified, and much information is still limited to the public. The firms have difficulty establishing mid- and long-term management plans due to this limited access to detailed information. The entry barrier of newcomers is very high, and most firms make few efforts to develop the advanced critical technologies.

Defense revenue was only 7.8% of the defense industry's total sales in 2005, and the low productivity of most firms impedes the progress of the defense industry. Firms are faced with excessive financial cost due to their lack of budget compared to initial investment in large-scale R&D projects. Every year, the investment of firms decreases—by \$7.6 million in 2000, \$5.1 million in 2002, and \$4.5 million in 2004.

In this environment, the aggressive management strategy of industries isn't established enough. Entrepreneurs and employers don't formulate great visions and goals for their companies because there is almost no rivalry among existing competitors or threat of new entrants.

#### **5. Government Defense Policy**

Despite numerous attempts to improve the Korean acquisition system, the issues of inefficiency and noncompetitiveness within the defense industry are not yet resolved. In recent years, the government has tried to initiate drastic improvement in defense acquisition policy. The domestic R&D of advanced military materiel takes precedence over overseas acquisition. In addition, the government has tried to establish acquisition plans that ensure the balanced development of advanced military materiel, in accordance with the requirements of the Joint Military Strategy and within the limits of the national budget.

The government has also discontinued the current specialization and grouping system of the defense companies to improve industry competitiveness. Thus, technology innovations among associated companies will be induced. And the technology level of defense companies can be raised up to the level of the developed countries.

The government has endeavored to work in close cooperation with defense companies to enhance exports, and has reinforced the export administration to support them. To help establish vision and goals within defense companies, the government has expanded its disclosure of information on defense investment projects to the public.

#### **6. Industrial Cluster**

National competitive advantage is generally more remarkable in industrial clusters than in individual industries. Industrial clusters often emerge and begin to grow naturally, such as Silicon Valley in the US. But, in Korea, governmental policy initiated many industrial clusters, such as industrial parks, complexes, and high-technology parks in several areas. The government has established some special industrial and R&D regions by providing specialized infrastructures and technical centers.

Figure 6 shows one of industrial clusters of the Korean NDI in Changwon City. Related and supporting industries, agencies, institutes, academia, research centers, society and



associations, and suppliers are interconnected to research, develop, produce, and operate the defense materiel. Another type of cluster, the defense R&D industrial cluster in Daejeon City and Chungcheong Province, is shown in Figure 7. It is a unique one in Korea in the respect that most institutes, agencies, and universities related with R&D—in military, government, and civil fields—are centralized in this region. Nevertheless, the Industrial Clusters are not yet complete, as they are not creating the necessary high value-added products due to the lack of the proper establishment of knowledge-based networks.

