

THE IMPACT OF INNOVATION IN MILITARY INDUSTRIAL COMPLEX

Arsen PETROSYAN

PhD, Associate Professor, Vice-Dean of REIER, ASUE, Armenia

Atom MARGARYAN

Head of IIR SEL, ASUE, PhD, Associate Professor

Key words: innovation, military industrial complex, national innovation system, defense industrial base, military expenditure.

Introduction. The high innovation potential of the military-industrial complex can become a source of technology for the civilian industry. In the context of the diversification of the military-industrial complex, the development of an effective technology transfer can become one of the key elements in building a competitive economy. The article contains a diagram of the mechanism for the innovative technology development and transfer between the military and civilian sectors. On the basis of this method, it is possible to build effective schemes for technology transfer and exchange and joint work of the military and civilian industries. It also considers the military, technological and political drivers that have led to these technologies being sought from commercial companies for military use. It then considers the recent engagement of the major innovation systems in activities for the military sector. The review is based on open source information as available in official government reports and data, conference reports, academic literature, and specialist and ordinary news items. Finally, it considers what these developments imply for the dynamics of the arms industry and the relationships within the Innovation System and the military industrial complex (MIC).

Methodology. For the processing and application of information necessary for the research work dialectic, scientific research, as well as analytical and comparative methods have been used. Methods of comparative analysis is used particularly to compare world military expenditures by regions and the share of world military expenditure of the 14 countries with the highest spending in 2021 related to innovation activity, as well as other methods used in economic analysis. We have arranged meetings for exchanging ideas, organized group discussions. In the framework of our research we attempted to use methods of collecting empirical data, as well as the data published by the SIPRI statistical service.

Literature review. In the decade and a half that followed Eisenhower's address, during and immediately after the Vietnam War, the phrase "military-industrial complex" (MIC) enjoyed considerable currency. The number of books published on the subject peaked in the early 1970s. See, for example, (Herbert et al., 1970); (Melman, 1970); (Lens, 1971); (Rice, 1971); (Pursell Jr., ed. 1972); (Sarkesian,

1972); (Rosen, 1973). For a concise, much more recent overview of the subject, see (Roland, 2001). During the Cold War, the defence industry took on a particular structure that continues to influence developments now. The national government was the main customer and regulated exports and determined its size and structure. This monopsonistic structure of the market led to an emphasis on performance rather than cost of the products (high-technology military systems). Risk was borne by government, which often financed R&D and, in some cases, provided investment in capital and infrastructure. Elaborate rules and regulations on contracts, were developed to compensate for the absence of any form of competitive market and to assure public accountability. This all meant that close relations developed between contractors, the procurement executive and the military, notably what is termed the 'revolving door' in which military and civil servants move to defence contractors they had dealings with and staff from defense contractors move into the bureaucracy. These characteristics tended to favor those firms who specialize in defense work, as they knew their way around the red tape, had useful contacts and became experts at negotiating contracts with government. These were different skills to those needed in commercial markets. Firms used strategies such as 'buy ins', where they understated the risk or cost to win initial contracts, with a view to making up the losses later, with the inevitable changes that allowed renegotiation of contracts or additional payments. Defence companies became experts at getting contracts out of government and these skills and the structure of the market meant that there were both barriers to entry and barriers to exit. This led to the Cold War DIB showing remarkable stability in terms of its composition of main contractors. Monopsony in the defense market also helped to create near-monopolies for certain companies particularly in smaller countries. Outside of the US, there was a prevalence of companies that were national monopolies or close to it. Any competition was going to come from foreign firms, but governments tended to protect national companies, wishing to maintain a national DIB. Much of the work on the MIC sees a negative impact of vested interests as a fairly clear and constant feature of the Cold War. The argument is that in the absence of a 'hot war' between the two superpowers to test the strength of the adversary, it was possible to overemphasize and exaggerate threats. These developments then justified high levels of military spending and allowed inefficiencies to develop (Dunne & Sköns, 2010, 286-287). World military spending peaked in the late 1980s, then declined by roughly one-third during the subsequent decade, first as a result of improving East-West relations and then with the end of the Cold War. The international arms trade dropped by a half between the 1982 all-time high and the 1995 trough, then fluctuated somewhat until it began to increase consistently in 2003 (The SIPRI Arms Transfers Database). These changes had a direct impact on the demand for the products of the MIC and the environment in which they operated, calling into question the ability of even the major countries to maintain a comprehensive domestic defence industrial base. Governments

