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European defence cooperation in the second machine age

by Andrea Gilli and Mauro Gilli

Over the past year the EU has made important steps to strengthen collective security and address its two more pressing challenges. On the one hand, European countries need a broader – and thus more expensive and complex – portfolio of capabilities to address the newer and wider set of threats they are confronted with. On the other hand, different technological trends are undermining the leadership in weapons manufacturing European countries have long enjoyed.

According to existing plans, in order to address these challenges EU member states need to step up defence cooperation. Because of structural changes in both the strategic environment (demand) and the economics of defence (supply), when it comes to technology, procurement, and weapons manufacturing, there is a strong case for European countries to move beyond their traditional approach to defence cooperation, i.e. joint procurement of armaments programmes, and pursue new cooperative frameworks – at least where technological change has been more intense, rapid or disruptive.

Disruptive transformations

During the Cold War, European countries were primarily concerned with containing a Soviet conventional attack. In terms of research and equipment, their investments were thus concentrated on the development and acquisition of land capabilities for territorial defence and of naval assets for both sea control and the protection of strategic lines of communications. On the one hand, this focus on a relatively narrow set of technological domains generated strong incentives for defence cooperation within Europe and across the Atlantic. On the other hand, because of the state of technology, multinational cooperation in armaments procurement could generate economic, industrial and political returns that ultimately favoured its adoption. First, by increasing production runs and thus through the larger economies of scale and faster movements along the learning curve, joint programmes produced economic savings. Second, the transfer of technological know-how they entailed, at least among industrialised countries, endowed all partners with the technological capabilities necessary to contribute to the success of the cooperative venture (e.g. the joint DE-ES-IT-UK Eurofighter Typhoon and the BE-DK-NE-NO-US co-development F-16 Agile Falcon programme). Finally, joint programmes, because of the then nature of technology, also produced important commercial spin-offs that countries could leverage to promote the expansion and value-added of their civilian industry.

Since the end of the Cold War, and in particular after 9/11, the Arab Spring and Russia's annexation of Crimea, the EU has come to face a multidimensional security environment: conventional and hybrid forces on the eastern flank, transnational terrorism and cyber capabilities with the capacity to strike subtly and repeatedly inside and outside EU borders; instability and ethnic-religious grievances in the Western Balkans, Middle East and North Africa; non-state actors like Daesh with their extra-regional spillovers; and, last but not least, the *democratisation of precision* (as defined by James Hasik from the Atlantic Council), namely the widespread availability of extremely lethal capabilities at limited costs.

These transformations (on the demand side) call for a broader portfolio of capabilities. However, its development poses several challenges. In particular, as the capability portfolio widens, countries face a trade-off: they can either decide to face a plurality of threats and operate in a wide range of settings (full-spectrum capabilities) or to narrow their focus on few areas (specialisation in force structures). The implications of this choice, however, are more marked than in the past. First, while specialisation delivers increasing returns on investments, in the current environment it also requires superior alliance cohesion and support, both because specialisers will depend on allies for some capabilities and because it may reduce their capacity to contribute to multinational operations. Armed forces trained and equipped for conventional warfare in the eastern flank or for anti-submarine warfare in the North Sea cannot be easily redeployed for counter-insurgency in the Middle East or for patrolling the Mediterranean.

Second, interoperability among different national armed forces is essential, as full-spectrum options require allies' cooperation both to generate economies of scale (joint procurement) and for long-term operational sustainment (rotation and mass). Third, this discussion has implications on procurement and in particular on the choice between multirole and single-mission platforms. Multirole platforms are more expensive, but also more flexible and thus easier to deploy in different operational environments. Conversely, single-mission equipment is less expensive, *ceteris paribus*, but its contribution is more limited outside certain theatres.

Modularity – e.g. the plug-and-play of different modules to meet specific operational requirements – offers a compromise between these two main options, but this comes at some economic and operational costs. Fully modular corvettes or frigates, for instance, can be designed for employing different modules, like land attack and anti-submarine warfare suites. However, modules cannot be changed during operations, modular platforms remain ill equipped to address a multidimensional threat environment, and initial design choices inevitably constrain employment: tracks vs. wheels for land equipment, or tonnage for warships (as small vessels cannot operate out of area for a long time).

