



INFORMATION REPORT N°996

on the challenges of digitizing armies

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Published on 05/06/2018

Sciences & technologies

INTRODUCTION & RECOMMENDATIONS :Whatever name we give it, "digital revolution", "datafication" of the world, "datafication", "datafication", "datafication", "datafication", "datafication", "datafication", "datafication", "datafication". digital transition" or simply "digitization", networked data sharing and processing is a must for everyone:

- States as individuals, companies as public organizations
- In all fields of human activity
- From the most mundane everyday tasks to the most advanced business applications.

More than just technology, it is a phenomenon that underpins and profoundly transforms our societies; it is a whole way of life that changes with technology. In this respect, perhaps it is not too much to speak of a "revolution".

And never before has the industrial revolution brought about as many upheavals - and as quickly - as the digital boom, which has profoundly changed the way we live and work. The digital revolution has profoundly altered not only the production and consumption of goods and services of all kinds, but also the way we interact, learn and think in just a few years.

Armies cannot, of course, remain on the sidelines of these transformations. Indeed, how would they do so?

Armaments have long been the driving force behind technological innovation and, although armies are no longer the main prescribers of technological innovation in the "digital revolution", they are no longer the main drivers of technological innovation. In any

case, they are part of a human, social, industrial and administrative ecosystem that, like society as a whole, is undergoing the changes brought about by digital technologies.

This is true for armies as it is for any organisation: digitisation has profoundly changed production and consumption methods, with productivity gains that armies cannot do without in the field of their so-called "organic" activity, i.e. their daily activities.

This is also true in the operational field, where our Western armies must maintain the technological superiority that is their operational ascendancy. It is therefore a question for them, through the technological upheavals at work, of maintaining and constantly increasing their capabilities in three orders of functions:

- identifying the threat, which is something that digitized means must make it possible to do ever more quickly, or even predictively;
- Neutralizing the threat, through a set of means to which digital technologies can confer greater effectiveness, or even efficiency, whether in terms of conventional weaponry or cyber combat;
- protecting the vital organs and systems that animate, irrigate or innervate this complex social body that is the Nation, starting with the security of its weapons and networks.

This report therefore takes stock of the state of the art of the appropriation of digital technologies by the armed forces and, on the basis of this observation, studies how they should consolidate their achievements and meet the new challenges posed by the technological breakthroughs that are possible in the digital sector.

Under review, it appears that France has made a fairly good start on the "digital shift" in the transformation of its armed forces, although with varying degrees of success. The rapid evolution of our allies as well as our potential adversaries, as well as the technological breakthroughs to come, make it necessary today to make the digitisation of our defence tool a national priority, on pain of being downgraded.

The main conclusion to be drawn from this is that, at the end of the day, the stakes involved in the digitisation of armies are in fact eminent issues of sovereignty. Sovereignty in the use of force, of course, but sovereignty, too, in the possession of technologies. Let us not delude ourselves: far from the utopias that may have presided over the development of these technologies for a time, digital technology has indeed become a tool of power, a formidable lever in the service of outreach policies and - it can be said without hyperbole - of domination. In this respect, the digital industry is a field of rivalry between major technological powers, among which Europeans are no longer in the forefront.

It is for our armies, the instrument par excellence of our strategic autonomy, that the regaining of a higher level of technological sovereignty is particularly crucial. In the digital age, there is no sovereignty possible in a state of technological dependence.

This is why the rapporteurs are studying ways and means of consolidating an ecosystem of technological innovation capable of providing the industrial and technological basis for our strategic autonomy. The Ministry of the Armed Forces has a major role to play in this consolidation effort. And if, for certain technological developments, the national scale seems too narrow, it is with a view to a strategic autonomy extended to the European Union that cooperative efforts deserve to be made. Such an effort presupposes

investment - both financial or technological and human - as well as a change in our administrative practices and organisations. France's ability to "stay in the race" and, ultimately, the success of our armed forces are at stake.