found it harder to justify previous levels of support for the industry and 'competitive procurement policies aimed at value for money were introduced in a number of countries' (Dunne & Sköns, 2010, 289-290). In addition to the changes in the level of demand for arms, new technologies enabled new types of warfare and changed the nature of demand. Communication and control technologies became increasingly important in the theatre of military operations. Network-centred warfare, the use of satellites, communications equipment and multi-node networks changed the nature of demand. This was part of the Revolution in Military Affairs (RMA), a term used to emphasize the way that improvements in information technology, precision targeting and smart munitions created the possibility of a new form of warfare, network-centred warfare. It also changed the nature of military technology, with increased importance of software and ICT and an increase in their share of costs in the production of weapons systems. The internet came to play an important role in the development of communications, but it also provided a further area of potential security threats. Uncertainty about the enemy and the growth of 'homeland security' added new types of demand, making communications and surveillance technologies increasingly important (Boulain 2017, 33-36; Smith 2009, 132-138). In addition, the growth of peacekeeping roles around the world, created somewhat different military systems and personnel requirements (Dunne et al 2006, 394). Another major development that introduced some new faces was the significant expansion of the military services industry from the end of the Cold War. This resulted from the outsourcing of functions that once were provided by military forces or defence ministries to private companies and was expanded greatly during the war in Iraq (Singer 2003, 21; Wulf, 2005, 11-13). This led to a significant change in both the structure of the DIB, with new companies, such as KBR, previously owned by Halliburton, becoming a major DoD contractor for its provision of construction in conflict zones (Briody, 2004, 199) and in the nature of the MIC, as companies providing military services are often engaged directly in conflict zones. Their interests are different and more problematic than the vested interests of military goods-producing companies, whose products are also in high demand during peacetime (Perlo-Freeman & Sköns 2008, 13). These developments all led to a defense industrial base that was looking rather different to the one inherited from the Cold War. In the US it was still dominated by a few main contractors that had merged and made acquisitions to retain their position. In other countries there were limited cross country mergers, but there was some restructuring and companies that survived remained dependent on national governments and their support for arms exports. There was change but also continuity, as Dunne et al (2020) argue. Over the last generation, a variety of newer studies has continued to enrich our understanding of the long-run development of military-industrial and innovation relations. (Garry Weir, 1991, 107-109). Military have also affected the development of new technologies. Of all the scholars working on questions

related to the MIC, historians of technology have been especially successful in creating a rich sophisticated body of work. At its best, this work has managed to document the ways in which the military has indeed altered the course of technological development, without overlooking the equally important contributions of individuals and companies in the private sector (Christophe, 2007, p.84).

Scientific novelty. The research paper has a number of conclusions serving theoretical foundation for solutions of practical problems. Particularly, it considers how the developments in national innovation systems and new technologies imply for the military expenditures and the relationships within the innovation sector and Military Industrial Complex. At present it is difficult to predict what is likely to happen or how this will affect the MIC. The established defense producers may fight back, both groups may stick to their specialisms, mergers may take place, or the new guys on the block may come to dominate defense production. In the framework of our research we discovered that, new developments in technologies, the internationalization of production and supply chains, the growth in the use of civil components, and the significant expansion of the military services area, all had significant impacts on the size and structure of the arms industry and countries must find effective combinations between them to increase the level of economic efficiency

Analysis. Since the mid-2010s, there have been developments in defence policy that have aimed to increase the engagement of innovation companies in military-related activities. This represents a significant change in procurement policy and could have a significant impact on the arms industry, an industry that has already seen considerable change, with the end of the Cold War and changes in the international security environment. It also potentially has profound implications for the relationship between the arms industry, the government and the military.

