

Department of Political Science Master's Degree in International Relations

Course of International Economics

The European Defense Industry: From Fragmentation to Innovation

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List of Abbreviations and Acronyms

ACT	Allied Command Transformation		
CARD	Coordinated Annual Review on Defence		
CDP	Capability Development Plan		
CFSP	EU Common Foreign and Security Policy		
COFOG	General Government Expenditure by Function (Eurostat)		
CSDP	Common Security and Defence Policy		
DARPA	Defense Advanced Research Projects Agency		
DG	Directorate General		
DG GROW	Directorate-General for Internal Market, Industry, Entrepreneurship and		
	SMEs		
DIB	Defense Industrial Base		
DoD	Department of Defense		
EADS	European Aeronautic Defence and Space		
EDA	European Defence Agency		
EDAP	European Defence Action Plan		
EDC	European Defence Community		
EDF	European Defence Fund		
EDIDP	European Defence Industrial Development Plan		
EDTIB	European Defence Technology Industrial Base		
EMU	Economic and Monetary Union		
ESDP	European Security and Defense Policy		
ESRP	European Security Research Programme		
EUMC	European Union Military Committee		
EUMS	European Union Military Staff		
FY	Fiscal Year		
GDP	Gross Domestic Product		
IPRs	Intellectual Property Rights		
MALE RPAS	Medium Altitude Long Endurance Remotely Piloted Aircraft System		
M&A	Mergers and Acquisitions		
MFF	Multiannual Financial Framework		
MoD	Ministry of Defence		
MS	Member State		

NATO	North Atlantic Treaty Organization		
NSIB	National Security Innovation Base		
NSPA	NATO Support and Procurement Agency		
OCCAR	Organisation for Joint Armament Cooperation		
OECD	Organisation for Economic Cooperation and Development		
PADR	Preparatory Action on Defence Research		
PASR	Preparatory Action on Security Research		
PeSCo	Permanent Structured Cooperation		
PMC	Product Market Competition		
pMS	participating Member State		
PMSCs	Private Military and Security Companies		
PPP	Public-Private Partnership		
R&D	Research and Development		
R&T	Research and Technology		
RPAS	Remotely Piloted Aircraft System		
S&T	Science and Technology		
SCC	Strategic Context Case		
SMEs	Small and Medium-sized Enterprises		
STO	(NATO) Science and Technology Organization		
SWD	Staff Working Document		
TEU	Treaty on European Union		
TFEU	Treaty on the Functioning of the European Union		
TRL	Technology Readiness Level		
UAV	Unmanned Aerial Vehicle		
VC	Venture Capital		
WEU	Western European Union		
WTO	World Trade Organization		

Introduction

Ever since the beginning of European integration processes, the idea of creating a common defense cooperation at the continental level has been consistently discussed. Nonetheless, in terms of practical progresses, the record of such projects has remained particularly dismal throughout the decades, even as the general structures of European integration have been advancing and reaching more complex levels of maturity. The present thesis analyzes two central questions concerning European defense. On the one hand, our interest is attracted by the quite evident urgency to set up some degree of shared defense industry and market in Europe; in particular, looking at possible economic and innovation dividends. On the other hand, we shall still focus on the persisting limits to such projects, which are at least as evident as the opportunities.

Furthermore, there are more specific and conjectural characteristics of European defense which make it the proper subject of an academic dissertation. Firstly, the topic of this work is peculiarly interesting because of the interdisciplinary possibilities it provides. While the main focus of the thesis remains on the economic side of the issue, one is unable to properly grasp the area without some basic understanding of EU Law and International Relations, which will also be presented to strengthen our arguments and to provide a comprehensive perspective – at least in the remit of our main research questions. Secondly, the timing of our research was deemed to be specifically appropriate, since crucial initiatives like the European Defence Fund (EDF) have now been delineated and are starting to come into force. Thirdly, even on a long-term basis, it is a timely moment to reconsider the path of common defense, and evaluate its problematics and opportunities, providing the economic rationales behind a call to pooling and sharing that has become more and more frequent, from academics, as well as defense analysts.

The present work, also following the rich literature on the issues concerned, starts from two general hypotheses. First, a common European defense industry is still a required goal of the European Union. Unless the continent wants to condemn itself to defense stagnation and to a definitive loss of its innovation potential, the industry will have to face certain remodulations (also at a transnational level). Second, and to qualify the first hypothesis, a common industry and market of defense remain difficult to achieve and they will require a vast effort in terms of industrial policy compromises and other types of trade-offs. Although interesting developments are already happening (and policymakers should be careful not to lose the acquired momentum), many issues remain unsolved (to cite the most important problematics: common procurement is still weak and conditional, often hampered by the protective clause of article 346 of the Treaty on the Functioning of the European Union, cooperative Research & Development remain below the suggested thresholds, and the industry is exceedingly "duplicated" in general).

To tackle these complex and multifaceted points, the thesis unfolds with three different chapters. The sections use a variety of concepts, methods, and data to analyze the economics of defense, the integration possibilities allowed by law and political constraints, as well as the innovation capacity which rests within clusters of firms, investors, research centers, universities and public regulators.

Chapter 1 provides the reader with a set of useful concepts to understand the defense industry at the European level. The first section introduces the idea of European integration in such a sensitive policy area and, importantly, describes the "failing forward" model of EU integration: a paradigm which mixes intergovernmentalism and neofunctionalism to understand the advancement of the European project.¹ The model was designed to explain monetary integration, but its authors considered it as useful to understand other areas: our thesis finds that it is particularly apt to study the progression of shared defense projects. Section 1.2 describes certain peculiar features of the defense industry. The most important characteristics that shall be anticipated are the significant barriers to entry and exit (many are their causes, with high fixed costs being at the front and center, together with the large R&D costs), the high frequency of monopolistic and monopsonistic markets (on the one hand, Merger & Acquisition processes have been particularly frequent, more so in the United States than in the EU, on the other, governmental actors often act as the single buyers, creating the case of monopsony), innovation dynamics affected by the amount of competition allowed (with the States facing trade-offs in deciding whether they shall favor smaller and more 'disruptive' firms or larger players that are able to achieve more significant economies of scale), the complex intermingling of private and State actors, and the political rationales that often lead public authorities to interfere with the free market. Sections 1.3 and 1.4 analyze the integration possibilities provided by the EU (going far back to the Western Union Alliance, the attempted European Defence Community, and then scrutinizing the more recent developments through to the European Defence Agency, the Permanent Structured Cooperation and the European Defence Fund, just to mention the most significant tools

¹ Erik Jones, R. Daniel Kelemen, and Sophie Meunier, "Failing Forward? The Euro Crisis and the Incomplete Nature of European Integration," *Comparative Political Studies* 49, no. 7 (2016): 1027.

and agencies) and the North Atlantic Treaty Organization (with a specific focus on the common commitments for budgetary efforts reaching 2% of GDP, according to the Wales Summit Declaration, and on the structures that the Alliance deployed to favor shared procurement and research).² Lastly, section 1.5 scrutinizes the realities of a currently fragmented European Industry. This final part of Chapter 1 dedicates a subsection to each of the most relevant States in the perspective of European Defense: France, Germany and Italy. For each country, we briefly unpack the main market features, policy stances and commitments in terms of public spending. We thus begin to follow a *fil rouge* of the work, one leading from fragmentation to innovation: from the affirmed *status quo*, to the possibilities behind a more integrated market (what we call "innovation by integration").

Chapter 2 moves on to analyze the scenario of fragmentation delineated thus far. The first section scrutinizes data concerning European Research & Development (R&D), the amount of continental duplication/non-standardization which may lead to lost economies of scale, and cooperative procurement conducted by public authorities. The main data sources are the European Defence Agency, the Eurostat databases (in particular, General government expenditure by function – COFOG), and the European Commission, but wider comparisons are conducted by referencing figures collected by SIPRI (i.e. the Stockholm International Peace Research Institute), the OECD and the US Congressional Research Service. Section 2.2 is dedicated to more recent EU efforts in favor of common defense. This part describes the functions of the EDA, the Permanent Structured Cooperation (PeSCo), as well as the Preparatory Action on Defence Research (PADR), the Coordinated Annual Review on Defense (CARD), and the Capability Development Plan (CDP). Additionally, a section of its own is dedicated to the Defense Fund (EDF), explaining the precursory initiatives which led towards the full-fledged version of this instrument, highlighting its envisioned budgets (pre- and post-Covid crisis), its fund-allocation mechanisms and the economic rationales behind its Research Window and Capability Window. Additionally, we stress the crucial point constituted by the self-reinforcing dynamics behind the Fund, which should lead the States to further contribute to its assets.³ The last part of the chapter provides a case study about the Medium Altitude Long Endurance Remotely Piloted Aircraft System (MALE RPAS, also known as Eurodrone), which explores the possibilities of collaborative procurement,

² NATO, *Defense Expenditure of NATO Countries (2013-2019) – Press Release*, November 29, 2019. <u>https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2019_11/20191129_pr-2019-123-en.pdf</u>

³ Gueorgui Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," *Armament Industry European Research Group*, Policy Paper no. 48.

referring to this interesting – yet struggling – continental consortium, which was also hosted under the aegis of OCCAR (i.e. the Organisation for Joint Armament Cooperation, as well as those of PeSCo and – quite recently – the EDF). This project is a nice example of European division of labor, which would assign different tasks to *Airbus* (its prime contractor), *Dassault Aviation* and *Leonardo* (its major subcontractors), and many adhering smaller subcontractors. Nonetheless, the uncertain future of the initiative is also an instance that well exemplifies the persisting obstacles to such cooperative moves.

The concluding chapter focuses on innovation dynamics and European opportunities in this realm; furthermore, a comparison with the United States Defense Industrial Base (DIB) is also provided, as an example of more cohesive and integrated industry. Section 3.1 deals with the basics of innovation. Firstly, we describe the main players behind successful innovation: firms, universities, public research centers, governmental authorities, intermediaries and various types of investors (including public ones – often times the military in our context – as well as venture capitalists and so-called 'angel investors'). Secondly, we explore the relationship between innovation and competition, referencing a foundational paper that studied such link within different industries and interestingly found out an "inverted-U relationship."⁴ Thirdly, we unpack specific characteristics of innovation within the industry of defense. Lastly, the focus moves to risk-taking and certain specific traits of evolving DIBs. Section 3.2 constructs the comparison with the United States: it looks at the different types of defense firm within the country, together with their frequent M&A activities, analyzes American R&D (also looking at the difference between consecutive stages from more basic to more applied types of effort), and discusses the crucial role of regulatory agencies. The country features a perfect example of more cohesive industry: it shall be recognized that the EU is not a federal State (and an analysis of that possibility exceeds, by far, the remit of the present work), yet the US can function as a reasonable benchmark for integrative progresses, nevertheless. Finally, section 3.3 explores the scenario of the European innovation base. To begin with, the issue of a 'generational' problem, dating back to the industrial model of the Cold War is explored: the need to overcome such old schemas and allow an effective 'dual-use' industry is particularly emphasized, since the possibility to remain at the cutting edge of defense innovation clearly depends on a shift of paradigm.⁵

⁴ Philippe Aghion, Nicholas Bloom, Richard Blundell, Rachel Griffith and Peter Howitt, "Competition and Innovation: An Inverted-U Relationship," *Quarterly Journal of Economics* 120, no. 2 (2005): 701-728.

⁵ Renaud Bellais and Daniel Fiott, "The European defense market: Disruptive innovation and market stabilization," *The Economics of Peace and Security Journal* 12, no. 1 (2017): 37-45.

Subsection 3.3.2 studies the current situation of European defense firms: it gauges their average innovation capacities, looks at the M&A market, and general business opportunities. The third and last subsection deals with European defense industrial policy (which is, indeed, a plethora of different national policies). The general compromise between French-like protectionism and Anglo-German preference for neoliberal free market (or at least emphasis on "value for money") is briefly presented.⁶ Subsequently, the chapter's conclusion investigates the possibility to find some middle ground for developing a more effective model of pooling and sharing based on different, intra-European industrial clusters.

Therefore, this work expands upon several different tools. It builds on an enormous multidisciplinary literature, utilizes economic data and models, while also taking into account fundamental pieces of EU law, together with dynamics conditioned by public policies (whenever possible, we also mention States' White Papers) and International Relations. After all, the complex conundrum of European defense can only be tackled with a multi-faceted approach. Single States are both interested in preserving their national sovereignty (particularly enshrined in their Defense Industrial Base) and reaping economic/innovation dividends that might mature, if the continent finally manages to get rid of military duplication and the *efficiency losses* that derive from it. As explained by the last chapter (which succinctly points out some policy recommendations), the mentioned shift, although almost imperative, will require the finding of a concerted way, so that European States can preserve their most important strategic priorities and also avoid a significant amount of workers' layoffs. The latter worrisome hypothesis is particularly threatening for the smaller Member States, since they are the ones with less relevant economies of scale and learning.

To highlight some possible ways out of the recurrent impasse has also been a hope and objective of the author.

⁶ Jocelyn Mawdsley, *The European Union and Defense Industrial Policy*, (Bonn: Bonn International Center for Conversion, 2003), 26.

Chapter 1

The Status Quo of European Defense: The Realities Behind Continental Fragmentation

An analysis of the emerging European defense industry requires – at the beginning – a set of fundamental concepts, facts, and figures that may guide the reader towards a basic understanding of the subject. The opening chapter of this work attempts exactly to assemble this sort of basic toolkit.

To begin with, the first section will provide a brief overview of European integration and EU law concerning the defense industry and its market. Thus, we will offer an introductory *excursus* on a series of international and supra-national mechanisms affecting the European experience and make some basic references to certain Treaty articles regulating common market and the defense sector. We will also briefly refer to the main theoretical models explaining EU integration (i.e., intergovernmentalism and neofunctionalism).

Secondly, section 1.2 will summarize the most important peculiarities of the way of doing business in defense. The section will describe certain market features and mechanisms (e.g. the prominent role played by mergers and acquisitions or, on the other hand, the frequency of monopsonistic conditions). Additionally, this part will analyze the main rationales behind governments' interventions, which are also dictated by different strategic considerations from policymakers.

Sections 1.3 and 1.4 will look at the initiatives and structures influencing the defense industry, which have been developed by the European Union and the North Atlantic Treaty Organization, respectively.

To conclude, the last section features three parts describing the scenarios of the three largest defense players among EU Member States: France, Germany, and Italy. For each of these Member States, we will provide a brief overview concerning the main firms and market conditions, alongside the traditional and more recent defense industrial policy stances, plus the trends concerning the respective defense budget figures throughout the years.

1.1 European Integration Towards Sensitive Policy Areas

The European Union (EU) has largely been acknowledged as the most advanced project of regional integration. Indeed, the EU is something more than an intergovernmental enterprise, since it represents a *sui generis* supranational organization. This trait has been recognized by international law, with scholars stating that "unlike most regional organizations, [the EU] has progressed to become supranational in character and functions."⁷

This peculiar status has tangible consequences. Firstly, the advanced *character* of the Union means that its legal and policy processes are managed with a decision-making model that has overcome the standard intergovernmental procedures.⁸ Secondly, and most importantly for the purposes of this work, the EU *functional* advancement has allowed it to expand its supranational method reaching areas which were previously exclusive purview of the intergovernmental proceedings. In other words, the EU acquired an increasing set of exclusive and shared competences with regards to different policy areas.

The existence of such policy areas finds its legal *ratio* in the fact that Member States "agreed, as a result of their membership of the EU, to transfer some of their powers to the EU institutions."⁹ Thus, the Union has started a process of "deconstruction of the concept of State sovereignty," which has affected a progressively larger set of policy areas.¹⁰ The origins of European supranationalism can be traced back to the European Coal and Steel Community, whose founders agreed, with the 1951 Treaty of Paris, to pose under common (supranational) administration the production of certain natural resources which represented economic, strategic and military assets. The original idea was promoted by French foreign minister Robert Schuman to try and make intra-European war "materially impossible."¹¹

That seminal mechanism has been repeated multiple times, leading to subsequent steps of European integration, such as the 1957 Treaty of Rome which created the European Economic Community and the European Atomic Energy Community. It is

⁷ Alexandra Harrington, International Organizations and the Law, (New York: Routledge, 2018), 143.

⁸ This is formally stated at article 289 and 294 of the Treaty on the Functioning of the European Union (TFEU).

