

The Strategic Management of Defence Industry: A Science and Technology Based Configuration

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Different kinds of conflicts are increasing day by day in the world. The increase of disputes and mutual conflicts cause countries continue to devote high amounts of resources to the defence industry for national security. In order to obtain the maximum benefit from defence spending, the defence industry needs to be based on science and technology. Developed countries trying to build an effective defence industrial strategy based on science and technology to stay in peace. As a result of strategic management of science and technology based defence industry; faster, more talented, distinctive and unique defence systems and equipment production have gained importance. The ability for the production of defence systems and equipment needs to produce knowledge in different scientific fields and that knowledge requires to be converted into the application by research and development. It has high potential to provide technological progress and development in the long run, when getting into account the high amount of defence spending. Developed countries such as US, managing their defence industries based on science and technology to develop technological infrastructure, improving the level of industrialization, developing education in basic sciences and developing research and development in applied sciences. The literature about defence spending generally discusses the amount of defence budget but the way of spending the budget is also very important. In this context, the objective of the research is to discuss the importance and impact of science and technology among the strategic management of defence industry under the different practices of US, the world's most defence spending country. The other objective is to help for further studies putting forward a new science and technology based defence industry model. By this way the research will improve the current literature about the way and importance of defence budget spending.

JEL Codes: A12, F14, F59, H57, H72, L52, O14 and O32

1. Introduction

Many countries have a significant portion of resources devoted to the defence. This portion is usually in larger amounts than much of the other expenditures in the budget (Saunders 1993). The studies conducted by Benoit (1973, 1978) and by Whynes (1979) in different times showed that defence spending has positive effects. On the other hand some researchers such as Saadet and Somnath (1983) identified the negative impact of defence spending (Zekey 1999). The study carried out by Chowdhury (1999) about the relationship between defence spending and economic growth with the data of 55 less developed and developing countries demonstrated that the relationship between defence spending and economic growth cannot be generalized between the countries. Similar results have also been identified in a study including 77 developing countries conducted by Newman. Contrary to common

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thinking that it may not be appropriate to generalize the relationship between, economic growth and defence spending in developing countries. (Newman 1994)

The effects of defence expenditures vary depending on the nature of defence spending, current government policy and the current cyclical conditions (Georgiou & Smith 1982). However, the amount of defence resources that need to be allocated in the budget and to what areas this amount should be spent is a serious subject of discussion. Developed countries devote their defence resources to strategic investments in science and technology. By this way, they are increasing their economic superiority also while providing their national security.

Defence industry has strategic importance in terms of nation's safety and effectiveness. For this reason, the countries that want to dominate in the international arena trying to develop advanced technology in management of defence industry. The economic efficiency of the resources devoted to defence industry by its own has always been discussed by many economists. However, the effects of the defence industry during the implementation of national policies and strategies in the international arena, the contribution to the deterrence, to reduce the risks of dependence to other countries on defence systems, the contribution to the technological development and national prosperity cannot be ignored (Zaim 2009).

High defence spending has an opportunity cost to other types of spending in the budget. So it is strategically important to spend the resources allocated to defence domestically instead of abroad. To plan the defence expenditures as to gain ability in science and technology so to get contribution to the national economy is the goal of developed countries. (Zaim 2000) Technological independence is an important goal during the strategy making process in the world. Defence industry should be considered as a leading sector while carrying out the technological independence. High defence budgets could be used to accomplish this aim. (Ziylan 2009)

Within the scope of strategic management of the defence industry, spending the defence resources to develop science and technology has become a prime objective for developed countries. It is possible to get reversed the resources again to the national economy by this way. (Zaim 2000)

Countries selling defence systems and equipment are shaping their immense defence acquisition programs in order to get the most strategic benefit for their nations (Aytekin 1999). Underdeveloped countries also must give importance to the efforts for developing technology in defence spending. While developing science and technology-based defence industry, it is better focusing on a few scientific areas which will provide a competitive advantage in the world market rather than tending many different areas.

U.S. examines the strong countries' military power without stopping in the world. They want to know the wide range of connected ideas and events about global technology. By this way they know the militarily critical technologies of others and adjust their head direction in the world. (Jan 2005) U.S. science and technological strategy mainly depends on defence technology.

The studies looking into the defence spending generally examining the amount allocated to defence. However, the means of defence spending is also an important issue. Particularly the less developed and developing countries have to spend the resources allocated to the defence very efficiently. These countries should plan the

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defence spending as to remain within the country so strengthen the national economy in the long run. This means strategic management of defence industry. The objectives of this research are to explain the defence spending and to investigate the importance of science and technology for managing the defence industry strategically. In this way the way of spending the defence budget will be another viewpoint for the progress of national economy. In this context, the study first analyzes the defence spending of some major countries. Then it appraises science and technology, research and development expenditure and successful practices among the defence industry. Finally the relationship between, defence related research and national progress is examined. The article concludes with the strategic importance of science and technology based defence industry.