The first shock to the industry came when world military expenditures began to fall in the late 1980s and continued on a downward trend during the first post-Cold War decade. At the same time, the fixed costs of R&D for major systems continued to grow, both for platforms and for the infrastructure (e.g. satellites, strategic air assets) and the information-based systems needed to support network-centered warfare (Dunne and Sköns, 2010, 286-287). Changes in technology, with increasing importance of electronics and of information and communications technology (ICT) in military technology, resulted in an increased need for enabling technology in weapon systems. This led to a major restructuring of the arms industry and in the relations between it, the government and the military. Arms contractors changed, becoming systems integrators, outsourcing nationally and internationally, spinning in civil technologies and components, rather than spinning off innovations for the civil sector. These processes resulted in a reduced number of dominating companies but of much larger size, and

increased reliance on foreign components. However, the traditional defence producers, specializing on the military market remained dominant, partly through takeovers to acquire expertise in new areas. There is little evidence to suggest that the links between the industry, the military, government and the legislature weakened. Rather, it would still seem that it is a political rather than economic logic that controls the international arms market. There has been change, but also a remarkable degree of continuity. (Dunne & Sköns, 2010, 288). In 2021 world military expenditure surpassed the two trillion US dollar mark for the first time, reaching \$2113 billion. Global spending in 2021 was 0.7 per cent higher than in 2020 and 12 per cent higher than in 2012 (see figure 1). The economic effects of the Covid-19 pandemic have not ended the continuous upward trend in world military expenditure seen since 2015. As a result of the strong economic recovery across the globe in 2021, world military spending as a share of world gross domestic product (GDP)—the global military burden—reached 2.2 per cent, down from 2.3 per cent in 2020. Average military spending as a share of government expenditure in 2021 remained the same as in 2020, at 5.9 per cent. This Fact Sheet presents regional and national military expenditure data for 2021 and highlights trends over the decade 2012–21. The data comes from the updated SIPRI Military Expenditure Database, which provides military spending data by country for the years 1949–2021.

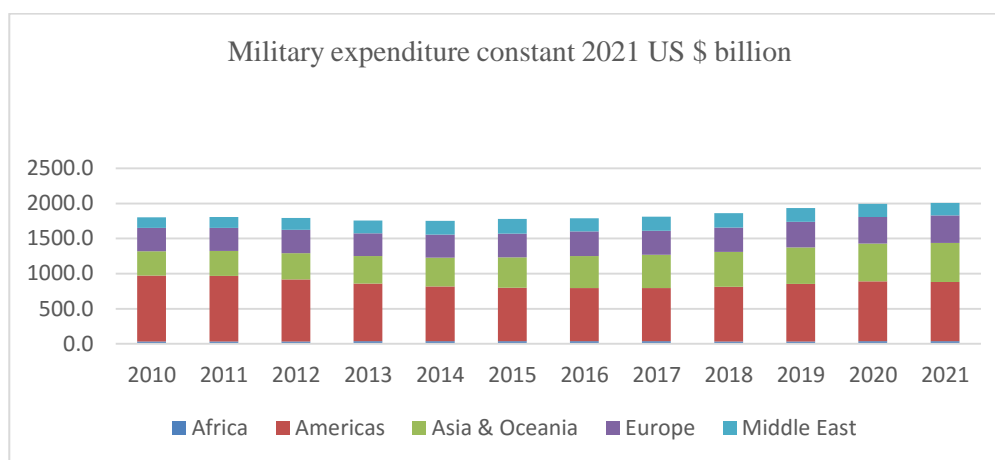


Figure 1. World military expenditure, by region, 2010-2021

Source: SIPRI Military Expenditure Database

Military spending by the top 15 countries reached \$1717 billion in 2021, accounting for 81 per cent of global military expenditure. The United States (accounting for 38 per cent of world military spending in 2021) and China (14 per cent) remained by far the two largest spenders (see figure 2). There were, however, some notable changes in ranking among the top 15 between 2020 and 2021. The United Kingdom and France each moved up two ranks, becoming the fourth and sixth largest spenders in 2021, respectively.