⁹ Martina Schonard, "Supranational decision-making procedures," Fact Sheets on the European Union, November 2019.

https://www.europarl.europa.eu/factsheets/en/sheet/8/procedure-decisionali-sovranazionali

¹⁰ Roberto Baratta, *Lezioni di Diritto dell'Unione Europea*, (Rome: Luiss University Press, 2017), 11. ¹¹ "Schuman Declaration," 9 May 1950.

https://europa.eu/european-union/about-eu/symbols/europe-day/schuman-declaration_en

beyond the scope of this writing to provide a complete historical or legal account of European Integration. This introductive review has a rather illustrational aim: it tries to convey the sense of the growing scope of European supranationalism, leading towards its effects on the economic dimension and the defense dimension that will be the focus of this thesis, together with their own overlapping processes and characters.

The economic consequences and impingements of supranational development are extremely evident if we simply look at the exclusive competences which have been acquired by the Union following the principle of conferral.¹² Article 3 of the TFEU enumerates as areas of exclusive competence a) customs union; b) the establishing of competition rules necessary for the functioning of the internal market; c) monetary policy for the Member States whose currency is the euro; d) the conservation of marine biological resources under the common fisheries policy; e) common commercial policy. Each of these points has, to a different extent, significant economic repercussions, affecting the defense market as well (more on this below). To be sure, any of the cited areas may be considered as a rather successful example of economic/policy integration.

The defense policy impingements are obviously more subtle and still at the early stage of their continental integration. It is, thus, necessary to look at the so-called shared competences and at more blurred policy action to start grasping their European dimension. While the strategic value of defense policy contributed to making this sector a hardcore bastion of State sovereignty, European Institutions have nonetheless applied indirect ways to affect this area, together with foreign affairs.

Although foreign affairs and military policy are areas which each EU Member State controls as it sees fit, the Council of the European Union will still provide guidance and direction for these policies within the EU as a whole.¹³

Such "guidance" does not possess binding value, since these policy areas see a protection of State sovereignty (with limited participation of the communitarian institutions, and implementations decided by the two Councils, which host governmental representatives of the Member States), but this encroachment has progressively expanded

¹² The principle of conferral is a basic feature of the Law of International Organizations. For the European Union it is laid down by article 5 of the Treaty on European Union (TEU).

¹³ Harrington, International Organizations and the Law, 145.

even with the EU Commission's action (hereafter Commission).¹⁴ As observed by some analysts, "defence policy does not fall within the Commission's remit, but the single market does," and that was the path to be followed towards increasing activism by communitarian institutions.¹⁵ Thus, the EU developed its own projects within its Common Security and Defense Policy (enshrined in the Treaty of Lisbon of 2007), and a progressive advancement via the 2014-2019 mandate for the Commission and the European Parliament (see section 1.3 for more details). Additionally, the EU also developed a special relationship with NATO, that will be fundamental to understand the realities and perspectives of European defense (see section 1.4 to this regard).

Now let us focus on the theoretical lenses to analyze the progress of EU integration. This work will try to study the landscape of European Defense applying a metatheoretical model of integration created by Erik Jones, Daniel Kelemen, and Sophie Meunier, that is the "failing forward" template. This group of scholars devised the paradigm to study the architecture of the Economic and Monetary Union (EMU), but argued that it may actually be applied "to explain political development in many other areas of European Integration."¹⁶ Hence, some parts of the present thesis will try to do so with the dawning sector of European Defense. Theoretically speaking, "failing forward" tries to reconciliate two apparently opposite models for explaining European integration. On the one hand, *intergovernmentalism* is the basic starting point.¹⁷ On the other hand, the first approach is reconciled with *neofunctionalism*.¹⁸

The tension between the two models unleashes a sort of evolution by crises. First, there is the intergovernmental template, according to which, integration typically proceeds by "transferring new policy competences to the EU [...] as a result of lowest common denominator bargaining among powerful Member States."¹⁹ Second, there is the

¹⁴ States' prerogatives are protected by art. 346 TFEU stating that "any Member State may take such measures as it considers necessary for the protection of the essential interests of its security which are connected with the production of or trade in arms, munitions and war material."

¹⁵ Valerio Briani, *The Costs of Non-Europe in the Defence Field*, (Torino: Centro studi sul federalismo, 2013), 22. More specifically, the Commission may act in accordance with art. 173 TFEU (i.e. to promote and coordinate the functioning of the common market, ensuring the competitiveness of the Union's industry), whereas the Parliament and Council may act in accordance with art. 182 (i.e. to improve the scientific and technological base of the EU).

¹⁶ Erik Jones, R. Daniel Kelemen, and Sophie Meunier, "Failing Forward? The Euro Crisis and the Incomplete Nature of European Integration," *Comparative Political Studies* 49, no. 7 (2016): 1027.

¹⁷ Andrew M. Moravcsik, "Preferences and Power in the European Community: A Liberal Intergovernmentalist Approach," *Journal of Common Market Studies* 31, no. 4 (1997): 473-524.

¹⁸ Neofunctionalism is a classical model developed by Ernst B. Haas, *The Uniting of Europe*, (Stanford: Stanford University Press, 1958).

¹⁹ Jones et al., "Failing Forward? The Euro Crisis and the Incomplete Nature of European Integration," 1014.

neo-functionalist model arguing that "initial steps toward economic and monetary integration generate functional spillovers into adjacent fields of policymaking." The "failing forward" paradigm finds a common synthesis of the two aforementioned models: it suggests that the workings of intergovernmentalism can "produce lowest common denominator bargains" and, thus, "only incremental reforms," while the view of neofunctionalism can explain how "incomplete governmental structures should generate functional spillovers."²⁰

It can be argued, as this thesis will attempt to do, that European Defense is being developed after small crises which the Union faced as a result of intergovernmental lowest common denominators, and it is going forward or, rather, "failing forward" thanks to functional spillovers, which are effectively being utilized and amplified by the Commission, the Parliament and a series of competent Agencies that will be described in the next sections. To be sure, the aforementioned actors, as well as other agents in EU policy making processes, can use a wide and heterogeneous *spectrum* of "governance mechanisms" ranging "from supranational regulation on the one side of the continuum to non-binding coordination, on the other."²¹

In sum, defense industrial policy and foreign policy are a perfect subject for referring to the mixed model proposed by Jones et al. because such matters are certainly rooted in the intergovernmental competences and methods, but are, nevertheless, being affected by functional spillover. Crises, even when represented by relatively small shortcomings, can fuel the upgrading of regional integration. This understanding, after all, was the fundamental premise of the early functionalist tradition, in the words of Jean Monnet: "Europe will be forged in crises and will be the sum of the solutions adopted for those crises."²²

1.2 Some Peculiar Traits of the Defense Industry: A Unique and Highly Strategic Market Underpinning Fragmentation

Before analyzing the European institutional coordination of defense integration, it is now necessary to introduce some of the economic, technological and political peculiarities that

²⁰ Ibid, 1014-1017.

²¹ Gerda Falkner, "The EU's Current Crisis and its Policy Effects: Research Design and Comparative Findings," *Journal of European Integration* 38, no.3 (2006): 220.

²² Jean Monnet, *Memoirs*, (Garden City: Doubleday and Company, 1978), 417.

make the defense industry particularly sensible and provide its market with unique traits distancing it from the dynamics of perfect competition.

First, the market of defense displays numerous and quite significant barriers to entry and exit. Some of the barriers to market entry may be strictly economic, these are reflected by high fixed costs often supported via public procurement, which in turn lead to a solidified network of businesses that are very embedded in specific and cohesive value chains (intersectoral in nature), thus generating a consequent set of barriers to market exit as well. The latter originate because the incumbent firms tend to remain in the defense market even if profitability increases in alternative civil markets, since "defence markets [...] often involve long-term commitments" and even in troubling times "governments are still likely to bail out major contractors."23 Other barriers are technological in nature, these include a series of features concerning the peculiarity of defense Research and Development (R&D), the importance of players' reputation, or the role of intellectual property that is crucial and sometimes makes it hard to "invent around."²⁴ Lastly, we may add a political barrier to entry constituted by the uniqueness of regulation, acquisition and sponsorship processes which see the multifaceted action of States that are largely involved in each of these three processes: a characteristic of the defense market that led Henrik Heidenkamp, John Louth and Trevor Taylor to use the term "Defence Industrial Triptych" to explain interrelated governmental actions with regards to this industry.²⁵

Second, and consequent to the first point, competition in the defense market tends to be limited and conditioned. Frequently, markets feature both an *oligopoly* (i.e. a restricted number of large sellers) in the form of a highly specialized, politically sponsored industry and a *monopsony* in the form of the government acting as the exclusive buyer. For instance, even the United States – a country which has historically placed much emphasis on the importance of free markets – features "one single buyer, in the form of the Department of Defense (DoD), and a small group of major corporate suppliers – the prime contractors – that essentially form oligopolies in each sub-sector."²⁶

²³ Paule Dunne, "European Defense Industry – What Future?" European Monitoring Centre on Change, December 2015.

https://www.eurofound.europa.eu/observatories/emcc/articles/business/sector-futures-defence-industry

²⁴ Diana Heger and Alexandra K. Zaby, "Patent breath as effective barrier to market entry," *Economics of Innovation and Technology* 27, no. 2 (2018): 174-188.

²⁵ Henrik Heidenkamp, John Louth and Trevor Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, (Abingdon: Taylor and Francis, 2013).

²⁶ Ibid, 21.



Figure 1.1 The Top 10 US defense contractors and the respective US DoD expenditure in US\$ billion. Source: Statista https://www.statista.com/chart/4929/americas-biggest-defense-contractors/

Sometimes oligopolies encounter further (political) mergers that may be sponsored by governments, as was famously the case with the so-called "last supper" in 1993, when the Deputy Secretary, William Perry, used a dinner to explicitly invite US defense firms to merge and, thus, remain sustainable for the DoD's procurement budget.²⁷ Such limited competition is also complemented by rather unspontaneous market equilibria featuring artificial levels of sold quantities that "are typically fixed by both the government's budget and the notion of force structure."²⁸

Third, and related, the scant amount of competition has consequences on innovation dynamics. Indeed, there is a basic tension between the benefits of scale and the benefits of competition. In other words, even a government trying to steer the sector in a desired way will face a "policy dilemma": should it pursue the advantages provided by *economies of scale*, or should it place more emphasis on the *innovation bonuses* afforded by competition and diversification based on a varied market of Small and

²⁷ John Mintz, "How a Dinner Led to a Feeding frenzy," The Washington Post, July 4, 1997.

²⁸ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 34.

Medium-sized Enterprises?²⁹ As already mentioned, and as exemplified by Figure 1.1, governments usually prioritize the first option, but such behaviors unleash rather problematic repercussions on innovation systems, a fact that deserves a more specific analysis which will be conducted in Chapter 3. At this point, it can be anticipated that defense innovation requires highly specialized R&D, vast financial assets, notable amounts of secrecy and, thus, a variety of factors involving relevant risk-taking for investors. These features have originated the possibility of losing one's R&D investments in the so-called "valley of death," (i.e. the step between the research phase and the development process).³⁰ The risk of leaving developed knowledge unexploited (together with the huge sunk costs that this kind of event may involve) is an evident inhibitor to investment, which contributes to the development of reduced clusters of large firms, typically sponsored by governments that treat those businesses as national champions. Furthermore, return on investments is also endangered by the astounding cost increases exemplified by Augustine's Law number XVI, and the lack of competition can lead to the problems of *buy-ins* and *gold plating*, which add to the expensiveness and complexity of defense contracts.³¹ Hence, governments often had and have to step in for backing investments and supporting innovation as well, in a fashion similar to the one analyzed by Mariana Mazzuccato (more on this in Chapter 3).³²

Fourth, the sector's complexity, while maintaining a fundamental role for the State authorities, has also allowed some further encroachment for new types of private businesses, which have increased their presence in roles that used to be an exclusive Weberian purview.³³ New actors include contractors in the field of Private Military and Security Companies (PMSCs), and other Public-Private Partnerships (PPP) offering administrative and "people-support functions" that governments could not perform without the support provided by private *know-how* or private tools.³⁴ The opportunities

²⁹ Paule Dunne, "European Defense Industry – What Future?".

³⁰ Daniel Fiott, "Strategic Investment: Making Geopolitical Sense of the EU's Defense Industrial Policy," *Chaillot Paper* 156, December 2019, Chapter 3.

³¹ Norman R. Augustine, *Augustine's Laws*, (Renton: American Institute of Aeronautics and Astronautics, 1997). Law XVI (almost sarcastically) stated that "[I]n the year 2054, the entire [US] defense budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy 3-1/2 days each per week except for leap year, when it will be made available to the Marines for the extra day. Also see Paule Dunne, "European Defense Industry – What Future?".

³² Mariana Mazzuccato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*, (London: Anthem Press, 2013).

³³ Peter W. Singer, *Corporate Warriors – The Rise of the Privatized Military Industry*, (New York: Cornell University Press, 2003).

³⁴ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 16.

for these types of private interventions have known an unprecedented growth since the end of the Cold War, which caused an extraordinary downsizing in the States' public military commitment.³⁵ Moreover, it is sometimes difficult to draw the line between the public and the private, while the same holds true with regards to the line separating military and civilian sub-sectors. Therefore, such distinctions make it tough to delineate, quantify and study a Defense Industrial Base (DIB).

Fifth, and last, the sector has a strictly strategic value that makes it inescapably subject to political logics. The peculiarities related to this last point include information classification (that furtherly complicates intellectual property management and even labor mobility), export-control laws which characterize all the major powers, acquisition policies, and even "export-credit insurance" for those domestic producers that are authorized to sell to foreigners.³⁶

1.3 Soft Defense Coordination: The European Union

After the discussion of market mechanisms promoting fragmentation, let us look at European integration with a more specific focus on defense. European defense has a rather long and complicated story to tell, since it is an experience that goes back to the Western Union alliance. Such Union, also known as the Brussels Treaty Organisation, was a post-World War II alliance created by France, the United Kingdom and the Benelux countries in 1948, soon to be swallowed up by the North Atlantic Treaty Organization, which was formed the subsequent year. This point is interesting for our purposes since the relations between EU defense and NATO with their peculiar, often times uncomfortable, overlapping persist to these days (more on NATO in the next section).³⁷

The mentioned ambiguity survived because the European Communities project continued to work on defense integration as well. It did so by attempting to pose a specific community with a focus on that matter: the European Defence Community (EDC). The EDC's structure, ideally, would have included a common budget and, remarkably, a shared pan-European military; furthermore, in line with some of the industrial

³⁵ Interestingly, the end of the Cold War also provided larger space for the development of European defense cooperation, as argued by Seth G. Jones, *The Rise of European Security Cooperation*, (Cambridge: Cambridge University Press, 2007).

³⁶Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 83.

³⁷ Gustav Lindstrom and Thierry Tardy, ed., *The EU and NATO: The Essential Partners*, (Paris: European Union Institute for Security Studies, 2019).

problematics described in the previous section, the designers of the EDC were also willing to pose a common procurement mechanism. Perhaps because of the depth of these ambitions, perhaps because of the expedient nature that had inspired it in the first place (i.e. envisaging it only as a *next-best alternative* to an independent re-establishing of the German military), the Common Defence Treaty failed to be ratified by all national parliaments (1954) prompting European integration to pursue other ways for reaching a common defense.³⁸

After some failed attempts in the 1950s and '60s, the Community managed to establish a common foreign policy structuring under the European Political Cooperation (EPC), but its working remained mainly intergovernmental in nature. Some Member States tried to add the field of security within the EPC framework, but even this project was vetoed. Thus, the favorable countries decided to create their own sub-unit with the reactivation of the Western European Union (WEU, as the successor of the Western Union alliance) via the Rome Declaration of 1984. The next steps came with the codification of that communitarian project by means of the 1986 Single European Act and, subsequently, with the Treaty of Maastricht (1992) which established Common Foreign and Security Policy (CFSP) as one of its three famous "pillars". The WEU remained as a parallel means intertwined with NATO: it was to be used to intervene when EU members acted without the participation of other NATO members, and this was also a way to deal with the atavistic issue of the latter organization's burden sharing (more on this in the next section). Also, the "Berlin Plus agreement" would later on (1999, 2002) formalize the possibility to use NATO assets for EU States' initiatives.

After Maastricht, a further step towards the structure we see nowadays was taken with the Amsterdam Treaty (1997) that transferred WEU tasks to the EU and officially created the European Security and Defense Policy (legally coded by the following Treaty of Nice, in 2001). Such policy became one of the central hinges of EU defense. At the time of this writing, the mercurial realm of European defense is under the umbrella setting of Common Security and Defence Policy (which is, indeed, a renamed ESDP after the Lisbon Treaty, and a subpart of the Common Foreign and Security Policy).³⁹ Within this landscape, the main cogs to consider are the more restricted Permanent Structured Cooperation (PeSCo), the role of the European Defence Agency (EDA), and other PeSCo

³⁸ Kevin Ruane, *The Rise and Fall of the European Defence Community: Anglo-American Relations and the Crisis of European Defense*, (London: Palgrave Macmillan, 2000).