EU countries are legitimately sovereign about all these issues. However, their choices bear important implications for defence cooperation.

Disruptive innovations

Different economic and technological developments over the past decades have progressively altered the economics of defence production (supply):

• Because of inter-state competition on weapon systems' performance and of the exponential progress in technology, the complexity of major military platforms has been rising dramatically since the Second World War. More recently, the operational need to seamlessly and simultaneously operate different platforms – as parts of a 'system of systems' (of nodes, sensors, shooters, etc.) – has added further layers of complexity that ultimately make weapons manufacturing extremely difficult and challenging;

• Software is eating warfare. In every modern advanced weapon systems, software already runs into millions of lines of code. With the dramatic growth in the availability of digitalised information, on the one hand, and with the introduction of robotic systems, on the other (and thus the related need for teaming with other manned and unmanned systems), software will play an ever increasing role;

• The growing miniaturisation of processors and the exponential increase in their power along with the ongoing rise in commercial research and development (R&D) expenditure have progressively altered the relationship between military and commercial technology: the commercial industry is currently the main source of technological innovations and thus from spin-off during the Cold War, the current challenge is about 'spin-in', i.e. how to integrate commercial innovations into the battle-space.

These dynamics have several implications for defence research, arms production, and weapons acquisition:

• *Average is over*. The systems integration capabilities required for handling the dramatic growth in technological complexity observed over the past decades – that represent a main source of competitive advantage for defence contractors – are becoming increasingly difficult to develop and maintain. As a result, markets for exquisite capabilities such as jet

fighters or submarines are concentrating further and competition is becoming fiercer. The second machine age, with its emphasis on networks effects and decreasing marginal returns, will likely reinforce these trends, and thus extend innovators' leadership further by granting them an increasing first mover's advantage:

• *Payload over platforms*. The increase in payload capabilities (like missiles or sensors) is occurring significantly faster than in platforms (like aircraft or warships). A focus on payload calls for modular designs in major weapon systems and for a competitive payload market, which in turn is possible through common standards and harmonisation in interfaces.

• *Disruption is here but not everywhere*. Because of their high innovation rates, commercial companies or non-traditional suppliers could provide more immediate solutions to armed forces' operational needs. The emergence of remotely piloted aircraft over the past two decades and the recent success of SpaceX in the space launchers market are two cases in point: commercial markets can push innovation and generate savings, but cannot necessarily address all operational needs or problems related to weapons acquisition and production, due also to image- and intellectual property rights (IPR)-related concerns.

Innovative cooperation

What do all these changes mean for European defence cooperation? Cooperation is important, but it can occur only among partners 'speaking the same language' and pursuing the same goals. Coordination is thus a *sine qua non* condition for generating avenues for cooperation, especially as countries decide between full-spectrum and niche capabilities and choose between multirole, single-mission or modular weapon systems. NATO, the European Defence Agency (EDA) or other fresh initiatives can equally serve this purpose and help EU member states meet their needs together or complement their assets.

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Given current changes in technology, traditional multinational cooperation in armaments production is likely to remain the most effective solution for developing moderately complex armament programmes like single-mission platforms or mature weapon systems. It can also remain a viable solution for minilateral programmes involving countries whose defence companies have integrated (like MBDA and Airbus but also Thales and Leonardo). In other cases, however, this may not be the case.

For instance, extremely advanced military platforms display a high level of technological complexity that does not enable a significant transfer of technological know-how among partners. This increases the procurement risks related to multinational armaments cooperation as some partners may not be able to acquire the necessary technological capabilities to contribute to the venture. Technological dynamics would call for either transnational consolidation of the European defence industry at the systems integration level or hierarchical industrial partnerships – so that systems integration activities are concentrated with a single actor, while companies (from other EU member states) work as subcontractors. Both solutions are economically efficient and industrially effective but politically contentious, as (some) European countries may not accept either a loss of influence over their industry or its *de facto* demotion. However, if European industry does not get out of this deadlock, its capabilities and international competitiveness may ultimately erode.

