

TRINITY OF DEFENSE INDUSTRY

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Abstract *Defense Industry has to perform three fundamental functions: 1. Providing buyers with services and products of suitable technological standards. 2. Manufacturing its products and services on a marketable price. 3. Ability to maintain its production in both peacetime and wartime. Consequently, the elements of the Trinity of Defense Industry include technological level, competitiveness and security of supply. However, it is becoming more and more difficult to meet all criteria concerning both the present times and the future. In this article I am going to emphasize the importance of these three critical factors and demonstrate a few challenges which are making it difficult for defense industry to perform its function of supporting the operation of military forces without any errors. I am not seeking to find answer nor solution for these challenges shaking the defense industry, cause even more talented experts in the industry can't do it. I just draw up some changes characterizing our defense industrial environment.*

Keywords: defense industry, military logistics, supply security, competitiveness, defense technology

1. Introduction

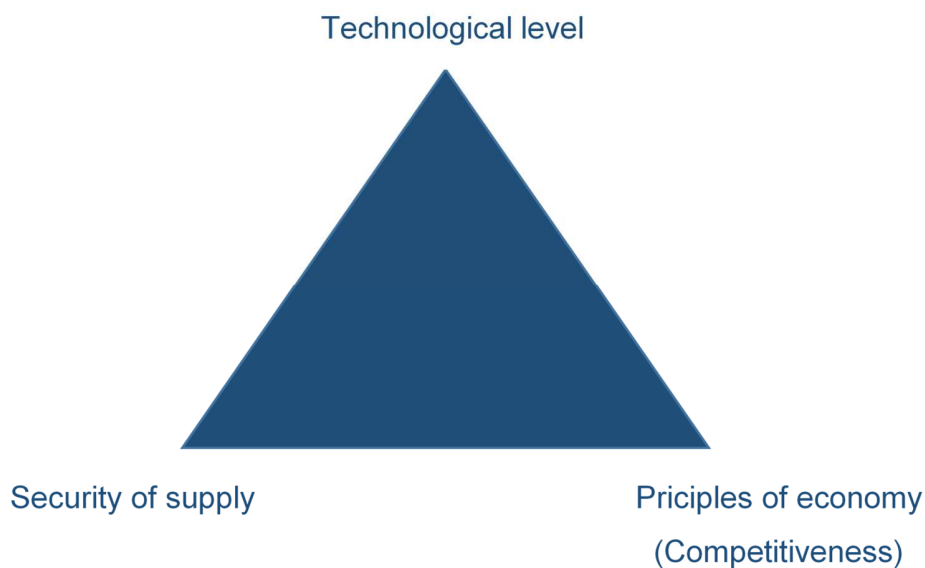
As the Holy Bible of the Christian religion says about the Father, the Son and the Holy Spirit, that each is God individually and yet they are together the one true God, we can also state that the Trinity of Defense Industry consists of the followings: technological level, the principles of economy (competitiveness), security of supply. These three make defense industry a dependable ally of military forces. It is known that without defense industry, there is no military force, nor military victory. But what qualities are the ones making – either national or international - defense industry able to support our soldiers in carrying out their duties? This is what I am seeking an answer to in this article. Besides all basic principles I am going to get into details about the issue of defense industry being more and more unable to maintain its ability to be supportive. Moreover, in the XXI. century, the basically changing warfare will be facing defense industry with further challenges, and the question of how defense industry will be able to react is still unanswered.

2. The Trinity

Our basic requirements towards defense industry are the following:

- To manufacture appliances meeting the technological standards of the present. (Technological level)
- To create its products and services in an affordable and competitive way. (The principles of economy)
- To be able to support the maintenance of appliances and to be able to operate the manufacturing or its services both in peacetime and in wartime. (Security of Supply)

There is no hierarchy among these three requirements, as they are all equally important, therefore it can be named The Trinity of Defense Industry [1].



*Figure 1- Trinity of Defense Industry
(made by the author)*

2.1. Technological level

Technological superiority has always been an important factor of wars, but by today it has become the main factor of them. This is partly the result of exponential technological development, resulting in a technological gap among the military forces of the world. In our days, for an army to carry out its duties, it is inevitable to be provided with the most modern military materials and platforms. If a soldier is not provided with the equipment appropriate for this age, they cannot be expected to fight their battles with success. Therefore, it is an important task of defense industry to put such items and services into soldiers' hands, which meet the technical standards of the age. Besides this, it is just as important of their operation to be reliable, which means improving the abilities of platforms and systems should not reduce the reliability of operation, since it doesn't matter if a major item is equipped with the results of the latest technical improvements if it cannot fulfill its tasks permanently in a user-friendly way, without any errors.