³⁹ Lisbon also transferred a solidarity close within the EU, thus paving the way for the demise of the WEU (2011).

initiatives under the recent European Union Global Strategy (in particular, the Defence Action Plan and the European Defence Fund, analyzed by Chapter 2).⁴⁰ Each and every mentioned point has relevant implications also on the industrial and innovation sides of common defense. Now, let us unpack them.

Firstly, the CSDP hosts the Permanent Structured Cooperation, established in 2017 as a subset of States (25 out of the 27 EU members, with Denmark on a *permanent opt-out*, and Malta activating a *neutrality clause*) that agreed to increase their cooperation on a more advanced and integrated basis. This is relevant to European defense industry, since – as recalled by Antonio Calcara – PeSco provides an important setting for the sector:

[A] binding framework of member states to develop joint defense capabilities, to invest in shared projects and to strengthen the operational preparation of armed forces. These incentives, both from the financial and strategic-operational point of view, represent important turning points.⁴¹

PeSCo initiatives are being deepened by the mentioned EU Global Strategy, as also noted by Calcara. The Cooperation is more advanced in the sense that certain commitments are legally binding (governed by article 42.6 of the TEU), and they possess an *on-going* basis.

Second, PeSCo is linked to the European Defence Agency, which acts in conjunction with the European External Action Service as its secretariat.⁴² The EDA was established in 2004 and it currently possesses several agenda entries of relevance to this thesis: 1) the Coordinated Annual Review on Defence (CARD), 2) the Capability Development Plan (CDP), 3) the Preparatory Action on Defence Research (PADR), and 4) European Defence Fund (EDF).⁴³ These tools concur to the growing coherence of EU defense actions. The next chapters of this work will dedicate particular attention to points 4 and 3, when studying integration perspectives and innovation possibilities (see chapter 2 and chapter 3, respectively).

⁴⁰ European Union External Action Service, *Shared Vision, Common Action: A Stronger Europe – A Global Strategy for the European Union's Foreign and Security Policy*, June 2016.

⁴¹ Antonio Calcara, "Making Sense of European Armaments Policies: A Liberal Intergovernmentalist Research Agenda," *Comparative Strategy* 38, no. 6 (2019): 567.

⁴² The Agency also developed the Code of Conduct on Procurement, launched in June 2006 and followed by more specific codes: firstly, for sub-contractors and SMEs, secondly, for industrial offsets. The Code of Conduct on Procurement allows for some competition even when art.346 of TFEU (i.e. a free-market optout for "essential security interest," previously enshrined as the Nice Treaty art.296) is activated.

⁴³ The complete and rapidly-evolving set of EDA priorities, "activities" and "programmes" is available on the agency's official website: <u>https://www.eda.europa.eu/</u>

Third, a further action stemming from the EU Global Strategy was the establishing of a new Commission Directorate General (DG) for Defence Industry and Space (2019). This provides another fundamental agent for EU defense integration, together with a specific doctrine of the new Commission, which is particularly concerned with the strategic relevance of the Union.⁴⁴

This plethora of tools and enhanced frameworks may lead observers to consider European defense as a *fait accompli*, and even the "scholarly literature on the topic has erroneously over-emphasized the cooperative elements."⁴⁵ That is why we chose the mixed analytical model described in section 1.1.1. In fact, challenges for integration remain extremely significant: the EDA itself is mainly driven by national ministries, budgets for the Agency and its projects are still limited and, lastly, the ambiguous intersections with NATO persist to this day. It is to the latter difficulty that we shall now turn with the next section.

1.4 Soft Defense Coordination: The North Atlantic Treaty Organization

The North Atlantic Treaty Organization is a complex intergovernmental military alliance with headquarters located in Brussels, Belgium. Three points concerning this international organization must be analyzed at this stage: NATO's overlapping with the EU, NATO's agencies and actions relative to defense integration, and the defense spending commitments taken by the Member States within the alliance's framework.

First, as already mentioned, the intertwining between NATO and the EU can be quite complex and deceiving. The relation encounters another multiplier if we actually consider the distinction between EU membership and CSDP involvement (which was described in the previous section and has been furtherly complicated by the new facet of PeSCo). Thus, the relationship features a complex triangle explored by Niels Lachman, who affirms that "the many and frequent instances of lack of synergy between NATO and the CSDP, and frustrated attempts to deepen cooperation contradict any idea of an easily emerging complementarity."⁴⁶ The main difference sees NATO as a more operative and military organization, while understanding the EU as a more civilian, structured and even

⁴⁴ Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 3-4.

⁴⁵ Calcara, "Making sense of European armaments policies: A liberal intergovernmentalist research agenda," 567.

⁴⁶ Niels Lachman, "The EU-CSDP-NATO Relationship: Asymmetric Cooperation and the Search for Momentum," *Studia Diplomatica* 63, no. 3/4 (2010): 185-202.

integrative counterpart. In other words, as stated by one of its former Secretary-Generals, "NATO is not an all-encompassing integration project": it lacks the communitarian instruments of the EU, and proceeds by the more flexible structures analyzed below.⁴⁷ Additionally, the EU affords a more marginal role to military officials of the Member States, who often try to act as an important force influencing the logics of industrial policy and procurement as well.⁴⁸ Importantly, NATO industrial base is even less cohesive than the European one, since it is afflicted by the difficulty of integration with the crucial United States' industry, which often embarrasses "Europe's smaller procurement budgets": a problem that was dubbed "Transatlantic gap."⁴⁹ As Chapter 2 will illustrate, one of the difficult questions concerning the development of the European Defence Fund is exactly *how* to allow the participation of American firms in EU promoted programs and projects.

Second, touching upon the NATO agencies' structure, we shall mention the NATO Allied Command Transformation (NATO ACT), NATO Science and Technology Organization (NATO STO), and NATO Support and Procurement Agency (NSPA). NATO ACT's role is to guide the common doctrinal orientation of the alliance, in terms of strategy, capabilities development and shared engagement. NATO STO is dedicated to Science & Technology research, development, testing and application, thus providing a common scientific platform to the allies. NSPA is the executive branch of the NATO Support and Procurement Organization (NSPO) and runs acquisition processes open to any member of the alliance that may be willing to participate. All in all, this last agency has quite limited functions in managing contractual procurement: its role is to "[meet] to the best advantage the collective requirements of [...] NATO nations in the fields of acquisition, capability, support and logistics provision to NATO and its constituent nations."⁵⁰

Third, and most importantly, NATO can anyway deploy its enormous political weight to push Member States to enhance their defense spending (to put this differently, the Alliance can steer members' defense policies in an indirect way, i.e. it can foster a *sui generis* form of defense coordination): this is what it decided to do with the famous Wales

⁴⁷ Jaap de Hoop Sheffer, *Nato and the EU: Time for a New Chapter – Keynote Speech by NATO Secretary General*, January 29, 2007.

⁴⁸ Lachman, "The EU-CSDP-NATO Relationship: Asymmetric Cooperation and the Search for Momentum," 187.

⁴⁹ Pierre A. Chao, "The Role of Europe's Defense Industrial Base in NATO Transformation,"

Transforming Nato Forces: European Perspectives, (Washington: Atlantic Council, 2003): 93-96.

⁵⁰ NATO Support and Procurement Organization, *What is NSPO*, retrieved April 13, 2020. https://www.nspa.nato.int/en/NSPO/nspo.htm

Summit Declaration of the North Atlantic Council. The Declaration saw the alliance's Heads of State agree to expend 2% of their Gross Domestic Product on defense. This move came after several claims about the imbalanced spending of the members, with many of them accused of acting as *free-riders* and not sharing the efforts to fairly distribute the security burden, especially in the "austere times" represented by the 2010s.⁵¹ Some scholars tried to analyze such "burden sharing" and, interestingly enough, they found statistical evidence of that kind of trend emerging since 2010.⁵² The trend is captured by the data of table 1.1.

	$ ho_{12}^a$	$ ho_{12,3}^b$	$ ho_{12,34}^{c}$
1999	0.14 (0.57)	0.23 (0.35)	0.13 (0.46)
2000	0.19 (0.46)	0.30 (0.23)	0.20 (0.24)
2001	0.14 (0.57)	0.27 (0.29)	0.16 (0.35)
2002	0.16 (0.53)	0.23 (0.37)	0.14 (0.42)
2003	0.19 (0.44)	0.27 (0.28)	0.19 (0.26)
2004	0.14 (0.50)	0.39** (0.05)	0.15 (0.29)
2005	0.10 (0.64)	0.37* (0.06)	0.12(0.41)
2006	0.07 (0.74)	0.33* (0.10)	0.09(0.55)
2007	0.05 (0.80)	0.29 (0.16)	0.06 (0.68)
2008	0.08 (0.71)	0.31 (0.12)	0.09(0.55)
2009	-0.02(0.91)	0.23 (0.45)	-0.03(0.84)
2010	0.27 (0.18)	0.36* (0.06)	0.22 (0.11)

(*Notes.* Numbers in parentheses are prob-values, indicating the probability of a type I error when testing the null hypothesis of no association between ME/GDP and GDP ranks. ***significant at .01 level; **significant at .05 level; and *significant at .10 level.

Variables: 1 = ME/GDP; 2 = GDP; 3 = GDP/POP; 4 = exposed borders.

^aSimple rank correlation coefficient.

^bPartial rank correlation coefficient with GDP/POP held constant.

Partial rank correlation with GDP/POP and exposed borders held constant.)

Table 1.1 Correlations of GDP and countries' defense burden. Source: Sandler and Shimizu (2014).

The last row of the table registers a notable increase for each of the three correlations. That was the beginning of the "free-riding" trend, repeatedly underlined by the Trump Administration. At the time of this writing, only 9 of the 29 Members States meet the defense spending target cited by the Wales Summit Declaration.⁵³ Table 1.2 features data

⁵¹ Anders Fogh Rasmussen, "NATO After Libya: The Atlantic Alliance in Austere Times," *Foreign Affairs* 90, no. 4 (2011): 2-6.

⁵² Todd Sandler and Hirofumi Shimizu, "NATO Burden Sharing 1999-2010: An Altered Alliance," *Foreign Policy Analysis* 10 (2014): 43-60.

⁵³ The nine MS are (in order of higher share) The United States, Bulgaria, Greece, the United Kingdom, Estonia, Romania, Lithuania, Latvia, Poland. A thirtieth member, North Macedonia, recently joined the Alliance at the end of March 2020; thus, we do not have NATO defense spending data for it, but the national figures were significantly below the 2% threshold: 1.09% of the nation's GDP according to data collected in 2017.

on NATO members' defense budgets.⁵⁴ Additionally, 2019 estimates were provided by an official NATO Press Release, from which figure 1.2 was retrieved.⁵⁵

The latest estimates available see some enhancement in spending for certain members, mostly embodied by Eastern European countries which responded to fears of Russian expansionism, in the years after the annexation of Crimea. Importantly, these States are usually quite small in terms of size of the military, hence they reach the threshold, but they do so more easily, since they are starting from a quite low denominator altogether (i.e. a generally lower Gross Domestic Product). Therefore, it is complicated to evaluate the general spending trends of the alliance, it might be claimed that they are apparently on the rise, as reported by NATO November 2019 Press Release (see Figure 1.3), but also this evaluation should be qualified, since large European members remain below the 2% threshold. Figure 1.3 shows an improvement of the post-austerity defense spending, interestingly defense expenditure tends to "lag", so to speak, in the sense that it decreases or increases with some delay compared to the trends of the general economic cycle. Nonetheless, it is not possible to generalize a causation involving different countries, and it is generally difficult to compare different contexts on a national or historical basis.⁵⁶

To this regard, let us take the opportunity to highlight an important clarification. Many analyses – and not only those provided by NATO – consider defense spending over the total GDP as a general measure of the economic defense effort of countries. This involves two major problems. First, the measure is so generic that it cannot distinguish the different stages of defense research, development, acquisition et cetera, let alone the plethora of security/defense subsectors. Second, the ratio of defense expenditure and GDP is, in reality, very difficult to utilize.

> d GDF

⁵⁴ C.K. Hickey, "NATO Defense Funds Have Been Building for Years, but Trump Wants the Credit," *Foreign Policy*, December 3, 2019,

https://foreignpolicy.com/2019/12/03/nato-defense-funds-have-been-building-for-years-but-trump-wantsthe-credit/

⁵⁵ NATO, *Defense Expenditure of NATO Countries (2013-2019) – Press Release*, November 29, 2019. <u>https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2019_11/20191129_pr-2019-123-en.pdf</u>

⁵⁶ Abdur R. Chowdhury, "A Causal Analysis of Defense Spending and Economic Growth," *The Journal of Conflict Resolution* 35, no. 1 (1991): 80-97.

As straightforward and attractive as it may seem, the fraction above is problematic because both the nominator and the denominator are very complicated to estimate. The process of computing such data involves a large amount of arbitrary choices (e.g., NATO has established to exclude military pensions). Hence, it is important to underline the risks of comparing expenditure shares data provided by different organizations. As also pointed out by NATO's Public Diplomacy Division report:

In view of differences between both these sources and national GDP forecasts, and also the definition of NATO defence expenditure and national definitions, the figures shown in this report may diverge considerably from those which are quoted by media, published by national authorities or given in national budgets.⁵⁷

This is something to bear in mind, since data provided by NATO, Eurostat, SIPRI, the European Defense Agency and single States may be based on different methodologies and, thus, they may not be perfectly comparable all the time.



Notes: Figures for 2019 are estimates.

Figure 1.2: NATO estimates for Members States' defense expenditure as a share of GDP and equipment expenditure as a share of defense expenditure. Source: NATO *Defense Expenditure of NATO Countries (2013-2019) – Press Release*, November 29, 2019.

⁵⁷ NATO, Defense Expenditure of NATO Countries (2013-2019) – Press Release, November 29, 2019, 1.



Notes: Figures for 2019 are estimates. The NATO Europe and Canada aggregate from 2017 onwards includes Montenegro, which became an Ally on 5 June 2017.

The dubious cohesiveness of the Atlantic Alliance, divided even when trying to apply a declaration concerning common budget efforts, casts huge doubts on the possibility to create a shared defense industry. Therefore, the still fragile landscape of EU industrial coordination seems to have more chances of success – on the market level – than one hypothetically built around NATO. (Whereas the latter organization retains a different, but crucial, advantage on the operative level: "when hard numbers count, NATO remains the big brother of the two, because of its interoperable capabilities and integrated command structure").⁵⁸ This does not mean that the role of NATO is in any way secondary – indeed, nothing could be further from the truth – only that the level of cohesiveness and homogeneity is lower in the organization if compared to that featuring the EU (due to the transatlantic gap which has been described). Furthermore, the European defense architecture is not separate from this other organization, and its design actually follows the input of NATO defense planning.

Therefore, we will now focus on the realities of current European fragmentation and then try to analyze perspectives for defense market integration (mainly) within the EU, and the relative innovation possibilities that this landscape provides.

Figure 1.3: NATO Europe and Canada – defense expenditure (annual real change, based on 2015 prices and exchange rates). Source: NATO *Defense Expenditure of NATO Countries (2013-2019)* – *Press Release*, November 29, 2019.

⁵⁸ Nina Graeger and Kristin M. Haugevik, "The EU's Performance with and within NATO: Assessing Objectives, Outcomes, and Organizational Practices," *Journal of European Integration* 33, no. 6 (2011): 743-757.

Country	Expenditure as Share of GDP (2019)	Percent change from 2014
United States	3.42%	-8.31%
Bulgaria	3.25%	146.21%
Greece	2.28%	3.17%
United Kingdom	2.14%	-0.93%
Estonia	2.14%	10.88%
Romania*	2.04%	51.11%
Lithuania*	2.03%	130.68%
Latvia*	2.01%	113.83%
Poland*	2%	8.11%
Turkey	1.89%	30.34%
France	1.84%	11%
Norway	1.8%	16.13%
Slovakia	1.74%	75.76%
Croatia	1.68%	-8.7%
Montenegro	1.66%	10.67%
Portugal	1.52%	16.03%
Germany	1.38%	16.95%
Netherlands	1.36%	18.26%
Denmark	1.32%	14.78%
Canada	1.31%	29.7%
Albania	1.26%	-6.67%
Italy	1.22%	7.02%
Hungary	1.21%	40.7%
Czech Republic	1.19%	25.26%
Slovenia	1.04%	7.22%
Belgium	0.93%	-5.1%
Spain	0.92%	0%
Luxembourg	0.56%	47.37%

Table 1.2: Defense Spending of NATO Member States. Source: C.K. Hickey, *Foreign Policy*, 2019.