A possible solution addressing this dilemma may come from European R&D funding. Weapon systems evolve through generations: from third generation combat fighters like the Tornado Panavia to the fourth generation of the Eurofighter Typhoon, to the fifth generation of the F-35/Lightning II Joint Strike Fighter. Each generation requires R&D funding to make a technological leap forward (mostly concerning architectural changes). Thereafter, production starts. The defence industrial debate in the US highlights two important aspects in this respect. First, while industry consolidation can serve relatively well the case of efficiency, its effects are more ambivalent when it comes to innovation. Second, evidence from both the commercial (PCs and photolithographic alignment equipment industries) and the military (combat fighter industry) domains shows that, as products move from one generation to another, incumbents at times struggle to preserve their market position because they do not possess the technological know-how required for new architectural designs.

In light of these considerations and in agreement with EU member states, the European Commission could set up a framework whereby several companies bid for the development of a particular programme. Losing teams would be guaranteed work as subcontractors (but not as systems integrators) and, more importantly, they would simultaneously receive R&D funding for working on the following generation of military platforms. This has several benefits. First, it would give strong incentives to streamline weapons development in Europe. Second, it would reassure the (temporary) losers with real benefits. Third, and related, this system can preserve competition and promote innovation. Additionally, framed and designed in this way, this mechanism would not violate current regulations (against offsets) as it would simply adapt free market principles to the specificities of the defence market and defence economics.

Similarly, traditional industrial cooperation is going to prove difficult with respect to cyber capabilities. The reason is that the economics of software development is different from weapons manufacturing: know-how is stickier and economies of scale are less important. Thus, the benefits of cooperation are much lower while its transaction costs are higher, including those related to preventing the diffusion of critical information. In a realm like cyber, European cooperation may therfore concern primarily the development of common standards and the identification of common areas of vulnerabilities.

In order to take full advantage of the benefits of modularity, European security will require a more integrated market for payload like missiles, sensors and subsystems. The 2009 EU Commission Directive on defence procurement discusses this issue and highlights the need for an open, vibrant and integrated payload market. However, its emergence requires the definition of common standards and interfaces so that different payloads can be easily plugged and played into existing systems. The EDA, with the Commission, could try to promote this change. The resulting, market-based cooperation would not only produce economic savings but also promote additional innovation as new or non-traditional suppliers could progressively enter the business or develop innovative solutions.

Innovative procurement

Commercial technology offers important opportunities. However, it also presents significant challenges. Two deserve attention. At the Research and Technology (R&T) and early R&D phase, existing IPR regimes do not generally protect commercial firms' or civil research labs' long-term commercial interests, thus deterring them from joining defence programmes. At the product level, both existing acquisition regulations and the procurement workforce are unfit for dealing with commercial technology, mostly because of its differences from military hardware (from time cycles to its specific features).

International experience shows that training the acquisition workforce for dealing with commercial technologies is extremely important. However, initiatives in Europe are scarce, limited and not coordinated. EU institutions can intervene to promote coordination, harmonisation, cooperation and integration in this domain. Specifically, the Commission or the EDA could install specific taskforces aimed to gather lessons learnt with commercial technologies across Europe, process them into best practices, eventually turn them into guidelines or in any case diffuse them among the procurement workforce of member states.

Self-evidently, the challenge is two-fold: promoting change at the domestic level while also achieving cross-national harmonisation. For this twin-purpose, the EDA could move beyond current activities (its database for procurement training and conferences) and directly set up a training course on commercial technology open to all EU countries' defence acquisition workforce. This would simultaneously endow national governments with critical in-house skills and promote cross-European homogeneity in practices and procedures – an important factor for achieving further coordination and cooperation.

Europe faces a complex multidimensional environment. The challenge does not only concern the evolving nature of security threats but also change in technology. Over the past decades, defence cooperation has helped European countries preserve their security. Defence cooperation in the second machine age may, however, need to evolve and move beyond traditional joint procurement programmes to pertain also to new domains, from R&D to payload, from commercial technology to the training of the acquisition workforce.

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