2.2. The principles of economy (Competitiveness)

Defense industry is also required to function efficiently and competitively. Competitiveness is important for two reasons. Firstly, equipping a military is terribly costly. Therefore, how much defense industry requires to create its products and services is an important matter for taxpayers, since if it is more expensive than in other countries, then taxpayers are required to spend more money on providing the same amount of security as in other countries. In this case there are two possibilities. Taxpayers either pay more tax, having less income for personal use, or pay the same amount of taxes, forcing the government to reduce the amount of resources towards other fields, such as education, healthcare, public transport, infrastructure-development, etc. Social well-being

will be reduced in both cases. The third possibility is that the government buys less military equipment and material for its army, than other countries, due to higher prices. However, in this case, the security of the country will fall.

The second reason, which is why competitive military production is so important, is that the ability of exporting services and products is necessary for the maintenance of the sector. A country's military cannot maintain its own defense industry for a long period of time. Even the largest military force of the world, which is also the world's largest military purchaser, the US military is unable to maintain its own military, therefore they are forced to export as well as every other military in the world is forced to do so on the world market. However, to be able to put a product on sale in another country, not only does an enterprise need to ensure high technological standards, but also, they need to offer their products for a competitive price. (Even if military supplies are often based on political decisions in defense industry.) It is not workable for a country's defense industry to depend exclusively on its own army, as a buyer. Since the life cycle of military equipment is quite long, supplying (re-armament) is mostly followed by upkeep only, which isn't as much order as needed to maintain the capacity of military improvement and production. This way, companies of the sector can easily go bankrupt, or, in case of government ownership, permanent losses would have to be covered from its central budget. Neither is a pleasant scenario. Especially, if companies producing a certain type of equipment cease, since, in this case, it will become difficult to buy components for, or operate the equipment.

2.3. Security of supply

The last sentence above already connects to the factor of supply security. Defense industry has to be able to supply its buyers in both peacetime and in the period of crisis. It includes solving the problem of supplying components for purchased equipment, supplementing consumable material, as well as maintaining the ability of continuous production. This latter point is especially important and critical in the times of war or armed conflicts. These times create a huge demand for military equipment and material, and it is uncertain whether defense industry can fulfill every need. In case of a prolonged war situation, used-up war material and damaged military equipment needs to be supplemented constantly. If defense industry is unable to do so, the army loses the war. Therefore the third element of trinity is security of supply.

3. Challenges in the XXI. century

Keeping the balance among the above three elements is getting harder these days, since there are several contradictions in the triangle. The strengthening of one might often result in the weakening of the other two. In this chapter there will be such external or internal factors listed, which weaken defense industry's ability to meet all three criteria mentioned above.

3.1. Globalisation and transnationalization

Throughout globalization, international trade in goods and services, as well as international capital flow expands faster than economic output. As a consequence, the production value chains are transnationalized. Which means the need for the cooperation of more and more national economies in order to create a product or a service, since certain procedures of the value chain are placed in different countries.

Knowledge and technology, which are included into the value chains, are also becoming transnationalized. International technology-flow has accelerated, and today there is no country in the world, which is equipped with the most modern knowledge on all fields of engineering or natural sciences [2]. As a consequence, in the case of defense industry, technical level and competitiveness encounters supply security.

Since, firstly, the appliances of modern military platforms are so complex systems, that in the value chain required for their creation, there are surely elements or processes which cannot be done in the given country. Let's just think of the role of rare earth elements in every single IT system. There are relatively few countries provided with supplies of such mineral elements, therefore there is a huge dependence on them in every high-tech sector – including defense industry. One of the biggest exporters is China, and it is still uncertain whether it would introduce export restriction in a given case of a war affecting its interests. Such act can seriously disrupt the production of other countries which China has already threatened with – in their border dispute with Japan, in 2010 [3].