1.5 The Realities of Fragmentation: A Set of National Scenarios

Now, let us look at the national realities behind fragmentation. There is a complex European industry, which is steered by private enterprises, governmental decisions and communitarian projects. Each of these categories might be unpacked as well, to reveal fragmentations of its own: for instance the private players include a plethora of Small-Medium Enterprises (SMEs), which present quite diverging interests and characteristics (according to some estimates such SMEs may be more than 2000 in number).⁵⁹

Indeed, continental initiatives, must necessarily move from the conditions of the single national landscapes, taking into account their markets, stakeholders, and governments.⁶⁰ Thus, we now briefly analyze that set of conditions for the three most important defense markets of the EU: those of France, Germany, and Italy. For each of these three States, we will briefly review the main characteristics of the *national market* and the incipient integration processes with the European partners, alongside the trends for *national defense budgets* and general *policy stances*.

This work does not feature a specific section about the United Kingdom – despite its very large and valuable industry – because the general interest of the thesis is concerned on EU industrial integration.⁶¹ Nonetheless, we will consider the UK in some instances, since certain projects, and trends remain clearly related to this State and conditioned by it. For example, joint ventures and consortia still tend to involve British businesses, even if Brexit is endangering this kind of cooperation and will increasingly do so over time.⁶²

National realities must be put front and center, since – as anticipated in the first section of this chapter – European defense integration is still to be understood with the lenses of a mostly intergovernmental approach. In other words, governmental attitudes (especially those of the large Member States which are going to be scrutinized) have a huge influence in determining the destinies of European defense.

⁵⁹ The Aerospace and Defense Industries Association of Europe, *Facts and Figures 2019* (Brussels: 2019). ⁶⁰ The characteristics and dynamics of what US President Dwight Eisenhower referred to as "Militaryindustrial complex" (MIC) have been described in section 1.2. Also see Walter Adams, "The Military-Industrial Complex and the New Industrial State," *The American Economic Review* 58, no. 2 (1968): 652-665.

⁶¹ The UK was among the six States which in 1998 signed a common "Letter of Intent" to promote crossborder cooperation for the defense sector. The other five parts of the initiative were France, Germany, Italy, Spain, and Sweden.

⁶² Paola Sartori, "Brexit and European Defence: What to Expect from a 'No-Deal' Outcome?", *IAI Commentaries* 18, 40 (2018).

The most interesting and recurrent points that we encountered through our research are 1) the problems of duplication (and low level of standardization), 2) the insufficient level of R&D investments, and 3) the incoherence of common procurement. The next subsections provide the reader with a review of the national basis behind each of the three weaknesses, whereas the next chapter tries to translate this to the European level (chapter 2 also includes national and "cooperative" figures on R&D and procurement), looking into the damages these problems are causing, as well as the perspectives for plausible solutions.

1.5.1 The French Context: Market Features, Policy Stances, and National Defense Budget

According to the French government, France features "165,000 direct jobs" in the defense sector, accounting for more than a quarter of total European defense industrial capabilities.⁶³ Other estimates may be different on the basis of businesses classification, for sure behind those figures there is an important segment provided by small and medium enterprises (SMEs).⁶⁴ Main players, nevertheless, remain the large contractors, usually protected by the government, often acting as a significant shareholder – sometimes the majority one.

Prime contractors of the French panorama include *Safran*, which was created in 2005 with the merger of *Snegma* and *Sagem*, and still has the national government as its majority backer. Other major firms are *Thales* (whose larger shareholder is, again, the government), *Dassault Aviation*, *Nexter* (completely government-owned), *Naval Group* and *MBDA* (now a transnational group). *Airbus* ought to be mentioned as well, although it is a pan-European consortium, the group has its largest assembly lines in Tolouse (France), and sees a relevant amount of industrial activism from Paris, exemplifying – to a good extent – the French-model championing for major firms, even on a European level.

This rich and diversified industry makes France "the only European State with technological autonomy," something that was demonstrated when the country decided to autonomously develop its own multi-purpose fighter, *Dassault Aviation*'s Rafale, after

https://www.diplomatie.gouv.fr/en/french-foreign-policy/economic-diplomacy-foreign-trade/supporting-french-businesses-abroad/strategic-sector-support/defence-industries-and/

⁶³ French Ministry for Europe and Foreign Affairs, "Defence Industries and Technologies," *French Diplomacy*, retrieved May 13 2020,

⁶⁴ Claudio Catalano, *La politica industriale nel settore della Difesa*, (Roma: Centro Alti Studi per la Difesa, 2016). Translations to English are our own. European total revenues were estimated at about \$95 billion – excluding non-defense aerospace – in 2016.

leaving the European consortium behind the Eurofighter Typhoon.⁶⁵ This completeness – which is actually uncertain in a landscape featuring fast-evolving technologies and a growing "Transatlantic gap" – has a relevant downside as well, since it implies the highest amount of duplication in the entire continent. The Rafale-Eurofighter case is a good example again, because it saw a simultaneous and competing involvement of *Dassault* and *Airbus* (which, from its part, worked for the Eurofighter project).⁶⁶

The potential of the French defense industry has been backed by the government for decades, applying even more rigorously a national tradition based on an interventionist approach to industrial policy, something which historically gained the accurate label of "Colbertism."⁶⁷ For the defense industry, the State usually makes its approach known through a white paper, which has been published every 5 years, since 2008, and has the important function of keeping the industrial players up-to-date and active on an on-going basis.⁶⁸

The French doctrine of public intervention which is behind the term "Colbertism" is based on the promotion of grand projects, which goes beyond the realm of aerospace and defense, but assumes its most statist aspects exactly in these sectors. Colbertism is based on industrial championing, strategic use of state-owned enterprises and other national companies, plus careful management of export for certain products or sectors.⁶⁹ The French tradition of industrial policy activism was smoothed in the last decades (especially since the 1990s): the trend originated for complying to World Trade Organization (WTO) and Maastricht integration rules, and its most relevant result was a turn in favor of "horizontal integration," this led the country to "relinquish its interventionist arms and especially its vertically integrated industrial policies," *de facto* reducing the powers of the prominent Ministry of Industry.⁷⁰ The new approach was developed creating the structure of the "pole de competitivité": a kind of network, which was conceived as part of a "policy [...] designed to foster strategic collaboration on a territorial basis between companies, research centers and universities."⁷¹ Such poles are a form of local coordination similar to an industrial cluster, but far less spontaneous in

⁶⁵ Ibid, 32.

⁶⁶ Ibid, 34.

⁶⁷ Elie Cohen, "Industrial Policies in France: The Old and the New," *Journal of Industry, Competition and Trade*, no. 7 (2007): 213-227.

⁶⁸ Catalano, La politica industriale nel settore della Difesa, 32-33.

⁶⁹ The study of national and European "industrial champions" is nowadays subject of a complex literature of its own.

⁷⁰ Cohen, "Industrial Policies in France: The Old and the New," 222.

⁷¹ Ibid, 224-226.

nature.⁷² Hence, these artificial clusters had mixed results, both in terms of efficiency and industrial policy outcomes. Indeed, the French approach has become more heterogeneous, it is now more compromising and moderate in terms of interventions, yet it remains the ideal type of strong championing in the European continent. To this regard, France has been considered at the opposite end of the continuum if compared to the UK, which had already privatized most of its defense industry in the 1990s.⁷³

To be sure, France's abandonment of strict interventionism has left relevant consequences, nonetheless, as it allowed a reduction of the emphasis on autonomy: a trend that, of course, was in favor of a general opening to European cooperation. In 2001, France was among the founding members of the Organization for Joint Armament Cooperation (OCCAR), signaling its interest to foster continental coordination on defense and security products.⁷⁴

However, French commitment to European defense remains limited and conditioned. An example of the hesitations of the country can, at present, be seen with its ambiguous obstruction vis-à-vis *Fincantieri*'s merger bid to acquire *Chantiers de l'Atlantique*. Both the German and French governments prompted scrutiny by the European Commission, a symptom of Paris mixed commitment to European defense championing.

To conclude, we may now provide a quick overview of France's defense budget. As figure 1.4 shows, the last decades saw a dramatically declining trend in terms of GDP ratio, which poses the basis for a stimulus to reduce the persisting amount of duplication, possibly via increased EU coordination and standardization.

⁷² The concept of "industrial cluster" has certain defining traits, which can be found in Paul R. Krugman, Maurice Obstfeld, Marc J. Melitz, *International Economics: Theory and Policy*, (Harlow: Pearson Education Limited, 2018), chapter 7.

⁷³ Jocelyn Mawdsley, *The European Union and Defense Industrial Policy*, (Bonn: Bonn International Center for Conversion, 2003), 14.

⁷⁴ The organization comprises six Member States: Belgium, France, Germany, Italy, Spain, and the United Kingdom.



Figure 1.4: French military spending/defense budget. Source: *Macrotrends*, SIPRI data. Note: the data includes pensions spending; All 2020 and later data are UN projections and *do not* include any impacts of the COVID-19 virus.



We may now provide a similar overview for the German case. The Defense industrial base of Germany is a fast-growing and dynamic one. In 2014, the German security and defense industry generated a direct value added of \$12.2 billion, and employed 135,700 people directly, while 273,400 more were involved in an indirect way, according to data from the Economic Research Institute WifOR.⁷⁵ An important characteristic is the high level of integration between the defense and civil productions, with businesses of the two kinds interacting quite frequently, alongside the integration between large prime contractors – which, as it happens with the French case described above, have a fundamental strategic importance – and a myriad of small-medium enterprises, accounting for more than half the total production.⁷⁶

The main contractors are large firms, such as *Krauss Maffei Wegmann (KMW)*, *Rheinmetal*, *ThyssenKrupp*, *MTU Aeroengines*, *P+S Werften*, *Flensburger Fahrzeubau*

⁷⁵ Federation of German Security and Defence Industries (BDSV), "The German Security and Defence Industry," *BDSV*, retrieved May 13 2020,

https://www.bdsv.eu/about-us/the-german-security-and-defence-industry.html

⁷⁶ Catalano, La politica industriale nel settore della Difesa, 37.

Gesellshaft, Diehl, and *Hensoldt*. We might also consider the prominent aerospace firm *EADS* (i.e. *European Aeronautic Defense and Space*, derived from the merger of *DaimlerChrysler Aerospace*, French *Aeriospatiale-Matra*, and Spain's *Construcciones Aeuronauticas SA*), with headquarters in Ottobrunn (Germany), which was acquired by *Airbus* in 2014. These large groups, also thanks to the support of lower-tier contractors (SMEs do play a fundamental role in Germany's coordinated market economy) provide the country with a quite complete set of production possibilities, even though the French level of strategic autonomy remains unparalleled.⁷⁷ For instance, Germany lacks the nuclear compartment, which is – by contrast – one of the most important components of the French industry. Moreover, a comparison with France, shows higher deficiencies in terms of armament acquisition as well.

Although Germany lacks the French sort of "Colbertism," the country does display significant public management of the defense-industrial realm.⁷⁸ Interventions happen via the Ministry of Defense (Bundesministerium der Verteidigung, abbreviated BMVg), acting in the interest of the Bundeswehr (i.e. the United German Armed Forces). The MoD has undertaken a process of transparency enhancement to make its goals clearer to the industrial players, as well as to better comply with EU rules. This increase in transparency is being pursued methodically: "[t]hrough a series of official, unclassified publications by the BMVg, public speeches and media appearances by the minister of defence, and the publication of external audit reports, the government has presented the structure and process of the new German acquisition system."⁷⁹ The transparency project should boost the industry's efficiency together with its possibilities of integration within the European market. Interestingly, it has been noted that the recurring German "lack of transparency echoes the traditionally low interest of the German public in security- and defence-policy matters."⁸⁰

As a consequence of that lack of interest, Germany has to a certain extent underestimated the value of its defense budget, as will be illustrated below. The need to increase the German security stocks, both quantitatively and qualitatively, has been acknowledged by different voices. For instance, Patrick Keller, affirmed in his Atlantic

⁷⁷ The so-called "Variaties of Capitalism" may help to understand the workings of the different national markets, see Peter Hall and David Soskice, *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, (Oxford: Oxford University Press, 2001).

⁷⁸ Heidenkamp et al. state that "[i]n general, industry is viewed by the German government as a crucial partner of the Bundeswehr on operations," (Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych*, 55).

⁷⁹ Ibid, 43-44.

⁸⁰ Ibid.

Council paper that "the tension between shrinking capabilities and rising ambitions is obvious and remains unresolved."⁸¹ The urgency of a State-guided innovation for German defense has also been recognized through recent governmental white papers.

The official German white papers are decennial projects, and the 2006 one expresses exactly the kind of intent that we have now mentioned, together with the possibility of using a renewed industrial base to exert political influence (vis-à-vis European projects as well):

A modern Bundeswehr requires an efficient and sustainable defence industry base. It means having indigenous defense technology capabilities in order to co-shape the European integration process in the armaments sector. Only nations with strong defence industry have the appropriate clout in Alliance decisions.⁸²

This structural shift is also requiring an enhancement of governmental support, since the industry "requires substantial sponsorship by the German government to successfully exploit the highly competitive global defence market," and such "sponsorship role is quite limited in comparison to other European countries."⁸³ Such a shift will require, together with the improvements of transparency and communications that were mentioned above, an increase of the defense budget, which we may now focus on.

The German defense spending has not been corresponding to the economic growth of the country. Indeed, Germany has been significantly below the 2% target agreed by the NATO summit in Wales. As it may be noticed by looking at figure 1.5, the GDP ratio has been below 1.5% on a consistent basis, in the 2000s.

⁸¹ Patrick Keller, "Germany," in *Alliance at Risk: Strengthening European Defense in an Age of Turbulence and Competition*, (Brussels: Atlantic Council, 2006), 19.

⁸² BMVg, White Paper 2006 on German Security Policy and the Future of the Bundeswehr, (Berlin: German Federal Ministry of Defense, 2006), 63.

⁸³ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych*, 83,85.


Figure 1.5: German military spending/defense budget. Source: *Macrotrends*, SIPRI data. Note: the data includes pensions spending; All 2020 and later data are UN projections and *do not* include any impacts of the COVID-19 virus.

To conclude, a military and defense spending of this sort is very limiting, especially for a country that undeniably holds a front-and-center position of the European economic development, and integration processes. Observers have even noted that the country does not plan to invest the relevant resources that would allow it to near – let alone achieve – the 2% target.⁸⁴

1.5.3 The Italian Context: Market Features, Policy Stances, and National Defense Budget

Italy represents, by size, the third defense market of the European Union. The revenue of this industry was more than \notin 13.5 billion in 2016, with employed personnel amounting to about 45,000 within the national borders (without accounting for the indirect employment involved, which would take the total personnel to 159,000 for the Aerospace & Defense sector).⁸⁵ It is quite difficult to provide completely accurate estimates, also

⁸⁴ Patrick Keller, "Germany," in *Alliance at Risk: Strengthening European Defense in an Age of Turbulence and Competition*, (Brussels: Atlantic Council, 2006), 20. As noted by this work, only a significant economic recession may push the nominal outcome closer, but that would not imply the kind of evolution desired by NATO, of course.

⁸⁵ Leonardo Company, European House - Ambrosetti, *The Italian Aerospace, Defence and Security Industry*, September 9, 2018, 2-3.

because of the increasing intersection between civil and military production (the two are, whenever necessary and feasible, alternated to withstand periods of cyclical crises), which is being emphasized by the centrality of *dual-use technology*, something that largely features the German panorama as well.⁸⁶

The main players are a relatively small set of *prime contractors*. First and foremost, there is *Leonardo* (previously named *Finmeccanica*), active in the Aerospace and Defense sector. The most important shareholder is the State, owning 30% of the total shares. The corporation is multinational, and has been very active in terms of acquisitions, both in Italy and abroad. To this regard, we may remember, among its main subsidiaries, *Alenia Aermacchi, AgustaWestland, Selex ES*, and *Vitrocet*. Another major player is *Fincantieri*, a shipbuilding company with a revenue that surpassed \in 5 billion in 2018 (including a significant civil vessel section). *Fincantieri* is controlled by the State, owning a 71.6% share via *Fintecna*. In addition, we may consider as key contractors a series of businesses such as *Avio Aero spa*, *Iveco Defense Vehicles*, *Piaggio Aero Industries spa*, *Elettronica ELT*, and *Fabbrica d'Armi Pietro Beretta*.

The Small-Medium Enterprises' section is rather limited in Italy; nonetheless, these firms play an import role of support to the larger players, they usually act as the suppliers for prime contractors.