RECOMMENDATIONS

Creating the conditions for optimal data exploitation

1. Investing in a plan to reduce the digital divide within the Ministry of the Armed Forces, covering the extension of the coverage of its rights-of-way in terms of Internet access, the deployment of a digital identity for all personnel, and putting "everyday" applications online on the Internet as often as possible, and failing that on the Ministry's extranet.
2. Provide funding for the industrialization of digital transformation projects that have been successfully tested.
3. Establish rules for standardization and sharing of data produced within the framework of the activity of the Ministry of the Armed Forces, in particular for the maintenance in operational condition of its equipment.
4. Supporting the development of cloud computing technologies and accompanying the rise of one or more French operators.

Structuring an innovation ecosystem

5. Implement the recommendations of the report by our colleague Cédric Villani concerning the defence sector, not only for artificial intelligence, but also for other digital technologies useful to the armed forces, such as robotics, big data or 3D printing. In this regard :- support the creation of "sectoral platforms" shared between innovation players to pool information, services or equipment, in particular intensive and cloud computing capacities; - make exploitable data sets available to research bodies and innovative industrialists, i.e. to provide research organisations and innovative manufacturers with usable data sets, i.e. data that are as far as possible stripped of classified and annotated elements; - to encourage experimentation by French players in the field of information and communication technologies. encourage experimentation by French innovation players, both by facilitating access to real-life experimentation facilities and by easing administrative constraints.

The Innovation Défense Lab, once it has been set up at the head of the network of the various "labs", can spearhead the Ministry's actions in these areas.

6. Strengthen the links between research, industry, military education, the DGA and the armed forces, which can be achieved by :
 - Close links between higher military education and the chairs specialising in different disciplines of interest to the armed forces and the defence industry;
 - an increased effort in upstream research in the so-called deep tech sector, i.e. with a high degree of risk, without seeking to duplicate DARPA but drawing on its project management methods in the operation of the Defence Innovation Agency;

- a closer association of French industrialists with research organisations such as INRIA ;
 - a consolidation of the different "labs", which will benefit from being networked by the Innovation Défense Lab and, via the Defence Innovation Agency, in conjunction with the Définvest fund, to support the growth of the start-ups identified in this way;
 - a more frequent recourse to "challenges", which implies financing for their participants as well as contractual engineering support for the acquiring services; - a reinforcement of the practical means of support to participative innovation, under the aegis of the Defence Innovation Agency;
7. Combating risk aversion in the practices of administrations, which implies promoting a culture of experimentation and acceptance of failure in technological innovation.
8. Deconcentrate part of the means of supporting innovation, for example by entrusting the heads of corps and base commanders with appropriations for experimentation with technological innovations, by means of an effective system for central monitoring of initiatives and sharing of their results.

Preparing for tomorrow's digital battlefield

9. Initiate studies aimed at making artificial intelligence systems capable of providing justifications for their own results, which is a prerequisite for the recognition and effective adoption of artificial intelligence applications by the forces.
10. Establish, within a comprehensive doctrinal framework, day-to-day cybersecurity standards, including :
- a systematic, even rapid, study of the cybersecurity of all equipment used within the armed forces, so that the doctrine regulates its use in a secure manner;
 - rules for the carrying and use by the military of their personal digital equipment;
 - Cyber-hygiene" skills to be validated by the military in training and continuing education.
11. Increase the number of digital specialists by promoting the operational reserve among professionals in the civilian sector and by developing such training at all levels: "civilian" higher education, military schools, higher military education.
12. Never neglect the "degraded mode" operating capabilities of modern equipment and the training of personnel for "degraded mode" operations.
13. Establish a general plan for the operation in "degraded mode" of all the networks of the Ministry of the Armed Forces.
14. Conduct studies on the advantages of deconcentrated offensive cybernetic action capabilities as an alternative to kinetic means, for example on board the fleet's main vessels.
15. Intensify research in quantum computing, to prepare cryptanalysis capabilities, quantum cryptography skills and post-quantum cryptography means.