Secondly, as long as defense industry of a country intends to produce the most modern appliances for both itself and for other military buyers, they need to cooperate with other countries' military and civilian industries, including using their products and services as well. This will increase internal dependence further, and will also raise questions in connection with supply security in case of a conflict. However, these days, this is the only way of being a technological leader. [4]

Thirdly, if defense industry intends to turn out their products and services economically, it will also be forced to place certain labor procedures of production into countries of lower labor costs. This is a painful situation of having to decide for - typically political - decision makers, since they want to possess completely domestic military products, which were produced for an affordable price at the same time. These two, however, cannot be put into practice together in most cases. If production procedures are placed abroad, supply security is infringed. If it is kept inlands, production becomes more expensive. Especially, if whole plants and production lines need to be maintained because of this. In case of separation, at the point of producing military components, economies of scale get low. This way, not only the cost of higher wages and taxes, but also the lower volume of production will contribute to components for military use costing more than its version for civil use [4]. An example to this would be Boeing, which has the fuselage of its civil aircrafts put together outside the United States while the same procedures for military planes are done in the USA, making the costs of military planes incomparably higher.

3.2 Changing nature of war

As James Mattis, former secretary of the Department of Defense U.S said in a speech in front of the U.S Congress [5] as a consequence of the technological advancement, we have to question everything we have already know about the nature of war. By claiming the above, the world's most famous retired general meant the military uses of researches on automation, robotization, and artificial intelligence. New technologies will change warfare completely, certainly including defense industry as well.

However, we have relatively few ideas of these future changes. As American military experts stated in an article: "But the next war, especially if fought among great powers, may have strikingly little in common with wars of the past. It may unfold in completely unanticipated ways, quickly surging outside the intellectual fence lines of even the most creative military thinkers. The next

major power war will be the first war of the Fourth Industrial Revolution, and it may dramatically disrupt everything we think we know about the character of modern war” [6].

It is very difficult to get ready for the unknown, both for the soldiers and defense industry. And it is especially hard to make sure, that the soldiers are given weapons provided with the best technologies while it is completely uncertain, what way the technologies will be developed which the weapon itself is based on. Since the period of developing a complex weapon system can be several decades long, while developing technologies and their military use can reorientate drastically. A national defense industry not heading to the right direction – while neither of the directions can be seen clearly – can seriously fall behind on the field of technologies.

3.3. Blurring border line between civilian and military technologies

The technology of nuclear fission was developed for military purposes. Later, it was also used to generate electricity for civilians. Teflon, ball-pinned pen, zip-lock are all products of air and space industry, as well as the technology of internet, which was first made up in a military research institute. However, artificial intelligence, biotechnology, nanotechnology or robotization are not military inventions, neither is military good at developing them. The following can be stated about today’s high technology:

1. It expands faster than any recent one.
2. It is relatively cheaper to develop or get access to them.
3. The private civil sector is the forerunner in developing them.

To introduce it with an example, while there are relatively few countries equipped with nuclear weapons even after all these decades, even universities own and use satellites, and the private sector has spent more money on researching artificial intelligence than all governments ever have [7]. Running gene technological researches or creating the most advanced algorithms is still less costly than building a nuclear power plant. Which means it is much easier for anyone to join such sectors. Since the civil use of these technologies is a huge business, the capital funds emerged to finance their development cannot be competed by any government budget. Therefore, as opposed to the period of cold war, when the latest technologies were all in the hands of the governments or military participants tightly connected to them, the holder of today’s knowledge is the civil sector. Which raises several issues. On one hand, it is becoming more and more difficult to stop the proliferation – or even the military use – of such technologies. On the other hand, governments must realize that one of the most important requirements for being forerunners in technology is being able to attract the latest technological applications into defense industry from civil sectors. This is not a simple task at all, since, first of all, a government must have a quite exact image of what developments are going on at private companies, and second of all, military use of these developments must be made attractive enough somehow, since private companies of civil sectors often find it too demanding to work for the government, especially for the defense forces, because of all those restrictions and requirements. On top of that, society often does not support such cooperation (See Google-scandal [8].)

However, it can clearly be seen that the borderline between defense industry and civil enterprises is blurring. Today, even Google or Alibaba can be labelled as military participant, and who knows, maybe, in a few years, Uber’s robot technology will be used in the self-driven vehicles of the militaries. As it can also be seen such movement to the other way: the devices of Huawei, designed by retired Chinese generals are there in million pockets, or let’s not forget ZTE, another company

tightly connected to the Chinese army, which is at the forefront in developing information technology systems [9].