Suppliers are divided into two categories: first-level suppliers (providing complete systems: land systems, radio systems etc.) and second-level suppliers or subsuppliers (providing components, systems' parts, single pieces of equipment or execution of peculiar works, such as special welding, painting, coating, laminations etc.). Many suppliers have reached leadership positions in specific niches, on a global scale.⁸⁷

Analyzing the policy and doctrinal stances of the Italian government, we shall firstly mention the "continental" attitude of the country, whose approach is mixed, but certainly closer to the so-called "French model" than the "British" one (in general the British model is based on the use of *public companies* extended to include businesses in security and defense, whereas the French model applies a stricter state-ownership to the

https://www.leonardocompany.com/en/news-and-stories-detail/-/detail/filiera-italiana-dell-aerospazio ⁸⁶ Ester Sabatino, *The Innovations of the Italian White Paper: Defence Policy Reform*, IAI Working Papers

^{17,} December 2017.

⁸⁷ Catalano, La politica industriale nel settore della Difesa, 75.

strategic companies). To this regard, Italian public authorities exert, by law, the powers of a monopsonist: "only the State may possess armaments, hence it centralizes the whole demand of goods."⁸⁸

The priorities of Italian defense were more clearly expressed with the issuing of a "White Paper for international security and defence" in 2015.⁸⁹ With the Italian case – as with the previous ones – two opposing tendencies may be traced. On the one hand, the State is eager to protect its strategic purviews, on the other hand, allied and European cooperation are, by and large, considered as positive steps. The first tendency is captured by Claudio Catalano, who mentions the importance ascribed to "sovereign competences," understood as "the critical technological capacities" which – according to the White Paper – must be held under "a degree of national sovereignty, irrespective of international cooperation, since they are essential and indispensable in order to meet the needs of: national defence (...); national interest."⁹⁰ The second tendency is mentioned by other points of the same White Paper, which "advocates deeper integration of Italian forces with those of the other EU member states, with special emphasis on the development of shared capabilities."⁹¹

Thus, there is a certain priority on strategic protection for specific competences. Thereafter, if some products are not required by the needs of Italian defense they may still be developed and available for export. These industrial policy guidelines are specified by Catalano, who points to the 265th paragraph of the national White Paper stating that "[i]n those areas where excellence in technological knowledge is present, but is not the immediate need of the national armed forces, possible export markets of interest should be identified."⁹²

The White Paper furtherly clarifies that – when the aforementioned national priorities have been satisfied – the State is favorable to international cooperation and coordination. Paragraph 277, for instance, recognizes the importance of a common acquisition process:

⁸⁸ Ibid, 7.

⁸⁹ Ministero della Difesa, *White Paper for International Security and Defence*, (Rome: Italian Ministry of Defence 2015).

⁹⁰ Catalano, La politica industriale nel settore della Difesa, 23. Ministero della Difesa, White Paper for International Security and Defence, para. 262.

⁹¹ Sabatino, The Innovations of the Italian White Paper: Defence Policy Reform, 6.

⁹² Ministero della Difesa, White Paper for International Security and Defence, para. 265.

[A]t the European level, considering development, the acquisition process will be able to become more and more joint and multinational, allowing financial savings in terms of economies of scale, better interoperability, and operational integration. This objective can be achieved by stimulating the strengthening of the skills and capabilities of existing European agencies, such as EDA and OCCAR, with the contribution of nationally qualified staff.⁹³

This point is very interesting for our purposes, because it allows to introduce some of the advantages of a common defense industrial base, in particular the possibility to profit from *economies of scale* and *improved interoperability* (aspects which will be explored to a larger extent in the next chapter). To this regard, Italy is also quite favorable to enhanced cooperation to "stimulate specialization" and promote shared procurement: "cooperative procurement programmes, rather than simple bilateral acquisitions, are the options preferred by Italy precisely because they move defence cooperation towards greater interconnection and ultimately integration."⁹⁴

To conclude, we must briefly look at the Italian budget, which has been experiencing a complicated phase, due to the economic crisis faced by the country. As specified by Admiral Giampaolo Di Paola, "Italy's defense budget and priorities have been profoundly affected by the ongoing economic crisis across Europe and continued slow growth within Italy," a scenario in which the NATO "Wales commitments should be viewed as aspirational."⁹⁵ Indeed Italy's defense commitment is much below the 2% target of the NATO Wales Summit: in the last decade the ratio has consistently been below the 1.5% mark, as we may see from Figure 1.6, below.

⁹³ Ibid., para. 277.

⁹⁴ Sabatino, The Innovations of the Italian White Paper: Defence Policy Reform, 7.

⁹⁵ Giampaolo Di Paola, "Italy," in Alliance at Risk: Strengthening European Defense in an Age of Turbulence and Competition, (Brussels: Atlantic Council, 2006), 27.



Figure 1.6: Italian military spending/defense budget. Source: Macrotrends, SIPRI data. Note: the data includes pensions spending; All 2020 and later data are UN projections and do not include any impacts of the COVID-19 virus.

This first chapter had the goals to lay out a basic contextualization of the subject and to describe certain aspects and processes behind the European defense industry. Now that the main concepts and current coordinates have been provided, we may explore in detail the projects and mechanisms of the European defense practice (Chapter 2), and the innovation possibilities for a more integrated defense industrial base (Chapter 3).

Chapter 2

European Security and Defense Industry: Recent Developments

Chapter 1 has provided the reader with an introduction to certain general concepts, facts, and figures about the European defense industry and its current state of fragmentation. Now, let us turn to the main practical consequences of such state of affairs. To begin with, fragmentation can (and does) curb growth margins for the European industry, by making its processes less cost-efficient. This point and its roots – i.e., damages to Research & Development, lost economies of scale, additional costs due to duplication/non-standardization, and suboptimal procurement mechanisms – will be explored by the first part of Chapter 2.

Secondly, the chapter will focus on the current structures and programs the EU is using to mitigate and/or overcome the mentioned problems. We will, thus, analyze the instruments already deployed by the European Defence Agency (EDA), including the Capability Development Plan (CDP), the Coordinated Annual Review on Defence (CARD), the Preparatory Action on Defence Research (PADR), as well as the projects run within the Permanent Structured Cooperation (PeSCo), and some additional forms of common planning.

Thirdly, we will explore the communitarian budgets for the current Multiannual Financial Framework and the proposal for the next one (the 2021-2027 MFF). In doing so, we will also refer to the most recent trends and actions, considering the possible next steps of European defense and how these future phases might influence the described industry. To conclude the chapter, we will then provide a case study concerning one specific project that has been applying some of the described mechanisms: namely, the Medium Altitude Long Endurance Remotely Piloted Aircraft Systems (MALE RPAS), also known as *Eurodrone*.

2.1 Fragmentation: Issues and Opportunities

2.1.1 Damages to Research and Development

Research and Development (R&D) are activities which represent the initial stages for innovative defense (as well as civilian) projects. R&D constitute important investments that may be undertaken with the support of public funds: a case that is particularly frequent in the defense industry, due to the risk of leaving developed knowledge unexploited and thus register notable *sunk costs* (as previously explained in section 1.2).

Research and Development may be defined as two different and related phases. More specifically, "[r]esearch spending concerns projects not yet associated with any particular system [...] while development, by contrast, relates to scientific or technological contribution to a specific programme or project."⁹⁶ The perimeter of R&D spending extends "up to the point where expenditure for production of equipment starts to be incurred."⁹⁷ Certain institutions or authors also utilize the term Research and Technology (R&T) to refer to "a subset of R&D expenditure," including "expenditure for basic research, applied research and technology demonstration for defence purposes."⁹⁸

The aforementioned problem of losing the undertaken investments – which is particularly relevant in the high-risk sector of military innovation – sees a crucial step in the so-called "valley of death": a term utilized to indicate the phase that separates defense research from the development phase. Projects falling into the *valley of death* are the ones that incur "a failure to ensure technology transition through various technology readiness levels (TRLs)," hence the ones that will never (or perhaps very unlikely) reach the development and commercialization phases."⁹⁹ This is exactly a case in which sunk costs are met: for example, "[r]esearch institutes or SMEs conduct basic research into a new technology, but funding to take forward the project onto the development phase cannot be secured."¹⁰⁰

In the case of Research and Development, the "transatlantic gap" grows even wider, considering that, in 2017, the Unites States spent "almost seven times more than

https://www.eda.europa.eu/info-hub/defence-data-portal/Definitions

⁹⁶ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 70.

⁹⁷ European Defence Agency, *Definitions*, retrieved May 22 2020

⁹⁸ Ibid.

 ⁹⁹ Fiott, "Strategic Investment: Making Geopolitical Sense of the EU's Defense Industrial Policy," 31.
¹⁰⁰ Ibid.

the European Union on defence-related research and development (R&D)."¹⁰¹ It is true that the United States represents the most advanced country in terms of defense R&D commitments; nonetheless, the European Union Member States are lagging behind the standards they could potentially achieve. Defense R&D is a decisive variable to promote one player's position in the future of the industry, especially in a sector which is so affected by *high-tech* solutions. Yet, the EU's gap has increased again because of the official Britain's leave: the United Kingdom represented the most important investor in terms of defense-related R&D; thus, Brexit engendered a large difference between the EU28 and EU27 spending commitments, as we can observe in Table 2.1.



Figure 2.1: EU 28 and US spending in defense R&D. Source: Elizabeth Gibney, *Nature* (2019).

¹⁰¹ Elizabeth Gibney, "Europe's controversial plans to expand defence research," *Nature* 569 (2019): 476-477.

🖸 🕂 TIME 🕨	2012	2013	2014	2015	2016	2017	2018
🜵 GEO 🔻	÷	\$	\$	\$	-		
European Union - 27 countrie	3,910.1	3,119.3	2,977.9	3,129.9	3,068.7	3,011.9	3,080.3
European Union - 28 countrie	8,676.6	7,755.1	7,913.9	7,870.6	6,082.8	5,345.8	5,421.2
Belgium	25.1	24.4	22.1	20.0	25.1	23.0	24.3
Bulgaria	; (Z)	: (z)	: (Z)	: (Z)	; (z)	; (Z)	; (z)
Czechia	12.4	12.3	11.2	12.0	11.3	14.5	15.5
Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Germany (until 1990 former t	1,013.0	951.0	951.0	979.0	963.0	999.0	1,063.0
Estonia	0.7	1.2	1.9	2.1	1.8	1.8	2.0
Ireland	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spain	272.0	253.0	234.0	350.0	337.0	233.0	265.0 ^(p)
France	1,906.0	1,267.0	1,266.0	1,301.0	1,262.0	1,283.0 ^(p)	1,253.0 ^(p)
Croatia	0.0 ^(p)	0.0 <i>(P)</i>	0.0 <i>(P)</i>	0.0 ^(p)	0.0 ^(p)	0.0 ^(p)	0.0 ^(p)
Italy	133.0	135.0	86.0	79.0	75.0	45.0	55.0
Cyprus	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Latvia	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lithuania	1.0	1.4	0.6	1.5	0.6	0.5	0.5
Luxembourg	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary	0.0	0.0	0.0	1.2	0.4	0.1	0.1
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	59.0	34.0	35.0	61.0	60.0	56.0	66.0
Austria	2.3	0.9	1.3	0.9	1.6	2.2	2.3

Table 2.1: Governmental defense R&D spending for some European Countries, EU28, and EU27 (€, millions). Source: *Eurostat*, COFOG.

Looking at the 2018 column, one notices the huge difference affecting a *post-Brexit* European Union: the "R&D Defence" value of the Eurostat's "General government expenditure by function" (COFOG) database recorded \notin 5,421.2 million for the EU28, while the EU27 counterpart was only at \notin 3,080.3 million, in the same year.¹⁰² Hence, the Union lost its larger defense investor, a member basically doubling the expenditure of the second largest R&D spender, which is France with \notin 1,253 million, followed by Germany, a country that surpassed the one-billion euro threshold in 2018. Other Member States' defense R&D expenditures are almost negligible: to this regard, notice that Spain spent \notin 265 million in 2018, the Netherlands \notin 66 million, Italy just \notin 55 million. Moreover, it should be underlined that European defense-related R&D has been experiencing a consistent decline throughout recent years, this may also be noticed by looking at Table 2.1.

Additionally, it might be highlighted how R&D represents a very limited share of the total defense expenditure deployed by European States, which – again using the Eurostat COFOG database – is captured by table 2.2 below. If we exclude the UK and refer to the "EU – 27 countries" figures, the R&D value is a 1.9% fraction of total defense spending. By contrast, the United States defense R&D in 2017 was \$55.4 billion, "more than four times as much [...] than the rest of OECD countries combined," a huge expenditure, especially if we consider a new accounting methodology, applied since that

¹⁰² Eurostat, General government expenditure by function (COFOG), <u>https://ec.europa.eu/eurostat/web/products-datasets/product?code=gov_10a_exp</u>

year, according to which the R&D fraction of the US federal defense budget saw a large decrease (also see Figure 2.1 above).¹⁰³

🖸 🕂 TIME 🕨	2012	2013	2014	2015	2016	2017	2018
🕂 GEO 🔻	÷	\$	÷	÷	\$	÷	÷
European Union - 27 countrie	143,207.2	142,185.5	136,742.5	143,464.2	151,956.2	158,849.7	162,424.7
European Union - 28 countrie	192,972.3	188,509.4	185,550.4	197,119.3	198,472.2	203,461.7	207,589.8
Belgium	3,574.6	3,630.9	3,530.0	3,450.0	3,457.5	3,520.7	3,480.1
Bulgaria	438.1	502.3	589.7	633.0	522.7	553.2	636.8
Czechia	1,304.3	1,210.4	1,096.3	1,550.9	1,279.6	1,554.7	1,822.2
Denmark	3,571.6	3,393.2	3,024.6	3,052.4	3,149.9	3,438.8	3,517.4
Germany (until 1990 former t	30,258.0	29,769.0	28,138.0	29,158.0	30,582.0	33,174.0	35,542.0
Estonia	324.6	343.9	355.2	385.5	510.4	480.8	525.2
Ireland	682.9	682.7	769.6	803.0	836.6	825.1	973.5
Greece	4,610.0	3,879.0	4,757.0	4,443.0	3,706.0	4,486.0	3,751.0
Spain	9,695.0	9,877.0	8,950.0	10,416.0	10,888.0	10,374.0	10,283.0 ^(p)
France	37,525.0	37,523.0	36,191.0	38,499.0	41,160.0	40,995.0 <i>(</i> p)	41,385.0 ^(p)
Croatia	644.9 ^(p)	600.5 ^(p)	551.1 (p)	594.2 <i>(p)</i>	568.4 <i>(p)</i>	570.5 ^(p)	589.5 ^(p)
Italy	20,837.0	19,732.0	19,342.0	19,710.0	21,980.0	22,284.0	22,117.0
Cyprus	358.3	301.7	278.2	264.3	292.3	416.0	399.9
Latvia	198.2	206.5	211.4	249.4	410.6	446.1	616.3
Lithuania	312.3	320.1	348.5	469.5	574.9	686.7	782.8
Luxembourg	166.6	160.7	149.8	141.8	193.1	207.9	289.5
Hungary	726.0	686.8	621.7	755.9	904.6	1,365.1	1,260.8
Maita	50.6	49.1	62.9	77.9	60.8	70.9	63.3
Netherlands	7,475.0	7,503.0	7,288.0	7,708.0	8,015.0	8,531.0	9,088.0
Austria	1,892.4	2,013.4	1,928.5	1,912.1	2,122.0	2,192.0	2,250.7

Table 2.2: Governmental defense spending for some European Countries, EU28, and EU27 (€, millions). Source: *Eurostat*, COFOG.

Complex R&D investments, such as those of the defense sector, require relevant capitals. Hence, it is no surprise that large States are the only ones which are indeed able to develop advanced defense development plans. The example of the United States is quite illuminating, if we think that a unified player of that size has been able to develop a more coherent and extensive Research and Development plan: one that could field a highly "disruptive" power in terms of innovation (epitomized by the famous DARPA, i.e. the Defense Advanced Research Projects Agency), while retaining the capacity to consistently support a massive national industry. The European Union, by contrast, features the fragmented realities which were described by Chapter 1. Thus, for the old continent, it may often be hard to arrange an extensive investment plan to more effectively back common defense innovation programs.

To be sure, one of the most important rationales of the dawning European defense is the idea that "an innovation culture has to take root in the EDA and the new DG for Defence Industry and Aerospace."¹⁰⁴ This innovation culture may be sustained by the now unfolding European Defence Fund, acknowledging, nonetheless, "that the Fund can assist – but not replace – national investments into defence R&D."¹⁰⁵

¹⁰³ John F. Sargent, "Government Expenditures on Defense Research and Development by the United States and Other OECD Countries: Fact Sheet," *Congressional Research Service*, January 2020, <u>https://fas.org/sgp/crs/natsec/R45441.pdf</u>

 ¹⁰⁴ Fiott, "Strategic Investment: Making Geopolitical Sense of the EU's Defense Industrial Policy," 25.
¹⁰⁵ Ibid, 24.