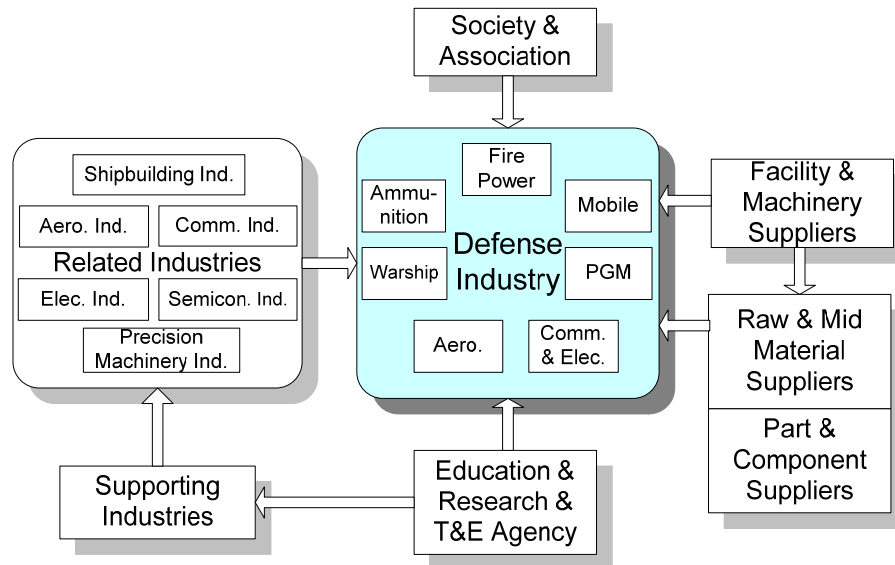


Figure 6. Defense Industrial Cluster for the Korean NDI in Changwon City

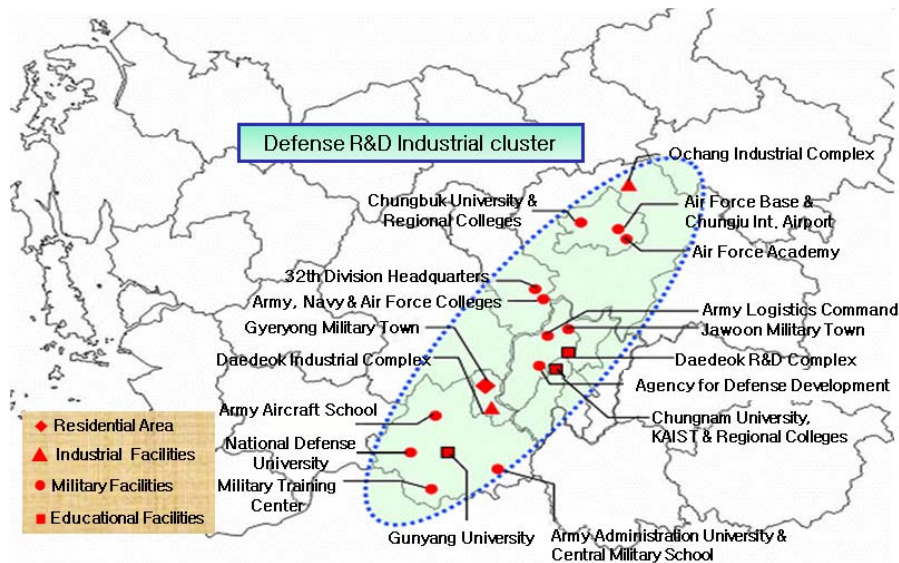


Figure 7. Defense R&D Industrial Cluster in Daejeon City and Chungcheong Province



## 7. Chance

Chances unexpectedly appear that have little to do with specific circumstances in a nation. They are important because they incur discontinuities that allow shifts in the competitive position. In the history of modern Korean economy, chances that have been particularly important in influencing competitive advantage are as follows: technology innovation, oil shocks, world financial crises, high volatility of exchange rate, international disputes and regional wars. Chances play a role partly by altering the determinants in the Pentagon-Defense 8 Factors Model.

Korea, like other nations, is facing significant changes in its defense outlook. Since the 2000 Joint Declaration (Pyeongyang in North Korea, June 15), South Korea and North Korea have promised proactive exchanges and cooperation. However, the Cold War structure is still lingering, with factors of potential regional friction (such as the North Korean nuclear issue). Countries in Northeast Asia are engaged in constant competition to expand their influence in this region while continuing to make efforts to modernize and transform their military forces.

In recent years, as a result of dramatic development in science and technology, the Korean defense companies have been subject to sweeping changes. There has been also a significant qualitative change in the nature of technology because civil technology has become increasingly important for weapon systems. The technological cooperation of the Korean NDI with civil industries is underway, and it presents the NDI with a chance to enhance its technological competitiveness. The oil shocks greatly reduce the defense budget in energy-dependent nations such as Korea, and downscale the size of the worldwide defense market. However, the US's Global War on Terror and the local wars in the Middle East and Asia have shown the sudden increase in demand.

## 8. Defense Policy and Relation (Foreign Government)

During the post-Cold War period, developed countries have gained military superiority by protecting their national critical technological capabilities. They have significantly increased their defense R&D budget to develop new technologies independently, and have reinforced their control over and prohibit the divulgement of critical military technologies and products to foreign countries. In addition, they have expanded the development of dual-use technology, a spin-on of civil technology and spin-off of military technology.

Most nations control and monitor the transfer of sensitive technologies to other nations while improving the export-control processes to promote and protect their domestic defense companies. With armaments cooperation programs to strengthen their military and industrial relationships, they bind other nations as their partners in strong security coalitions. In recent years, the restrictions of arms export and military technology transfer to competing countries are much more stringent.

To cope with the international defense environment, Korea has increased military expenditures to develop critical technologies independently, and has participated in cooperative programs with foreign advanced companies to introduce and co-develop advanced technology and to foster its arms exports. Korea has even tried to increase its arms exports in order to improve demand conditions within the NDI.



# Defense Acquisition Policy and Defense Industrial Base Reinforcement Strategy

## 1. Enlargement of Defense Budget

Korea's defense budget in its GDP is still low compared to other countries. In 2006, the ratio of the defense budget to the GDP was just 2.6%, obviously quite low compared to other nations' ratios: 3.7% of US, 3.9% of China, and 4.9% of Russia. Most nations engaged in inner- and outer-conflicts usually allocate an average of 5-6% of their GDP to the defense budget. The annual growth rate of Korea's defense budget is expected to increase up to about 9% through 2015, making the budget share out of GDP go up gradually to 3% in 2015 (MND, 2005). However, the budget share has to increase gradually up to the level of developed countries.

In addition, R&D financial resources must be expanded in order to support the acquisition policy. The defense R&D budget has to increase to 10% of the defense budget to enhance the international competitiveness of the NDI in 2015 from just 4.7% in 2007. The dual-use technology programs are reinforced to share effectively the limited defense R&D budget with the civil sectors.

## 2. Reinforcement of Factor Conditions

In planning its acquisition strategy, Korea must give the utmost priority to domestic R&D of Arms if it is to both enhance the critical technology capabilities of the NDI to the level of developed countries, and to raise the operating rate of the NDI to the level of civil industries. The NDI must participate more in R&D if it is to lead advanced arms development and to enlarge its technological capabilities. The ADD also has to be transformed into a core technology and system-of-systems-centric institute, and the NDI's role in developing general weapon systems has to be expanded.