3.4 Increasing difficulties in managing acquisition programs

It is clear from the above points that managing acquisition programs coming along with major platform development are getting more and more complicated. All these programs target the following three: a military product made by the planned time, from no more than the planned budget, having all the planned capabilities.

Technologic life cycles are getting shorter and shorter, while network based military technology devices are getting more and more difficult. Neither can make acquisition programs easier to be planned or carried out. The development of some more complex major platforms (such as airplanes or submarines) can be as long as several decades, while human knowledge can multiply, resulting in new technologies, which were unimaginable during the time of planning, and which technologies the military forces require to be built into their newly purchased systems, in order to match the technological requirements of the age, and to fulfill the technological element of the trinity.

However, replanning platforms under development has a negative effect on both the financial frame and the timeframe of the acquisition program. Also, during the delay caused by replanning, brand new technologies can occur, which might also be demanded. This can build up to be a vicious circle, which, from the aspect of government budget, can pair up with a bottomless well (endless financing need).

This is why companies of defense industry are trying to develop such modular platforms, which are capable of technological upgrade not only during operation, but also in the period of their development. However, it can be clearly seen that the acquisition program, which can meet all financial, time-related and capability expectations are considered exceptional. Although it isn't an industrial specificity, it is followed by similar consequences in every sector of technological development. However, deriving from the complexity of the systems and items and the longer timeframe of acquisition programs, such issues occur more frequently.

3.5. Shortage in labor force and organization culture problems

“Waiting, relying, demanding” – this is how a Chinese book characterized Chinese defense industry of the 80s and 90s [9]. This was compared to an organization culture characterizing civil sectors, which says “competition, innovation, action”. Such difference, however, does not describe socialist or post-socialist countries only. There was always and has always been a problem being “too important to fall” in connection with every important participant of defense industry, which means no matter how inefficient a business turns out to be, the government cannot let it go bankrupt. Interdependence is too big. If national defense industrial companies go bankrupt, security of supply is exposed to severe damage, and the country's external dependence will increase. No government would like to face such situation; therefore, they will always support the survival of their own defense industry in some way. This kind of sense of security, however, has no effect of increasing innovation. Companies can easily get comfortable, which will result in getting behind in technological development compared to both other countries and civil sectors. Especially in the accelerating technological development of the 21. century. And in this case, not supply security, but rather the technological standards will fall back within the Trinity.

In order to produce military equipment of high-tech standards, well-trained labor force is necessary. However, the sector is facing serious challenges in this field, too [10]. After the disappearance of the bipolar world order, the attractiveness of defense industry or the similarly affected air and space industry as employers, has significantly decreased among the young [4]. Especially, compared to a more youthful, more flexible and “cooler” sectors, for example, the information technology sector. In the consolidation period of the 90s, when profit significantly fell back, the companies of defense industry could not afford to provide their workers with as much training. As a consequence of all this, the staff of defense industry has aged, and has got behind in ability, not only on the western but also on the eastern side of the planet [9].

Moreover – for security reasons – defense industry could not profit from the accelerating international labor-flow which followed the ceasing of bipolar order, since, in many countries, it is forbidden by law to hire foreign citizens for jobs in research and development institutes or production plants of the defense sector. Such restriction is quite logical and acceptable from security aspects; however, it excludes a significant number of skilled workers from defense industry. While there are many countries facing shortage in labor force in the fields of natural sciences, engineering and mathematics, especially since manufacturing processes within the value chains were resettled to less developed countries as a result of globalization. This fact, added to the slight attractiveness of defense industry causes an aggravating shortage in labor force in the sector.

4. Conclusion

Looking into the dimness of the future, only uncertainty is certain. This is why, in this article I haven't sought to find answer nor solution for these challenges shrinking the defense industry. Even a full reorganization can be imagined in the sector. Nobody knows yet.

However, no matter what happens, the countries will keep making effort to maintain the trinity of defense industry, so that it can produce equipment of high-tech standards, for a competitive price, in both peacetime and wartime. For this, however, countries will have to face severe challenges caused by globalization, transnationalization, technological development, the technological supremacy of “civilians”, the decrease in their ability to attract labor-force, the obsolescence of organization culture, and the inflexible operation of the government as customer.

Defense industry is one of the oldest economical sector in human history. Military equipment is highly likely to be still necessary in the future. However, it is still left uncertain, where and how they will be produced and by whom.

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