The challenges and opportunities for a European defense research plan will be explored more thoroughly in the next sections. At this point, it should be anticipated that the EDF will feature both a "Research Window" and a "Capability Window," which are supposed to build on top of the existing EDTIB, PADR, and CDP; the European Defence Industrial Development Plan acts as a sort of "predecessor" of the new *Capability Window* (also, the PADR/EDRP – another "predecessor" – should merge with the EDF during the 2021-2027 multiyear financial framework, more on this in section 2.2).¹⁰⁶

Furthermore, the Research and Development strategy for Europe would be supposed to assume increasing risks throughout time. Nowadays, communitarian development projects are typically low-risk, and they are supposed to retain low-risk features in the first years of the new EDF. As the experience goes on, and the industry becomes less fragmented, the projects may become able to take higher risks and thus positively strengthen their "disruptive" innovating power. This is not only due to reasons that have to do with financing the projects, but also to a political rationale:

While in the initial stages of the EDF it will be politically important to prove the added-value of defence research projects, as the Fund matures the Union will have to accept that investments may 'fund failure'. [...] Investment in defence is inherently about risk-taking.¹⁰⁷

Therefore, R&D may be one of the first, and most important, beneficiaries of the currently projected boost to European defense. Similar benefits – similarly matured thanks to increasing de-fragmentation – are those that may come in terms of enlarging European economies of scale and enhancing continental standardization in defense systems. We shall now turn to an analysis of these topics.

2.1.2 Duplication, Standardization, and Economies of Scale

Another source of damages to European defense is the extensive presence of duplication, and non-standardization. These factors lead the European Union to lose potential economies of scale, underfund research and development for similar products sponsored by different Member States (or groups of MSs), or unnecessarily duplicate certain

¹⁰⁶ Mauro D'Ubaldi, "Il Fondo Europeo di Difesa: Il ruolo dell'Italia," in *Difesa europea: Quali prospettive*, ed. Ciro Sbailò, *Federalismi.it*, special issue 1 (2019), 25.

¹⁰⁷ Fiott, "Strategic Investment: Making Geopolitical Sense of the EU's Defense Industrial Policy," 36.

industrial and strategic structures. In this section, we will describe the main roots and results of so-called "Non-Europe" in defense and look at some estimates in terms of ensuing costs.¹⁰⁸

European duplication has two major causes, which are different in nature. Firstly, the lack of "a joint military structure, i.e. integrated land, sea and air EU forces"; secondly, the lack of "an EU-wide integrated defence market, i.e. the technological and industrial infrastructure needed for the production and distribution of the goods and services which enable the operation of the military system."¹⁰⁹ We will focus on the second absence, since it is the most important one for the purposes of this work. Indeed, the lack of a common defense market in Europe (which rather sees the presence of a plethora of different national markets, usually protected and sponsored by the respective governments) is the basic cause of economic costs due to "the unnecessary duplication of products [...] loss of economies of scale, and market inefficiencies."¹¹⁰ This is, ultimately, the clear link between standardization and economies of scale that must be studied. The eradication of excessive duplication is one of the main points to secure, in the process of "consolidating the European industrial base."¹¹¹

The problem of duplication is caused by the fragmented nature of European defense (which was discussed in chapter 1). As we have seen, the majority of defense expenditure and R&D investments are concentrated in a small set of European States, which – in turn – are usually trying to promote their own industries via favorable regulations, international sponsorship, and biased public procurement. To be more specific, a 2019 study affirmed that:

Currently, 80 percent of the development of defense capabilities and two-thirds of acquisition of defense capabilities in Europe take place on the national level generating massive unnecessary duplication. An estimated €25 billion could be used more effectively if unnecessary overlap was eliminated. [...] To cope with slow innovation cycles, Europe needs to spend more efficiently and better harmonize its scarce resources.¹¹²

¹⁰⁸ See, for example, Valerio Briani, *The Costs of Non-Europe in the Defence Field*.

¹⁰⁹ Ibid, 7.

¹¹⁰ Ibid.

¹¹¹ D'Ubaldi, "Il Fondo Europeo di Difesa: Il ruolo dell'Italia," 24.

¹¹² Erik Brattberg and Tomas Valasek, *EU Defense Cooperation: Progress Amid Transatlantic Concerns*, (Washington: Carnegie Endowment for International Peace, 2019), 9. Other estimates are more expansive in nature and – as will be noted in this section – consider the margin to be wider than the \in 25 billion one cited by Brattberg and Valasek.

These issues have officially been recognized by the European Commission, which pointed to the problems of "fragmentation and inefficiencies" to highlight how a more cohesive defense industry might: a) support the European Defence Technological and Industrial base, b) help Member States "get better value for their investments," and c) support the R&D phases "to make sure that the results of research are not lost."¹¹³ The problem of duplication is particularly evident if we look at the defense systems multiplication throughout the EU, and compare such landscape with the United States' counterpart. As we can see from Figure 2.2 below, which appeared in the cited factsheet, the differences are huge. The Union features 178 types of weapon systems in use vis-à-vis 30 American systems; the EU has 17 different "Main battle tanks," while the US has only one such model (i.e. the M1 Abrams); and the disparities remain huge in the naval and air contexts as well. As highlighted by the figure, the United States is also able to invest more on its soldiers, and something similar happens for its projects and systems – not just because of the larger budget, but thanks to a much less pronounced duplication.¹¹⁴

This brief comparison is particularly interesting because the US is a good example of integrated industry. Thus, we can properly see the presence of duplication as one challenge (and probably the main one) posed by the current European impasse.

Moreover, it should be remembered that such multiplication of systems causes additional costs that extend beyond R&D efforts and production costs, affecting the maintenance, training and operation costs, while also compounding the losses in terms of the separated acquisition and procurement procedures promoted by the respective sponsors of each and every system. For example, consider the multiplier effects – in terms of efficiency losses – represented by a "duplication of platforms," leading to "different products that will need different spare parts, different training for crews and maintenance staff, and will therefore have an impact on operating costs as well as on production costs."¹¹⁵

¹¹³ EU Commission, "The European Defence Fund: Stepping up the EU's role as a security and defence provider," *European Defence Fund - factsheet*, March 2019, https://ec.europa.eu/docsroom/documents/34509

¹¹⁴ Notice that the budget estimate – based, in particular, on NATO and SIPRI data – is a larger figure than the one based on Eurostat data (see table 2.2). This is due to certain methodological discrepancies, as previously pointed out by section 1.4.

¹¹⁵ Briani, *The Costs of Non-Europe in the Defence Field*, 15.

THE COST OF CURRENT FRAGMENTATION AND INEFFICIENCIES

2		UNITED STATES
Defence Expenditure		
Total amount	€ 227 billion	€ 545 billion
% of GDP	1.34	3.3
Investment per Soldier	€ 27.639	€ 108.322
Duplication of Systems in Use		
Number of types of weapon systems*	178	30
Main battle tanks	17 <u>6</u> 6 6 6 6 7 6 7 6 7 6 7 6 7 6 7 7 7 7 7	1
Destroyers/frigates		4
Fighter planes	20+++++++++++++++++++++++++++++++++++++	6 * * * * * * *

* Number of types of weapon systems for selected weapon systems categories Source: NATO, International Institute for Strategic Studies, SIPRI, Munich Security Report 2017

Figure 2.2: European defense duplication. Source: EU Commission Factsheets, data from NATO, IISS, SIPRI, and Munich Security Report 2017.

Another remarkable example of the expensive European duplication comes, more specifically, from the aeronautical equipment. As shown by Table 2.3 below, three European, quite equivalent jets (i.e. Eurofighter, Gripen, and Rafale) were developed visà-vis one model realized by the American industry (the JSF). Even though the Research Costs for the Eurofighter were roughly comparable to those of the JSF, the sum of European research costs far exceeds the non-duplicated American counterpart, not to mention the further operation costs deriving from European lack of interoperability, and the compounded production costs: in total "European assembly lines produced 1,798 units fewer than the JSF."¹¹⁶ Following standard economic theory, it is to be expected that the market will be affected by efficiency losses and thus encounter *deadweight losses*.

Aircraft	Research Costs (in € billions)	Units envisaged/produced
Eurofighter	19.48	707
Gripen	1.48	204
Rafale	8.61	294
JSF	19.34	3003

Table 2.3: Multiplication of costs in the air equipment case. Source: Briani, *The Costs of Non-Europe in the Defence Field*, 16.

¹¹⁶ Ibid, 16.

The practical side of such inefficiencies is fairly easy to grasp. In line with the general premise of this section, air equipment duplication has multiple repercussions: "production chains are differentiated and incompatible, there is no economy of scale, interoperability remains difficult, training is different for each one of the models, and separate logistics are needed for different missions."¹¹⁷

The two exemplifications provided help to realize how important the margin for a better European industry is. The point is at the front and center of the EU projects. For example, the European Defence Agency is pursuing "efficiency gains arising out of more effective coordination and generation of economies of scale," as it will be illustrated by the remainder of this chapter.¹¹⁸

A way towards reduced duplication may be represented by European standardization: something that is, indeed, being pursued by the current European initiatives. It has long been recognized that common production and operative standards, together with unified certification procedures "can lead to economies of scale and improve the global competitiveness of the European Industry," especially since "much unnecessary duplication is caused by the fact that new products have to be certified in every of the 27 Member States [causing] additional costs."¹¹⁹ Therefore, shared certification would allow particular benefits in sectors such as ammunitions and Remotely Piloted Aircraft Systems (which will be analyzed in more detail by the next sections).

The compounded losses deriving from the problems of a fragmented industry of this sort are very complicated to estimate. According to the Commission's factsheet cited above, "lack of cooperation between Member States, in the field of security and defence is estimated to cost between \notin 25 billion and \notin 100 billion every year."¹²⁰ Indeed the extended and multifaceted nature of the defense efficiency losses, which have been described thus far, makes the estimates (at least on the conservative level) quite reliable. A significant proof is also provided by the defense budget-to-capability ratio of the European fragmented industries vis-à-vis the American counterpart, the comparison is quite impressive:

¹¹⁷ Blanca Ballester, *The Cost of Non-Europe in Common Security and Defence Policy*, (Brussels: European Added Value Unit, 2013), 61.

¹¹⁸ Ibid, 43.

¹¹⁹ Ibid, 58.

¹²⁰ EU Commission, European Defence Fund - factsheet.

In 2003 [...] the total European budgets amounted to just under 50% of the US budget: \$173 billion against \$382. At a cost of half that of the US, the Europeans obtained only a tenth of the capacity.¹²¹

Furthermore, we may add that a more cohesive industry would allow for increased *specialization*, ideally utilizing each nation's industrial clusters for their best assets and cultivating intra-European clusters as well (something which is already existing, to a certain extent, but could be significantly enhanced). Reaping the fruits of better specialization may be a further avenue to obtain a more effective common defense market fueled by integration, strengthening the EDTIB.¹²²

To conclude, the area of duplication, and the margins it presents with regards to potential coordination, standardization, and shared certification constitute a fundamental domain to improve the efficiency of the European industry of defense. That is one of the main reasons why the Union is specifically working to reduce the described levels of fragmentation.

2.1.3 Public Procurement and Cross-national Acquisitions

A concept related to duplication, and indeed one of its main roots, is represented by the national practices in public procurement and acquisition. Procurement might be understood as one part of the acquisition procedure. In the defense industry acquisition processes play a fundamental role in terms of a State's strategic support for its own industry. As explained by Heidenkamp et al., "The defence acquisition process itself must be regarded as an instrument of defence industrial sponsorship, as it binds government to industry."¹²³ In the defense sector, the political rationale concerning the security of the State often promotes the idea of favoring national producers even if that is an inefficient action to undertake. The tendency is particularly expansive, since this kind of industrial protectionism often sees spillovers affecting areas of security which are not linked to the utmost interest of the nations. In other words, this strategic rationale may well become a sort of red tape to protect one State's national industry from foreign competition, even when national security risks are completely absent. For example, a country may decide to

¹²¹ Briani, *The Costs of Non-Europe in the Defence Field*, 28.

¹²² Ester Sabatino, The Innovations of the Italian White Paper: Defence Policy Reform, 7.

¹²³ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 77.

sponsor the development of a domestic product, in a situation where it could be possible (and usually more cost-efficiently possible) to purchase "off-the-shelf" (i.e. acquiring goods or services that are already offered by the international market).

This type of discussion is particularly pertinent for the case of the European landscape, where Article 346 of the TFEU (which was already mentioned in section 1.1) allows for an opt-out from the common market context. To be sure, "despite the efforts made by the European Defence Agency, Member States still tend to opt for their national markets, causing overlaps and duplication."¹²⁴ Even though the common market is undisputedly one of the most relevant accomplishments of the EU, the defense sector is still frequently characterized by the "national preference" for defence procurement."¹²⁵

Because of the mentioned sensitivity, characterizing defense goods and services, EU Member States retained the protectionist attitude vis-à-vis this peculiar market. This trend was also promoted by the relevant spread of the so-called "French model," on the continental level.¹²⁶ The "fencing-in," so to speak, of single national markets has been preserved also utilizing the aforementioned Article 346 of the TFEU.¹²⁷ Paragraph 1(a) of the article states that "no Member State shall be obliged to supply information the disclosure of which it considers contrary to the essential interests of its security."¹²⁸ Whereas paragraph 1(b) affirms that "any Member State may take such initiatives as it considers *necessary* for the protection of essential interests of its security which are connected with the production of or trade in arms, munitions and war material," nevertheless, it is added that "such measures shall not adversely affect the conditions of the competition in the internal market regarding products which are not intended for specifically military purposes."¹²⁹ The ambiguity is evident, since the article tries to protect two different needs and – as we will also point out below – it is very difficult to ascertain the *necessity* mentioned by the legal text (all emphases were added by the author).

¹²⁴ Ballester, The Cost of Non-Europe in Common Security and Defence Policy, 49.

¹²⁵ Briani, The Costs of Non-Europe in the Defence Field, 15.

¹²⁶ Malena Britz, "The Role of Marketization in the Europeanization of Defense Industry Policy," *Bulletin of Science, Technology and Society* 30, no. 3 (2010): 182. The "French model" is the "more state-oriented" one, which "has tied the producer more closely to the customer." More details about the French model can be found in Chapter 1.

¹²⁷ Because of art. 346, in the words of Britz, "the EU member states legally have the ability to side-up the procurement laws of the common market when procuring arms." Ibid, 16.

¹²⁸ Art. 346 of the Treaty on the Functioning of the European Union (consolidated version).

¹²⁹ The remainder of the article mentions a list, to be drawn and updated (by the Council, upon proposal of the Commission, including the products that may be affected by the described exemption).

The European Institutions have undertaken a series of initiatives to mitigate the problem of defense industrial protectionism.¹³⁰ In this section we will tackle those initiatives that are more directly related to procurement practices and legislation, whereas in the remainder of the chapter we will take a more complete approach to the Europeanization of the defense market.

Throughout the last decade, the European Union saw two procurement-related initiatives of different nature. Firstly, the EDA applied an intergovernmental approach, based on the creation of *Codes of Conduct*, which proposed sets of practices that could be accepted and promoted on a voluntary basis. Secondly, The EU applied a stricter, more communitarian approach based on two important directives: Directive 2009/81/EC (regarding defense and security procurement) and Directive 2009/43/EC (regarding the simplification of conditions for transferring of defense-related products within the Union). These two landmark directives formed the so-called "European Defence Package."¹³¹ Now, let us consider each of these initiatives, and conclude the section with a factual evaluation of the results witnessed by the industry.

The intergovernmental approach conducted by the European Defence Agency had a very limited impact. The outcome was not unexpected, considering that the initiative was driven by the Member States' governmental representatives who were, at the time, interested in preserving their respective national industries. Moreover, the agreed practices and Codes of Conduct (Including a 2007 *Code of Conduct on defence procurement* and a Code of Best Practice in the Supply Chain) were to be applied on a voluntary basis by the single MSs themselves: no mechanism of communitarian supervision or feedback was conceived. Therefore, the "inter-governmental approach has had only limited success and has been followed by a more concerted approach aimed at removing, as far as possible, the partitioning, and introducing market logic to the defense procurement market."¹³²

Such second approach was based on the two aforementioned directives. The *Directive on Defence and Security Procurement* (i.e. Directive 2009/81/EC) had the aim "to facilitate the development of an EU defence equipment market by creating a formal

¹³⁰ The European Council recognized the need to better integrate and support the industry of European defense in 2012, see conclusions of 13, 14 December.