2. Literature Review

2.1 Defence Industry

There are different definitions of defence industry depending on the point of view. While it is defining as a separate sector itself among the sectors of manufacturing industry; it is also evaluated as the combination of all other manufacturing industry sectors. In this context defence industry can be defined in different ways.

Defence industry is the combination of defence companies that supply a large spectrum of goods and services needed by the Ministry of Defence (Trevor & Hayward 1989). Defence industry is the companies owned by private and public organizations. These companies manufacture and develop all kinds of strategic and tactical offensive and defensive weapons systems and military equipment. They are in remarkably close collaboration, in the first place investment goods industries, and with all other areas of economic activity (Simsek 1989).

Defence industry consists of industrial assets, that correspond the main elements of military power and national security needs, which the government determines according to the result of risk assessments (House of Commons 1986). Defence industry has extremely clear definition superficially; in short it can be explained as a set of firms providing defence related goods and services to the defence ministry, but operationally it is more complicated and brings a lot of issues (Dunne 1995).

Defence industry covers manufacturers in all sectors that produce heavy guns, cannons, missiles, submarines and military supplies. It is known as defence industry because of the content and volume of the products manufactured by the sector. The volume of product manufactured by the industry is for the defence market so it is called as "defence industry" (Todd 1988). The studies carried out by Benoit (1973, 1978), Kennedy (1974), and Whynes (1979) showed that the impact of defence expenditures on the economy is positive whereas the economists Deger and Sen (1983) have identified the negative impact of defence spending in their research. (Zekey 1999) According to the results of the study, among 55 developing and underdeveloped countries, carried out by Chowdhury (1991), the relationship between defence expenditures and economic growth can not be generalized. Georgiou and Smith (1982) also stated that the relationship between defence expenditures and economic growth is varying according to the social-economic structure, the period, the character of spending and government policy. The study carried out by Newman (1994) including 77 developing countries has also found similar results.

2.2 Science and Technology

Science is a set of well-organized information, relating to some facts or event categories (Meydan Larousse 2003). Science is the common name of intellect activity based on impartial observation and systematic experiment about objective world and related with that world (Ana Britannica 1986). Science is a form of thinking other than being of an accumulation of knowledge. Science is a determined way of following the safe line to understand the world, to take control of ourselves and what is going on. (Sagan 1999) Science is all real cases and principles that could be covered with the human mind (Drucker 2000).

Technology is the collection of information to produce and design useful and new products (Ayhan 2002). Technology is all the consistent information and healthful practice based on scientific principles in a particular technical field (Meydan Larousse 2003). Technology can be defined as "production information" in the shortest form of expression (Yucel 2002). Technology is "scientific thinking" that can be applied and transferred to nature and life; therefore, technology is the applied scientific knowledge (Erkan & Erkan 2004). Technology is the basic field directing changes in social systems, that people put forward ideas and methods in order to dominate the nature (Erkan 2006).

2.2.1 Science and Technology Based Configuration

U.S. is very effective on world politics with the high-tech defence systems and equipment which is obtained through the importance given to the research and development in the field of defence. Technological superiority that forms the fundamental of the national defence strategy of United States provides to win the different types of conflicts with minimal losses and to become a dominant power in the world. (Fountain 2004)

U.S. has followed a different strategy by focusing on progression in the defence related research and development; they increased the related budget instead of decreasing. U.S. increased the budget, by developing the capacity of national science laboratories and with supporting the defence-related departments of universities. Today there is a big difference between U.S. and the EU when compared in terms of scientific innovation. The ratio about the Nobel awards between EU and U.S. is 1 to 5. The power of United States in question comes from well coordinated funding structure from the federal level to the offices working in this field. This is an important reason for the success of U.S. about creating new technologies. (Laredo 2005)

2.3 Strategic Management

Strategic management is a management technique setting out of an organization's reason of existence, future goals and the current actions (Bryson 1988). Strategic management analyzes the organization's future goal and the process about how to reach this goal (Barry 1986). Strategic management is developing effective strategies, planning, execution, and control for attaining the objectives of an organization. In other words, strategic management is a research area that examines what types of strategies should follow the companies to compete with its rivals (Aktan 2008).