As mentioned previously, the number of expert research engineers within the NDI is just about 2,000. Furthermore, the number of Korean defense R&D manpower under the government side is just 4,000, which is far less than the 200,000 in the US. Due to insufficient expert manpower, the technical level of the NDI cannot be as good as other developed countries. To ensure comparative advantages over developed countries, more expert researchers and engineers are necessary.

## 3. Innovation of Defense Technology

In the US, revolutionary innovations in military technology traditionally come from subcontractors or niche firms, and these firms frequently go on to dominate the markets. These monumental leaps are infrequently developed by the prime firms of their time. This paradigm has been observed frequently in many other industries as well.

In Korea, the ADD has taken the lead in developing innovative defense technology. But, it is difficult for the ADD to play a leading role anymore. The ADD has to cooperate with academia, institutes, research centers, and industries, and to transfer acquired technologies and support them steadily to innovate defense technologies. If necessary, the government has to change the acquisition strategy to ensure a competition-driven innovation. Also, the government must stimulate competitions through incentives, and designate multiple sources to



produce the desired technology. Probably the most important thing for improving and developing innovative technologies is to ensure robust funding.

#### **4. Establishment of Competitive Environment**

The Specialization and Affiliation System that the companies are designated to participate in the acquisition (R&D or purchase) programs was introduced to stimulate technology development and to save financial resources by preventing excessive competition. On account of the excessive preferential authority of designated companies, strong barriers are formed that block new entries and obstruct technological innovation.

To enhance the NID's industrial competitiveness and to induce technological innovation, the above system is expected to be abolished by the end of 2008. On the other hand, in order to promote technological development and efficiency, Korean decision-makers must prepare some criteria and processes to prevent excessive competition and to institutionally ensure the entrances of small- and medium-sized companies.

In addition, reasonable designation and management of defense materiel and companies have to be established; likewise, to promote competition efficiency, appropriate criteria for timing, scope and items in designating the defense materiel have to be set. The government has to prevent inefficiency by reviewing requirements periodically, and must consider appropriate measures to designate and manage the defense materiel and companies for the competitive system.

#### **5. Improvement of Management Condition**

The government should cover some key expenses to help the companies reform themselves and actively carry out additional activities. The supporting funds to promote the competitiveness of the NDI have to be secured, and enough subsidies to develop critical technologies and construct infrastructures of the NDI have to be granted. The cost-based-contract system of defense materiel should be improved to enhance competitiveness for exports by reflecting more expenses.

The government has to establish mid- and long-term strategies to reinforce the industrial base through regular investigation; it must also induce the rational supply system and promote the efficiency of resources through continuous analysis of the defense industry's demand and supply status. The government also has to expand industrial stratum by fostering defense-specialized small and medium-sized business. Small and medium-sized defense firms have to participate in defense R&D. In addition, the government must establish technology-innovation support programs for the small and medium-sized defense firms.

#### **6. Reinforcement of Arms Export Sales**

The establishment of an improved export marketing strategy by the NDI is restricted because customers are foreign governments. Thus, the government-wide networks to support defense exports must be strengthened. Potential and promising items have to be selected and developed to ensure competitive advantages over other countries, and the basis of cooperation among governments has to be strengthened by additional agreements.

Korea's defense imports ranked the 7th to the 9<sup>th</sup> largest in the world, while Korea's export market share was just 0.2% (the 20<sup>th</sup> largest) in recent years. In the period of 2001



through 2005, Korea's arms exports ranked the 17<sup>th</sup> largest (\$337 million), while Korea's arms imports ranked the 9<sup>th</sup> largest (\$2,561 million). This severe unbalance of the trade has led the Korean NDI to shrink. Operational support systems have to be established with trustworthy, importing countries, and measures have to be prepared to enhance price competitiveness—such as financial and tax support. Active cooperation with leading countries also has to be pursued aggressively in order to acquire their advanced systems and technologies.

## Conclusions

This study was conducted to investigate the international competitiveness of the Korean National Defense Industry. The characteristics and problems of various existing competitive models for other civil industries were reviewed and analyzed to develop a new optimized analysis model.

The new analysis model, the Pentagon-Defense 8 Factors model, fully takes into account the defense characteristics that have been derived to suggest the innovative strategy enhancing the international competitiveness of the Korean NDI. As for the Korean NDI, this model is composed of 5 determinants (factor conditions, demand conditions, firms strategy and rivalry, related and supporting industries, and government defense policy) and 3 influencers (defense industrial cluster, defense policy of foreign nation and mutual relation, and chance).

The researcher studied the international competitiveness of the Korean NDI by applying the P-D8F model. He then suggested a possible reinforcement strategy and defense acquisition policy to enhance the global competitiveness for the Korean NDI and to effectively achieve the desired technological advancement.

From this study, the researcher concluded that the proposed analysis model is a useful and practical one for analyzing and enhancing the international competitiveness of the Korean NDI.

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