¹³¹ Alyson J.K. Bailes and Sara Depeauw, *The EU defence market: balancing effectiveness with responsibility*, (Brussels: Flemish Peace Institute, 2011), 6.

¹³² Ballester, The Cost of Non-Europe in Common Security and Defence Policy, 53.

framework for cross-border defence procurement."133 Importantly, the possibility of utilizing article 346 of the Treaty as an opt-out remained, but the "European Commission has clarified in an interpretative communication that Article 346 should be treated as an exception rather than the norm," although it remains practically difficult to ascertain the protective *necessity* behind the activation of the article.¹³⁴ Thus, we are also witnessing the emergence of a supervisory role for certain EU actors: in particular the Commission which acts to ensure that the transposition and application of the Directives are done correctly, and the EDA which follows the evolutions of the market providing useful assessments of the situation (see below). On the other hand, the *Directive simplifying* terms and conditions for transfer of defence-related products within the Community (i.e. Directive 2009/43/EC) had the objective of allowing an easier transfer of equipment. The need for this flexibility was affecting both the operative and industrial sides of the sector, since "there were blockages impeding the movement of products and distorting [...], hampering innovation, industrial cooperation competition and [...] competitiveness."¹³⁵ It may be added that also the problem of operative mobility is a quite persistent issue for European defense, and it remains relevant to this day: indeed, the next EU multiannual financial framework is expected to allocate a specific budget to the socalled EU "military mobility" so that operative mobility for armaments is furtherly enhanced throughout the continent.¹³⁶

The results of the described actions were mixed. To begin with, the large majority of the Member States failed to transpose the norms of Directive 2009/81/EC before the deadline that had been set (i.e. August 21^{st} , 2011): only in 2013 was transposition achieved by all parts. In 2016 the Commission presented a report on the implementation of the Directive on public procurement. The report shows the progress achieved. The overall trend was positive, with a "total value of defence and security contracts awarded under the Directive in 2011-2015 [which] was around €30.85 billion."¹³⁷ To this regard

¹³³ Ibid. Directive 2009/81/EC can be found on the institutional website, <u>https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009L0081</u> (retrieved May 2020).

¹³⁴ Ibid, 54.

 ¹³⁵ Ibid, 55. Directive 2009/43/EC can be found on the institutional website, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0043 (retrieved May 2020).
¹³⁶ See, for example, Fiott, "Strategic Investment: Making Geopolitical Sense of the EU's Defense Industrial Policy," 8.

¹³⁷ European Commission, "Report from the Commission to the European Parliament and the Council on the implementation of Directive 2009/81/EC on public procurement in the fields of defence and security, to comply with Article 73(2) of that Directive," *EU Monitor*, November 2016.

https://www.eumonitor.eu/9353000/1/j4nvke1fm2yd1u0_j9vvik7m1c3gyxp/vkcweelo4wyv/v=s7z/f=/co m(2016)762_en.pdf

see Figure 2.3, which was retrieved from the accompanying Staff Working Document (SWD).¹³⁸

The improvement is quite evident, yet there is still a considerable margin for increasing the extent of the application. The partial success is clear if we consider that, in the cited five-year period, "the average yearly value of defence and security procurement published EU-wide was roughly ϵ 6.2 billion, or 7.8 billion if defence and security purchases under the civil procurement regime were added," representing "a more than twofold increase."¹³⁹ Nevertheless, we should highlight two points, concerning limitations, mentioned by the Commission's report. Firstly, the application of the Directive "remain[ed] uneven across Member States;" Secondly, "a very significant share of defence procurement expenditure is still made outside the Directive [which] was used to a very limited extent for the procurement of high-value, strategic, complex defence systems."¹⁴⁰

Additionally, the Commission found out that the procedures applied were very cost-efficient, with costs which accounted "for around 0.3% of the contract value" in the analyzed period, costs that are certainly paid back in terms of "EU added value," namely, by an "increase in competition, transparency, and non-discrimination."¹⁴¹

¹³⁸ Commission Staff Working Document (SWD) accompanying the cited Report.

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016SC0407&from=EN

¹³⁹ Commission Report, 4. This if we include both contracts published under the Directive and those "published on the Electronic Bulletin Board (EBB) of the European Defence Agency (EDA);" see note 7 of the Report.

¹⁴⁰ Ibid, 5.

¹⁴¹ Ibid, 8, 10.



Figure 2.3: Contract award notices published under the Directive, by year. Source: OJ/TED, manual correction by DG GROW.

We should remember that these figures are going to be affected by Brexit in the years to come, since the United Kingdom represented the highest share of European defense spending, as well as one of the most transparent countries, according to the so called "British model": favorable to privatization and, often times, to off-the shelf purchases. From Figure 2.4 (which was part of the Staff Working Document), we can see how most contracts were concentrated in a low-value tier. The Graph shows contracts under the Directive, which were below the value of \notin 100 million. Furthermore, the unevenness of the applications throughout different Member States is also quite evident, with "the majority of high-value observations [...] noted for the United Kingdom and France;" in terms of contracts above the \notin 100-million mark, again, the UK and France saw the highest numbers of observations (20 and 14, respectively), followed by Germany (3 contracts), whereas for Italy there were 2 contract-award notices published under the Directive in the observed period.¹⁴²

¹⁴² Commission Report, Staff Working Document, 34-35.



Figure 2.4: Distribution of contract award notices with values below €100 million published under the Directive in 2011-2015. Source: OJ/TED, manual corrections by DG GROW.

To conclude, a comment should be dedicated to the interaction between procurement under the Directive and cooperative equipment procurement. The latter is a form of shared procurement promoted by the European Defence Agency. Once again, the results appeared to be mixed, according to the Commission report, which made its assessment also involving a series of stakeholders, "the Directive does not hinder cooperative procurement."¹⁴³ On the other hand, EDA data shows a peak, at 24%, shortly after the year the Directive was developed (a time when, as we said, most MSs still had to transpose the norms into their domestic legislation), and a clear diminishing in percentage of cooperative defense equipment procurement after 2011 and 2012 (the reader may notice such trend by looking at the light blue line in Figure 2.5). To be sure, it is not possible to establish a fully reliable link between the two values, also because –

¹⁴³ Commission Report, 9. We should note that in the Directive's logic, as stated by the Report (Ibid.), "it is important to encourage Member States' authorities to make full use of the available flexibility under the Directive to pursue cooperative procurement." Hence, notice that *under-Directive procurement may cause, but does not necessarily lead to, increased collaborative equipment procurement.* This is also important to understand the computation of the "EU-wide procurement" cited on page 40-41, and the discrepancies between figure 2.3 and figure 2.5.

as mentioned by the EDA reports – common procurement is very difficult to assess accurately "because only a limited number of MS provide this data." Further, there may also be a lagging backlash due to the phase of low investments, which was faced during the years of the financial crisis. Even in 2011, the most successful year for cooperative procurement (as shown by the graph below), the cooperative share of procurement was only at 24%, more than 10 points below the EDA's 35% goal.¹⁴⁴ Thus, a certain degree of progress has been achieved in the last decade, but even in this instance, prominent potential remains to be exploited.





¹⁴⁴ European Defence Agency, Defence Data 2017-2018: Key Findings and Analysis (Brussels: 2019), 9.

2.2 Prominent European Union Instruments: EDA, PeSCo, PADR, CARD, CDP

The present section will provide a comprehensive overview of the most important European Union tools at the time of this writing. Some of these concepts have already been mentioned in the previous sections, but the goal of this part is to illustrate a more complete contextualization, one which shall highlight the relations between such instruments and the ways in which they try to promote the European defense industry.

2.2.1 The European Defence Agency

The European Defence Agency (EDA) was established in 2004 and is an organization of the Council of the European Union. All the European Union Member States, with the only exception of Denmark, have decided to take part in the Agency. In terms of historical inheritance, the EDA is the successor of the Western European Union (which was mentioned in section 1.3), thus assuming the role of moving certain WEU functions into the European Union framework (particularly those concerning armaments).

The functioning of the Agency and its tasks are regulated by articles 42(3) and 45 of the Treaty on European Union. The "four major functions" of the EDA are well summarized by Malena Britz:

[D]eveloping defense capabilities; promoting defense research and technology; promoting armament cooperation; and working to create a competitive European defense industry market and to strengthen the European defense, technological, and industrial base.¹⁴⁵

Therefore, it may be noticed that the role of the Agency is indeed multifaceted: as this thesis has already shown, defense integration shall consider a variety of aspects ranging from practical capabilities to R&D/R&T, from armaments coordination (the role inherited from the Western European Union) to coordination and strengthening of a common industry and market. This last aspect is the most important for the purposes of our work, but it can never be completely separated from the other ones (it goes without

¹⁴⁵ Britz, "The Role of Marketization in the Europeanization of Defense Industry Policy," 178. A basic comprehensive list is provided by art. 45(1) of the TEU.

saying that a powerful, stable and productive technological and industrial base cannot exist without the support of a well-promoted research and technology area).¹⁴⁶

The EDA pursues its different aims by guiding multiple initiatives (which will be described in the next sub-sections), the most relevant ones are the Coordinated Annual Review on Defence (CARD), the Capability Development Plan (CDP), and the Preparatory Action on Defence Research (PADR). Each of the mentioned points is considered a "priority" by the Agency, further priorities include the Permanent Structured Cooperation (PeSCo), "enhancing the coherence among EU defence tools", and the "Key Capability Programmes."¹⁴⁷ The second-to-last point is a basic necessity for efficiently coordinating the multiple assets behind European defense, whereas the latter point is particularly relevant in the eyes of this thesis, since it indicates the key Agency-run capacity projects; at the time of this writing there are four projects which receive such priority: 1) Air-to-Air Refuelling (AAR), 2) Remotely Piloted Aircraft Systems (RPAS, which will be part of our case study), 3) Governmental Satellite Communications (GovSatcom), and 4) Cyber Defence. The Agency also runs several smaller projects both for capacity-development and Research & Technology, thus constituting a major platform for coordinated research and development.

Additionally, the EDA takes forward PeSCo projects, as will be described below, and in fact it has (together with the EU External Action Service) the role of PeSCo secretariat. PeSCo includes other types of projects and has a slightly different membership, but it is *de facto* linked to the Agency.

We have already mentioned the EDA's role in the drafting of the Code of Conduct for defence procurement and its continuing function in promoting communitarian procurement and R&T (see figure 2.5). In general, the Agency's role is mostly one of coordination: the EDA functions are based on an intergovernmental principle; hence, the Member States retain a fundamental say in its remit. The breath of the EDA is quite limited in terms of budget: the "amending general budget" for 2020 amounted to €36.5 million, a quite limited sum, to which additional sources of revenue still must be added (these usually covering the bulk of operational expenses, which may be funded on an ongoing basis depending on the preferences and projects promoted by the different MSs or

¹⁴⁶ For example, Blanca Ballester notices EDA's "mission to enhance interoperability, and pooling and sharing relationships between the armed forces of the Member States, [as well as] the strengthening of the European Defence Technological and Industrial Base," Ballester, *The Cost of Non-Europe in Common Security and Defence Policy*, 43.

¹⁴⁷ European Defence Agency, *Our Current Priorities*, https://www.eda.europa.eu/what-we-do/our-current-priorities

other actors).¹⁴⁸ The introduction of the full-fledge European Defence Fund (EDF) should provide further resources to the initiatives, including the EDA projects.

It must be stressed that the EDA has an important role in terms of cohesion, as we will see with the next section, many of the defense continental initiatives are driven by the Agency – in conjunction with the Member States – with the role of supporting the common industry.

2.2.2 The Permanent Structured Cooperation

The Permanent Structured Cooperation (PeSCo) is a fairly recent initiative of the EU: it was established in December 2017. As mentioned in section 1.3, 25 Member States are part of PeSCo, with Denmark on a *permanent opt-out*, and Malta activating a *neutrality clause*.

PeSCo pursues a series of its own projects in "areas such as training, capability development and operational readiness in the field of defence."¹⁴⁹ As with the case of the EDA, we may notice how the nature of this initiative is multifaceted – focusing both on the capability development side and the operational one – but still very much linked to the economic aspects of research and development concerning defense products and systems. Although the EDA does steer PeSCo to some extent, the projects and workings of the latter are different in nature since this *permanent* side of cooperation is indeed *legally-binding* and not perfectly overlapped with the Agency. PeSCo was introduced by the Treaty of Lisbon: the initiative is regulated by articles 42(6) and 46 of the TEU, as well as by the Protocol No 10 on PeSCo, an annex also regulating the main aims of such Cooperation.

PeSCo objectives are laid out in article 2 of the cited Protocol and they are particularly important to grasp the practical and economic impacts of this kind of cooperation. The first objective – article 2(a) – mentions the necessity to cooperate with regards "to achieving approved objectives concerning the level of investment expenditure on defence equipment," thus it references the common commitments in terms of

https://www.eda.europa.eu/Aboutus/who-we-are/Finance

¹⁴⁸ European Defence Agency, "Finance,"

The general Member States' contributions to the budget of the Agency are calculated according to a GNP-based criterium.

¹⁴⁹ European Defence Agency, "Current list of PESCO projects," *Our current priorities*, <u>https://www.eda.europa.eu/what-we-do/our-current-priorities/permanent-structured-cooperation-(PESCO)/current-list-of-pesco-projects</u>

expenditure.¹⁵⁰ The second objective – article 2(b) of the Protocol – pertains the necessity of harmonization (which is rooted in the observations concerning the dichotomy of duplication and common standards that were explained by section 2.1.2), capability pooling and specialization. The third objective - article 2(c) - concerns flexibility and forces interoperability (something related to the previous point as well). The fourth point pertains the use of the "Capability Development Mechanism" in accordance with NATO objectives too.¹⁵¹ While the fifth and last objective mentions the necessity to "take part, where appropriate, in the development of major joint or European equipment programmes in the framework of the European Defence Agency."¹⁵² The last point shows one of the examples of evident overlapping with the Agency that also has the role to monitor the Member States' efforts in capability development and actual contributions (article 3 of the Protocol). It is important to notice that several EU initiatives work towards the achievement of the aforementioned objectives: the first point must contemplate the role of the Capability Development Plan and Coordinated Annual Revenue on Defence; the second objective is also followed in accordance to CARD and should be supported financially by the European Defence Fund. The third point is mostly operative, in nature, thus it is not related to any financial-support initiative and escapes the main remit of our thesis. The fourth objective, which directly involves general capability development (i.e. the strengthening of the EDTIB) should – similarly to the first one – see a certain valence afforded to both CARD and CDP. The last point is a clear statement concerning the intertwining with EDA's development projects.

Now, let us focus on PeSCo projects. The initial list of such projects was adopted in March 2018 and included 17 items (For instance, Military Mobility and EuroArtillery), a second list came out in November 2018 (including, again, 17 projects), whereas a third list (this time publishing a tranche of 13 new projects) was recently adopted in November 2019. PeSCo projects are of different kinds, ranging from training to development: the latter are particularly interesting because they see strict cooperation among different Member States in the creation of the products. An important instance of such kind is the European Medium Altitude Long Endurance Remotely Piloted Aircraft Systems (MALE RPAS), also known as *Eurodrone*, which will be the topic of the present chapter's case study. The Eurodrone is a good example to illustrate Member States' coordinated work

 ¹⁵⁰ Protocol no. 10 on PESCO is part of the Consolidated version of the Treaty on European Union.
<u>https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12008M%2FPRO%2F10</u>
¹⁵¹ Ibid.

¹⁵² Ibid.

involving PeSCo, the EDA, as well as the European Defence Fund and other agencies (especially OCCAR).

2.2.3 CDP, CARD, and PADR

In 2008 the European Defence Agency produced the first Capability Development Plan (CDP), supported by the EU Military Committee (EUMC) and the EU Military Staff (EUMS). As stated by the Agency, "the overall objective is to increase coherence between Member States' defence planning and to encourage European cooperation by looking together at future operational needs and defining common EU capability priorities."¹⁵³ Therefore, a CDP has the important mission to ensure a certain amount of cohesion among members with regards to development priorities: this is an important and ambitious goal to achieve, since it frequently encounters cleavages due to different economic and strategic interests put forward by groups of Member States. Moreover, the CDPs are particularly important to guide the Coordinated Annual Review on Defence (see below), but also to steer certain PeSCo priorities, and to some extent provide guidance for the European Defence Fund, as well.