After a 17 per cent drop in its military spending, Saudi Arabia fell from fourth largest spender in 2020 to eighth largest in 2021. Iran increased its military spending by 11 per cent, making it the 14th largest military spender in 2021. This is the first time in 20 years that Iran has ranked among the top 15 military spenders.

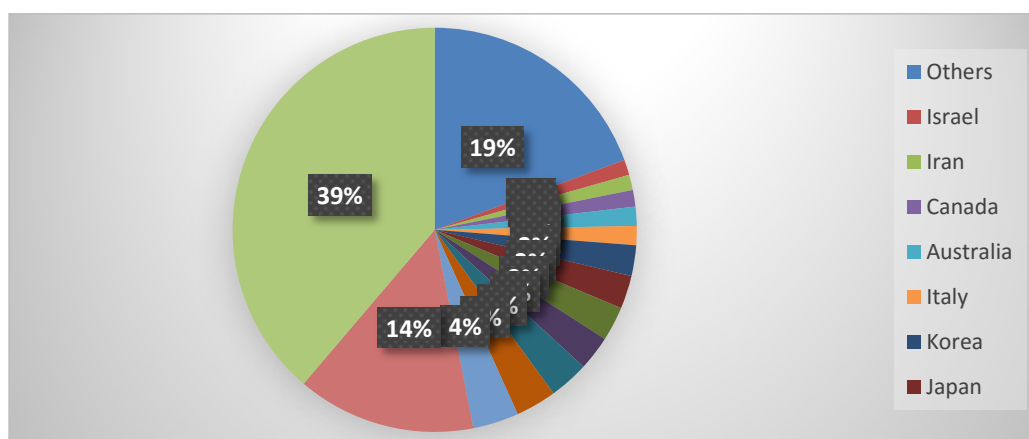


Figure 2. The share of world military expenditure of the 14 countries with the highest spending in 2021

US military spending totaled \$ 801 billion in 2021. While this was a nominal increase of 2.9 per cent compared with 2020, it represented a decrease of 1.4 per cent in real terms. The difference can be attributed to the USA’s rising rate of inflation. For example, US funding for military research and development (R&D) increased in nominal terms in 2021, but adjusting this for inflation gives a real-terms decrease of 1.2 per cent from 2020. Nevertheless, the US budget for R&D has grown by 24 per cent in real terms since 2012. In contrast, US funding for arms procurement shrank by 6.4 per cent between 2012 and 2021, and by 5.4 per cent between 2020 and 2021. The USA’s continued heavy investment in R&D (combined with the cut in procurement funding) seems to indicate that it is currently prioritizing the development of new technologies over large-scale spending on legacy systems. Nuclear-related spending was among the military budget items that saw the largest increase in 2021, which reflects the USA’s planned overhaul and modernization of its nuclear arsenal. China, the world’s second largest spender, allocated an estimated \$293 billion to its military in 2021, an increase of 4.7 per cent from 2020 and 72 per cent from 2012. China’s military spending has grown for 27 consecutive years, which is the longest uninterrupted sequence of increases by any country in the SIPRI Military Expenditure Database. As China’s GDP grew by an estimated 8.4 per cent in 2021, its military burden dropped by 0.1 percentage points, to 1.7 per cent of GDP—the same share as in 2012. China’s military budget for 2021 marked the first year of its 14th Five-Year Plan (FYP), which runs until 2025. The new FYP aims to deepen military–civil fusion by supporting military and civil science and technology collaboration in areas such as aerospace,

maritime and emerging technologies. India's military expenditure of \$76.6 billion in 2021 was the third highest in the world. Its spending was up by 0.9 per cent from 2020 and by 33 per cent from 2012. Amid ongoing tensions and border disputes with China and Pakistan that occasionally spill over into armed clashes, India has prioritized the modernization of its armed forces and self-reliance in arms production. In a drive to strengthen the indigenous arms industry, 64 per cent of capital outlays in the 2021 Indian military budget were earmarked for acquisitions of domestically produced arms.