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Institutions do analyzes to create and carry on competitiveness; take decisions appropriate to those analyzes and determine the courses of action to implement the decisions. All those actions are strategic management. All of these activities are continuous. Strategic objectives need to be considered simultaneously with the analysis of internal and external environment to get more accurate forecast. (Dess, Lumpkin & Eisner 2008) Strategic management is a group of decisions and actions established and applied to be successful in reaching the goals of an organization. (Pearce & Robin 2008)

2.3.1 Strategic Management of Defence Industry

Developed countries in Europe see their defence industries as a requirement of national sovereignty and improving defence technology is very crucial to establish a national defence industry. These countries refuse or eliminate foreign companies for their defence procurement projects. The protection and promotion efforts of national defence industries for these countries are increasing. European countries force close relationships with national companies and applying national main contractor method cause of advanced technologies using in the defence industry. (European Parliament Directorate 1993)

The common idea in Europe is to reduce the number of existing defence industry companies. Only one main system manufacturer and two software developer companies will be sufficient in the field of European defence industry. By this way developed European countries could compete with the United States. (German Industry: Time to Realign 1995)

The Federation of German Industries issued a report named "Armed Forces and Industry-2010" in 2004. The report mentioned important points about defence industry and the important strategic security subjects. A brochure named 'Security and Defence for Germany -Government and Industry Limitations' added to this report In December 2005. Brochure stated that it should be redefined the national interests and political strategy. In addition a section called 'German Defence Industry Interests in Europe' included to the Brochure. The purpose of this action is to put forward the national defence industry strategy containing the German defence industry interests in Europe. It is obvious that common defence market in Europe will have many opportunities for Germany. These opportunities also include risks, in order to avoid as possible as from these risks a common approach and co-ordination between industry and the government is stated in that document. (German Defence Industries Committee 2006)

The aim of France defence strategy is to defend own interests by oneself against any danger that might come from any source. Furthermore the protection of these interests can not be preserved without having a strong defence industry and structure. France's defence industry consists of complex expertise such as design; production and systems testing which is developed from many different manufacturing programs over many years and it is almost at the same level with England's defence industry which is comes immediately after United States' in the world. France's defence industry meets 90% of the defence systems and equipment needs of French army. Today France carries out 20-35% of the defence production with its European partners. (Humily at al. 1999)

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United Kingdom Ministry of Defence announced National Defence Industrial Strategy in October 2002 and revised it again by stating the future supply and industrial decisions in December 2005. Ministry of Defence developed a strategic point of view on the basis of industry. The report which determined the basic principles within the scope of the Defence Industrial Strategy is presented to the Defence Committee at the end of January 2006. One of the key points here is the necessity of focusing on fresh technologies and manufacturing new materials for renewable energy systems to reduce the dependence on oil and uranium resources to control the consumption of energy by research and development. Current defence industrial strategy provides a clear policy to protect the industrial and technological capacity in aerospace, engineering and electronics sectors in UK. (Schofield 2006)

When the U.S. defence industry analyzed, Buy American Act is the most significant among the basic laws regulating this field. Under this law, only nationally produced products could be procured for the military needs of public and national security. It is decided that small enterprises engaged in defence production and the areas that have surplus workforce need to be preferred while the procurement of defence systems and equipments for the protection of the national interests. (National Business Association 2009) U.S. Trade Act and the Defence Production Act give the authority of preventing to have the defence industrial facilities (even partially) by foreigners within the borders of the U.S. (Guler 2009)

3. The Methodology

The study seeks the importance and the impact of science and technology among the strategic management of defence industry. To answer that question different practices examined around the world, produced some findings that were not concluded commonly in advance and produced some findings that could be applicable for further studies about science and technology based defence industry model. To be exploratory is also another objective of the research. So the paper based on literature review and detailed information about defence industry, strategic management of defence industry and science and technology based defence industry. Accordingly qualitative approach has been used within the current context.

4. The Findings

Organization for Security and Cooperation in Europe announced that the U.S. is the most military spending country in the world (OSCE 2008). Britain, France, and Germany went after U.S. The U.S. military spending increased about 24.5% in 2008 compared to 2003. America exported more than six times military equipment that it has been exporting from Europe (Heseltine 1995). Total defence spending of Europe in 2007 is 204 billion euros, and for US, it is 454 billion euros, more than 2.2 times (EDA 2008).

United States ranks first in the world investing in defence related science and technology. U.S. launched history's greatest science-based research and development operation on the eve of Second World War. Under the management of General Leslie Groves, 43 000 people worked in 37 different places, in the Manhattan Project, and the cost of the project has reached 2.2 billion dollars at that time. During the Cold War, United States and the Soviet Union made large-scale public investments in basic and applied sciences, in the field of defence, to provide superiority in military technology. The existing and predicted defence industry needs

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largely directs the contribution made to science in the United States. U.S. Ministry of Defence budget is 2.5 times of the Ministry of Health budget, which is the next largest consumer of science fund. Defence-related science spending in the U.S. is continuing to get share of approximately 50% of all federal science spending. (James & Dorn 2006)

Research and development expenditure of U.S. in 2007 is \$ 371 billion and increase in research and development expenditure between 2002 and 2007 is 34% (SSM 2010). U.S. allocated 14.5% of the total defence spending to the research, development and technology in 2007. This rate is 5.98% for the whole of Europe (EDA 2008).