Strengthen our technological and industrial strategy

16. Consolidate a clear technological and industrial strategy that is assumed and discussed with Parliament. To this end, the rapporteurs propose to :

- create, under the Minister of the Armed Forces, a technological and operational foresight council responsible for supporting the political authority in theTo this end, the Rapporteurs propose to: set up, under the authority of the Minister for the Armed Forces, a technological and operational foresight council responsible for supporting the political authority in guiding the Ministry's technological choices in the field of armaments, drawing on the role played in its time by the centre for foresight and evaluation;

- to entrust this council with the task of steering the drafting of a document on thirty-year technical-operational foresight, which sets a clear direction for the foresight work of the armed forces and the DGA;

- articulate with this plan the technical-operational foresight plans for each operating environment and each category of weapon systems;

- on this basis, associate research and industry with this strategy by means of technological roadmaps concluded between DGA and the main DTIB players.

17. Conduct interdisciplinary studies in order to provide a basis for the drafting, when the time comes, of a French doctrine on the precise modalities for implementing the so-called "man in the loop" principle in all operational decisions.

This work should be carried out in a framework involving specialists in technical-operational foresight, research in neurosciences and robotics as well as in artificial intelligence, R&D in the applications of these sciences and ethics.

The doctrine could pertinently distinguish different levels of autonomy of a weapon system or artificial intelligence, in order to establish graduated rules. 18. In line with the "Defence-SME Pact", consolidate the financial instruments for supporting innovation aimed mainly at start-ups and other SMEs, for example in order to be able to finance start-ups for an amount exceeding their turnover, and to make purely military applications eligible for a device such as RAPID.

19. Reserving sensitive uses for "sovereign" software. In the absence of sovereign software, encourage the use of open source software and in-house development. Overhaul arms acquisition procedures

20. Rewrite "1516" in such a way as to distinguish :

- a short corpus of rules and methods common to all armament programs;

- rules of procedure differentiated according to:

- on the one hand, the complexity and the cost of the programs, so as to lighten the procedures (and thus reduce the delays) for the simplest programs;

- on the other hand, the nature of the programmes, so as to treat differently, for example, the acquisition of a vehicle and that of an information system.

21. To give impetus to the practice of contractualization and, in this connection: - to promote the use of derogatory procedures, such as innovation partnerships or competitive dialogue, by means of legal security measures designed to overcome the

reluctance of purchasers; - to promote the use of derogatory procedures, such as innovation partnerships or competitive dialogue, by means of legal security measures designed to overcome the reluctance of purchasers;

- invite DGA to contract more frequently with start-ups and other SMEs, either directly or through a consortium;

- create, within the Innovation Défense Lab as well as the Ministry's buyers, expert support units for contractualisation in order to encourage the use of innovative procedures or suppliers other than the Ministry's usual partners.

Using the European scale as a lever to regain strategic autonomy

22. To avoid being locked into certain technological standards, promote the establishment of European standards for cybersecurity and interoperability of digital components and equipment.

23. Support the European pooling of supercomputing capacities and the location in France of supercomputers, starting with one of the two exaflop computers to be financed by the European Union.

24. Take an active part in European programmes aimed at developing European industrial capacities in the components sector, in particular processors.

25. Promote the use of the European financial and technological strike force in favour of high-tech research, whether in the framework of emerging instruments - such as the European Defence Fund - or of a "European-style DARPA".

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| Title : | MM. OLIVIER BECHT ET THOMAS GASSILLOUD, Députés |
| Author (s) : | MM. OLIVIER BECHT ET THOMAS GASSILLOUD, Députés |
| Editor : | ASSEMBLÉE NATIONALE |
| Collection : | Enregistré à la Présidence de l'Assemblée nationale le 30 mai 2018 |
| ISBN : | RAPPORT D'INFORMATION N°996 |
| Release date | 03/06/2018 |

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