The UK's military expenditure totalled \$68.4 billion in 2021, up by 3.0 per cent from 2020 and by 3.7 per cent from 2012. This was the fourth consecutive year of growth. The UK's military burden was 2.2 per cent of GDP in 2021 and was therefore above the North Atlantic Treaty Organization (NATO) target of 2 per cent. In 2021 the British Government published a new policy that, among other things, aims to increase the Ministry of Defence's budget by \$33.0 billion over four years. The additional spending is meant to fund R&D and a new Space Command, sustain nuclear deterrence, and support the modernization of the Royal Air Force and Royal Navy. Russian military expenditure grew for the third consecutive year in 2021. Russia's spending rose by 2.9 per cent, to reach \$65.9 billion (or 4.1 per cent of its GDP), buoyed by high oil and gas prices. The recent upward trend in Russian military spending followed a period of decline, which came in the wake of Western sanctions over Russia's annexation of Crimea in 2014 and a sharp drop in energy prices in 2015. The 'national defense' budget line, which accounts for three-quarters of SIPRI's estimate of total Russian military spending and includes funding for operational costs as well as arms procurement, was revised upwards over the course of the year. From an initial value of \$42.3 billion in December 2020, the budget line rose to \$48.4 billion by the end of 2021—an increase of 14 per cent over the year, which probably mostly went towards additional operational costs. In late 2021 Russia amassed troops along the Ukrainian border, which preceded its invasion of Ukraine in February 2022.

Conclusion. This paper has considered the changes taking place in the MIC, with the increased involvement of innovation systems. Context was provided by considering the developments that had taken place in the MIC since the end of the Cold War, identifying earlier technology changes and how the industry and state engaged with them. New developments in technologies, providing the foundations for the so called Revolution in Military Affairs, as well as the internationalisation of production and supply chains, the growth in the use of civil components, and the significant expansion of the military services area, all had significant impacts on the size and structure of the arms industry. The present developments, with a potentially high involvement of commercial tech companies, may have a more significant impact on the MIC.

At present it is difficult to predict what is likely to happen or how this will affect the MIC. The established defence producers may fight back, both groups may stick to

their specialisms, mergers may take place, or the new guys on the block may come to dominate defense production. The growth in the defense budget and support for exports reduced pressure on the established firms, but that may well change in the future. In terms of MIC dynamics, the recognition by the DoD of the need to access not only technologies from the commercial companies but also their expertise and advice has resulted in the appointment of leading figures from commercial tech to vital roles in DoD advisory boards and recruitment of tech company staff in arms procurement. What is striking is the speed with which the larger tech companies have embraced the non standard methods of working within the MIC, with behind the scenes activity, intensive lobbying and movement of staff between the tech companies and the DoD. Interestingly, the ‘revolving door’ between the DoD seems to have gone from being seen as a concern, reflecting cronyism in the MIC, to a useful way of engaging the tech companies into the procurement systems, so it is no surprise that established arms firms and some DoD officials are calling foul.

References.