Defence related research and development activities have a significant share among the innovations that have developed continuously by United States. Special-purposed organizations such as Defence Advanced Research Projects Agency-DARPA have a critical role in the achievement of scientific innovations by funding from the initial concept throughout the production of the prototype. The resulting output can be entirely different from the initial but DARPA also guides about the usage and target market. Even the obtained output would not be useful for the defence industry purposes it provides improvement for companies in interoperability, venture capital culture and research and development experiments. The most valuable contribution is to encourage the companies about commencing to develop valuable innovations. (Laredo 2005)

DARPA in U.S. declares its mission as, to prevent coming across technological surprises and do technological surprises for the enemies of the United States. The tactics applied in order to perform the mission in question are; continuously searching the revolutionary scientific ideas around the world, and support projects that will be a bridge between fundamental discoveries and new military capabilities. DARPA announces itself as lead office of innovation of the Department of Defence. (DARPA 2010)

To ensure sustainable cooperation between universities, industry and Department of Defence, U.S. has developed a distinctive method known as the Cooperative Research and Development Agreement-CRADA. Any state or local government, industry, private or public institution and other non-profit organizations could participate in such an agreement by applying to the Ministry of Defence. Involvement to the agreement is not within the scope of any allowance, procurement or joint production assignment. The intellectual capital, experience and data exchange can be furnished mutually. However, the shareholders permit the reciprocal use of resources such as personnel, services, facilities and other materials. The Department of Defence has the authority to allocate resources to the participating parties. Private participants can also cover the resources needed in the project. While the Department of Defence is not allocating any fund, the participants can benefit from the CRADA fund. The participants determine the usage rights of innovation and intellectual capital obtained from research in consultation. (Augustus 2005)

The developed method improving the cooperation between university, industry and the Department of Defence while providing a sustainable collective culture. Furthermore with the common use of facilities the parties save and prevent waste of effort.

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Defence-related research is the locomotive of the national progress in technological superiority of US. The best proof of this is Pentagon's finance support to the research of national Nobel awards winners. This is 58 percent in chemistry and 43 percent in physics in the last half century. Science and technology in the defence sector is a valuable source of U.S. military and economic power. (Sephilieberman 1999)

Italian Finmeccanica Group, world's sixth and Europe's third largest Corporation, is also an outstanding example for technology transfer. Company carries out different projects in aerospace, satellite operation, space, energy, and transportation sectors by means of the ability to transfer technology developed in the defence industry to civilian areas. They have railway signalling system project and a billion Euros valued communication satellite project in Turkey except defence industry. Company contributes to the national economy in this way significant extent through the non-defence projects. (Cinelli 2009)

5. Conclusion

U.S. is the most defence related research and development spending country in the world. Accordingly there is a direct relationship between the influential foreign policy and the advanced, self sufficient defence industry of it. This relationship is one of the main factors of becoming a dominant power in the international relations despite its isolated geographic location. (Berk 2009)

Building defence industry as science and technology-based provides strategically competitive advantage and long-term political and economic benefits among other countries (Tekin et al. 2003). The reason that the positive effect is, the gained technologies through the defence related research and development. Carrying out the technologies in question to different civilian sectors provides an increase in productivity and the value of output per unit labour or capital (TUBITAK 2004).

Economically and socially the contributions of science and technology based national defence production to the national economy, employment and supplier industry is high. Technologically the contributions to the development of the national technology, co-operation with the scientific organizations and the competitive power are also high. The contribution to the defence force in terms of security and deterrence are already high. (Ziylan 1999)

High amounts of resource allocated to defence industry by governments in the world. Efficient use of this resource is also important besides the size of it. To spend the defence budget for improving science and technology makes significant contributions to the national economy in the long run. In this context, it is important to analyze the issue.

The study can contribute to the formation of a new defence industry model. Social, economic and psychological contributions of that model can be examined. Due to the results, the proposed defence industry model could be a reference model.

Resources allocated to defence are not announced completely by countries due to the security and secrecy reasons. Likewise, scientific and technological defence research is strictly confidential. These are the constraints of the study. Nevertheless the partially announcement of defence related research expenditures with the reveal of improvements derived from these research are strengthened the study.

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