- Alex Roland, *The Military-Industrial Complex* (Washington: American Historical Association, 2001)
- Berkeley Rice, *The C-5A Scandal: An Inside Story of the Military-Industrial Complex* (Boston: Houghton Mifflin, 1971)
- Boulanin, Vincent and Maaik Verbruggen, ‘Mapping the development of autonomy in weapons’, SIPRI Report, Nov. 2017., pp. 147
- Briody, Dan ‘The Halliburton Agenda’ New Jersey, John Wiley, 2004., p. 304
- Brzoska, Michael (2006) *Trends in Global Military and Civilian Research and Development (R&D) and their Changing Interface*, Mimeo, Munich.
- Carroll W. Pursell, Jr., *The Military-Industrial Complex* (NY: Harper & Row, 1972)
- Christophe L, *Making Silicon Valley: Innovation and The Growth of High Tech, 1930-1970* (Cambridge, MA:MIT Press, 2007), pp. 408
- David Horowitz, ed., *Corporations and the Cold War* (NY: MRP, 1969)
- Dunne, J Paul, Elisabeth Sköns and Nan Tian, ‘The changing economics of global arms production’, PRISM, University of Cape Town, 2020.
- Franklin Cooling B., ed., *War, Business and American Society: Historical Perspectives on the Military-Industrial Complex* (Port Washington, NY, Kennikat Press, 1977)
- Gary Weir, *Building American Submarines* (Washington, DC: NHC, 1991), pp.166
- Gold, David, ‘US military expenditure and the 2001 Quadrennial Defense Review’, in SIPRI Yearbook 2002: Armaments, Disarmament and International security, Oxford, Oxford University Press, 2002, appendix 6E, pp. 309–322.
- Hartley K. & Jean B, *The Economics of Global Defence Industry*. Routledge, Abingdon, 2019.
- Herbert I. Schiller and Joseph D. Phillips, ed., *Super-State: Readings in the Military-Industrial Complex* (Urbana: University of Illinois Press, 1970)
- Markusen Ann R., *The Rise of the Gunbelt: The Military Remapping of Industrial America* (New York, Oxford University Press, 1991)
- Pages, Erik, ‘Defense mergers: weapon cost, innovation, and international arms industry cooperation’, in Markusen, Ann R. & Sean S. Costigan, *Arming the Future*, NY, CFRP, 1999, c 7

- Perlo-Freeman, Sam & Sköns, Elisabeth, *The Private Military Services Industry*, SIPRIInsights on Peace & Security, No. 1, September 2008.
- Perlo-Freeman, Sam, et al., 'Military expenditure', in *SIPRI Yearbook 2009: Armaments, Disarmament and International Security*, Oxford, OUP, 2009, pp. 185-189.
- Sarkesian S., *The MIC: A Reassessment* (Beverly Hills: Sage, 1972)
- Seymour Melman, *Pentagon Capitalism: The Political Economy of War* (NY, 1970)
- Sidney Lens, *The Military-Industrial Complex* (London: Kahn & Averill, 1971)
- Singer, Peter W., *Corporate Warriors: The Rise of the Privatized Military Industry*, Cornell Studies in Security Affairs, Ithaca, NY, Cornell University Press, 2003., pp. 46
- SIPRI Yearbook: Armaments, Disarmament and International Security*, Stockholm International Peace Research Institute, Oxford, Oxford University Press, various years.
- Smith, Ron, *Military Economics: The Interaction of Power and Money*, Basingstoke, Palgrave Macmillan, 2009., pp.203
- Wulf, Herbert, *Internationalizing and Privatizing War and Peace*, Houndmills, Palgrave Macmillan, 2005, p. 15

Arsen PETROSYAN, Atom MARGARYAN

The impact of innovation in military industrial complex

Key words: Innovation, Military Industrial Complex, National Innovation System, Defense Industrial Base, Military Expenditure

This article considers the changes that have been taking place and what they might mean for the future, focusing on developments in the world, recognizing that these are often the precursors of change in the international arms industry. Specifically, it raises the question of whether recent developments in defense policy and arms acquisitions, mean that the arms industry is undergoing another phase of structural and relational change. Then we provide background and context, outlining the main characteristics of the MIC focusing on post-Cold War developments. The next section considers the changing approaches to military technology and the arms procurement system and the drivers behind these changes. We discovered that the military and technological drivers led to latest technologies being sought from commercial companies for military use. Then we discovered the recent engagement of the major innovation systems in activities for the military sector. We found out that these developments imply for the dynamics of the world's military expenditures and the relationships within the Innovation System.