The recent version of CDP, which saw the cooperation of the Member States and came out in June 2018, produced 11 new *EU capability development priorities*. The list included relatively large areas – such as information superiority, air superiority and naval maneuverability – and each area of priority had a corresponding Strategic Context Case (SCC) to collect data and identify challenges for each instance. For the purposes of this thesis it is important to notice that the EDA also runs an *Industrial Consultation Portal*, with the aim "to collect industry's views to inform the development of the Strategic Context Cases;" in other words, industrial players may submit their own views pertaining specific priority areas, with the objective to improve the respective SCCs.¹⁵⁴ The CDP should also ensure the coherence of common R&T efforts, "providing a view into the shortfalls and opportunities of related research activities and the current state of the European defence industry for each capability."¹⁵⁵

 ¹⁵³ European Defence Agency, "Capability Development Plan," *Our current priorities*, <u>https://www.eda.europa.eu/what-we-do/our-current-priorities/capability-development-plan</u>
¹⁵⁴ Ibid.

¹⁵⁵ European Defence Agency, "Capability Development Plan," *EDA fact sheet*, June 2018, <u>https://www.eda.europa.eu/docs/default-source/eda-factsheets/2018-06-28-</u>factsheet_cdpb020b03fa4d264cfa776ff000087ef0f

The Coordinated Annual Review on Defence (CARD) was launched in May 2017. The annual review has the goal to check current capability levels to address shortcomings and establish common development guidelines, in a coherent and shared way following "Member States' aggregated defence plans, the implementation of the EU Capability Development Priorities resulting from the CDP and the development of European Cooperation."¹⁵⁶ The CARD functions on a voluntary basis, with the EDA acting as its Secretariat together with the EU Military Staff (EUMS).

Firstly, there is a phase of information gathering to collect the necessary data for the Review. Secondly, there are bilateral dialogues involving the Member States and the CARD Secretariat, the MSs clarify the provided data during this step. Third, and last, the data is analyzed with the CARD Aggregated Analysis resulting in a final Report.

The CARD had a Trial Round which analyzed the defense data of the 2015-2019 period. The Trial did find "a positive trend in the overall defence spending of the 27 participating Member States," investment was increasing, reaching €47 billion for 2017, even if 81% of total investment was done in just 12 Member States, and the investment on defense R&D had actually decreased (21% of total investment in 2017); to this regard, it would be particularly important to strengthen R&T for ensuring the well-being of the European industry on the long term.¹⁵⁷ The CARD also noticed certain collaboration opportunities that may lead to effective results and – interestingly for our case study – included the area of Unmanned Aerial Systems among such opportunities.

After having described CDP and CARD we have a clearer idea of the intertwined architecture of the different (and often recently launched) European defense initiatives:

In a somewhat simplistic manner, we could say that the CDP tells us what to focus our common efforts on, the CARD gives us an overview of where we stand and identifies next steps, PESCO in turns gives us options on how to do it in a collaborative manner, while the EDF could provide the funds to support the implementation of cooperative defence projects in general, but with a bonus, if in PESCO.¹⁵⁸

¹⁵⁶ European Defence Agency, "Coordinated Annual Review on Defence (CARD)," *Our current priorities*,

https://www.eda.europa.eu/what-we-do/our-current-priorities/coordinated-annual-review-on-defence-(card) ¹⁵⁷ Ibid.

¹⁵⁸ Ibid.

We should also analyze the Preparatory Action on Defence Research (PADR). The PADR was launched in June 2017, as a 3-year initiative, acting as a demonstration of the "added-value of EU-supported defence research," with the objective to "prepare a future European Defence Research Programme (EDRP) as part of the EU's next Multiannual Financial Framework 2021-2027."¹⁵⁹

The Preparatory action may, thus, be understood as a test before achieving a fullfledge EDRP in line with the strengthening of the European Defence Fund. Thus far, the experience of the PADR has been a positive one. In particular it "has shown that open tenders are an effective way of attracting SMEs and mid-caps to apply for EU support," this helped the EU in the process of "bringing in industrial partners as early as possible [...] to reduce the inevitable 'information asymmetry' that will exist between governments, firms and institutions."¹⁶⁰ Involving single enterprises and institutions can indeed be crucial for the success of defense innovation and, at the same time, very difficult because players usually fear the loss of their knowledge or sometimes do not want to participate in the defense realm because of image and reputation reasons (these issues are tackled in more detail by Chapter 3).

The PADR was afforded a 3-year budget of \notin 90 million. These funds were distributed in yearly tranches, with the first and third year receiving \notin 25 million and the second year allocating the remaining \notin 40 million: figures which should still be much smaller than the ones planned for the next cycle. The projects of the first year (2017) have already started, 2018 projects have been approved, whereas third-year projects are waiting for the confirmation and approval of the received proposals.

To this regard, we take the opportunity to mention the European Defence Industrial Development Programme, which has the goal to boost the competitiveness and *innovation capacity* of the defense industry. The EDIDP is also very recent and acts as a "test phase towards the fully-fledge capability window of the European Defence Fund."¹⁶¹

https://www.eda.europa.eu/what-we-do/our-current-priorities

https://ec.europa.eu/growth/content/2019-calls-proposals-european-defence-industrial-development-programme-edidp_en

¹⁵⁹ European Defence Agency, *Our current priorities*,

¹⁶⁰ Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 3-4. A mid-cap firm has no more than 3000 employees, whereas an SME can have a maximum of 250 employees and makes less than \in 50 million in annual turnover.

¹⁶¹ European Commission, "2019 calls for proposals: European defence industrial development programme (EDIDP)," *Internal Market, Industry, Entrepreneurship and SMEs*,

The EDIDP included 9 calls for proposals in 2019 and 12 calls for proposals in 2020; in addition, there were two projects for direct award: the Eurodrone and the ESSOR (for more details to this regard, see section 2.4).

The EDF will feature both a *research strand* and a *capability strand* (see next sections), and it will move from the initial pilot version (with 2 pilot programs) to the 2021-2027 expanded plan. The EDIDP "test phase" had a limited budget of \in 500 million for the 2019-2020 period.

Thus, we have noticed with increasing detail how the different agencies, initiatives and projects at the communitarian level may be linked; further, they are also connected to other international organizations (e.g. NATO and OCCAR), and should soon be expanded by the full-fledged European Defence Fund. The graphic illustration provided by Figure 2.6 may help the reader to visualize the complex architecture of European defense, and to identify some of the main initiatives described in the present section.



Figure 2.6: The Architecture of European defense initiatives. Source: EDA.

2.3 The European Defence Fund

2.3.1 The European Budget Towards a Full-fledged Defence Fund

The European Defence Fund (EDF) was launched in 2017, by then Commission President Jean-Claude Juncker. The goal of the initiative is to support increased interoperability as well as finance defense research and development (as we will see in the next section, the fund will feature a *Research Window* and a *Capability Window*, to this regard). The initial budgetary allocation – which came in the middle of the 2014-2020 Multiannual Financial Framework – consisted in a small (test) envelope of €90 million for research and €500 million for development (spread over the 2017-2019 and 2019-2020 periods respectively, see Figure 2.7). The Ocean2020 project (for integrated maritime missions) received €35 million for research purposes, whereas the Eurodrone (MALE RPAS, which will be the object of our case study) received €100 million for its development phase. These two pilot projects provided interesting instances for illustrating some of the potential that a full-fledged EDF might be able to unleash.



DEFENCE SPENDING 2017-2020

Figure 2.7. The initial commitments of the (precursory) EDF. Source: EU Commission Factsheets.

The next Multiannual Financial Framework was – and is – expected to increase these figures in a relevant way, yet we are still navigating in uncertain waters due to delays and cuts caused by the current crisis related to the Covid-19 pandemic. The 2018 Commission's proposal for the 2021-2027 period budget had mentioned a \notin 27.5 billion allocation for "Security and Defence," of which very large fractions were going to be allocated to the *European Defence Fund* (\notin 13 billion throughout the 7-year period) and *Military Mobility* (\notin 6.5 billion).¹⁶² Nonetheless, the 'negotiating boxes' of the Council of the EU had set lower amounts (\notin 6 billion for the EDF and just \notin 2.5 billion for Military Mobility).¹⁶³

On top of these doubts forwarded by many Member States came the current Coronavirus "Black Swan" - so to speak - which posed further obstacles in front of European Defence's growth. We thus take this subsection as an opportunity to pose a caveat about the growth margins of defense cooperation in Europe, since the post-Covid19 landscape will probably require some cuts on the part of the EU envelope. Yet the Commission remains determined to maintain a relevant budget for the EDF, which was allocated €8 billion by the recent (May 2020) proposal, and to keep military Military Mobility alive with a €1.5 billion allocation, (part of the new Resilience, Defence and Security envelope should be financed via Next Generation EU).¹⁶⁴ These figures are yet to be secured, but they demonstrate the Union's commitment to common security and defense. This commitment is particularly important because the industry is still suffering from the consequences of the global financial crisis, and a lack of funds in the years to come would determine a long-term innovation and capability deficit for the industry of the Old Continent. (On the shorter term, the Covid-19 crisis could hurt investments and lead to a fall in exports). If these figures were to be confirmed, they would represent a major victory for European defense in times of such acute crisis (when, as it usually happens with similar circumstances, defense budgets are among the first targets for austerity measures). On the other hand, even a further cut on the May 2020 proposal, would not compromise the entire design of European defense, since its initiatives will also be supported via Member States' contributions and are mutually-reinforcing with regard to other efforts such as the Horizon Europe research plan, which (according to the May proposal) should still receive an envelope exceeding €105 billion (additionally, the

01aa75ed71a1/language-en/format-PDF/source-120904996

¹⁶² European Commission, "EU Budget for the Future: Proposal of the Commission for the Multiannual Financial Framework 2021-2027," *Volume 1*, 29, https://op.europa.eu/en/publication-detail/-/publication/1888be65-743a-11e8-9483-

¹⁶³ To this regard see Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 8.

¹⁶⁴ European Commission, "The EU budget powering the recovery plan for Europe," *Eur Lex*, May 2020, <u>https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0442&from=EN</u> The EDF will probably be scaled back to €7 billion.

Strategic Investment Facility – a new component of the *InvestEU* program with the purpose of kickstarting the recovery of certain businesses, in a period of large investment gap – should intervene to boost and protect crucial value chains of the EU, and may thus involve the defense industry as well, since it represents part of the EU's economic resilience).¹⁶⁵

The European Defence Fund is particularly crucial because of the potentiality demonstrated by the current stage and the further possibilities that may be developed by a full-fledged version of such initiative. We now turn to those sets of potentialities.

2.3.2 The European Defence Fund and its Mechanisms

The European Defence Fund regulation proposal follows the footsteps of two "precursor" programs that have already been described: the Preparatory Action on Defence Research (which allocated €90 million to research projects in the field of defense throughout the 2017-2019 period), and the European Defence Industrial Development Programme (which addressed a budget of €500 million to development projects in the 2019-2020 biannual period). Certain details of the proposal are still debated, yet we can review and analyze the economic rationale and basic framework of the EDF architecture.¹⁶⁶

The main turning point is provided by the *modus operandi* of the new initiative: "for the first time in the history of communitarian institutions, funds from the common *budget* of the Union will be expressly addressed to the defense sector."¹⁶⁷ This represents an important shift in the kind of action taken by the EU, a shift due to a series of pressing necessities in terms of defense industrial (as well as operational) inadequacies, which are now threatening the continent.

The shortcomings of the European defense industries are numerous to this day, and many of them have been explored in depth by previous sections. They include: the problems of fragmentation, the ineffectiveness of the previous forms of attempted European cooperation, the constantly increasing costs of defense products (especially in

¹⁶⁵ Ibid. To give more details, the Commission proposal would allocate $\notin 2.5$ billion to the Internal Security Fund, and more that $\notin 15.5$ billion to Resilience and Crisis Response (a huge increase, compared to the initial $\notin 1.2$ billion proposal). By contrast, there is no mention of the European Peace Facility (EPF) to finance Common Foreign and Security Policy in its external action with military and defense implications: this initiative (of up to $\notin 8$ billion, financed by MSs) was in fact supposed to remain off-budget, but at the current stage it is not cited throughout the text of the Commission's proposal.

¹⁶⁶ European Commission, "Proposal for a Regulation of the European Parliament and of the Council establishing the European Defence Fund," *Eur Lex*, June 2018,

terms of R&D), the frequent and widespread cuts in terms of defense spending by States (again, especially in terms of R&D), a stagnant conjuncture in terms of capability development. As underlined by Gueorgui Ianakiev, the EDF was conceived as a remedy to this peculiar set of problems.¹⁶⁸

In fact, the EDF perspective allows to tackle fragmentation by posing rules that incentivize Member States, nay different firms operating in different MSs, to cooperate: a project can be supported by the Fund only if it sees the participation of at least three companies, from three different States. This tries to take European incentives to the next level, after the rather dubious results of the previous forms of European defense cooperation (especially the Directives of the "Defence Package" discussed by section 2.1.3 and the Collaborative defence procurement). As shown by Figure 2.8, the fraction of European Collaborative defence procurement – promoted by the EDA – remains quite limited to this day: as underlined by Ianakiev, the 35% target of the Agency (as a fraction of total defense procurement spending by Member States) is still far from being achieved, while the gap is actually increasing (particularly due to an increase in general procurement spending).¹⁶⁹ To this regard, the cited paper also points out the important fact that "[f]alling levels of defence spending have limited the resources available to launch new programmes and Member States have often prioritised the short-term objective of supporting their industries through national spending."¹⁷⁰

 ¹⁶⁸ Gueorgui Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," *Armament Industry European Research Group*, Policy Paper no. 48.
¹⁶⁹ Ibid, 10.



Figure 2.8: European Collaborative Defence Procurement. Source: Ianakiev, EDA.

The latter point takes us to the problems related to Research, Development and innovation, which the EDF is trying to address. The notable trend of *cost escalation*, which in the defense sector significantly exceeds general inflation rates, causes the States to cut certain investments especially on R&D/R&T, this is also where the EDF should intervene, thanks to its dedicated *Research Window*.¹⁷¹ Funds especially dedicated to research, even for "disruptive" technology, may be an effective remedy to the short-sighted approach, used by States. If the damages to R&D pointed out by section 2.1.1 persist, Europe will lose its relevance in the field of defense innovation: costs will increase while the single MSs remain unable to individually fund the most significant projects (and also being pushed to further downsize R&D expenditure by the aforementioned, short-term logic). European defense industries are still on a rather good spot in terms of innovation, thanks to investments which had been undertaken several years ago: "success is to a large extent rooted in technologies developed over the past decades," and this kind of lagging effect may mean a difficult future for the next generation of products, when cutting-edge countries may be able to consistently surpass European technologies.¹⁷²

Here the EDF initiative would most likely be able to make a difference, since – as also pointed out by Ianakiev – it may unleash a share of funds "second only to France's,

¹⁷¹ In chapter 1, we referred to cost escalation by mentioning the so-called "Laws" of Augustine.

¹⁷² Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial

Collaboration," 5.
and it will exceed the combined R&D spending of all remaining EU Member States."¹⁷³ Now, the mentioned calculations could not predict the cuts that will hit European defense following the Covid-19 crisis; nonetheless, it is still important to mention this kind of reasoning, because this is the point where the Fund could and should actually lead to a turning point. National budgets will remain absolutely predominant in terms of absolute weight, but the European ones shall pursue a more strategic, structural and long-term approach, one particularly concerned – among its priorities – with the innovation perspectives.

Moreover, the strategic nature of the EDF is highlighted by its mechanisms for resource allocation. Let us describe certain points envisioned by the regulation proposal. A *consortium* trying to obtain financial support via the EDF will have to feature – as we have briefly mentioned – a minimum of three firms from three different Member States. Projects proposal are then assessed on the basis of certain criteria mentioned by article 13 of the regulation: among these are the disruptive potential of the proposed technologies, the "contribution to the innovation and technological development of the European defence industry," alongside "contribution to the creation of new cross-border cooperation between legal entities" with a specific focus on SMEs.¹⁷⁴ The cooperative rationale does not entail a lack of strategic possibilities for the States, that will have to co-finance the projects, someone has already noticed that:

the recipient of communitarian subsidies are formally firms, and not the States; yet the subjects benefited, from a macroeconomic point of view, by the financial support of the Union will be the States where those firms operate.¹⁷⁵

This is a relevant point, implying that States should be prepared to wisely co-invest in the projects. The strategic valence of this aspect is multifaceted: it also provides a constant incentive to cooperation via States' financing. This is a crucial feature of the mechanism of the Fund: on the one hand, it should stimulate MSs to invest and cooperate in an efficient way, on the other, it "limit[s] significantly the risks that EDF funding

¹⁷³ Ibid, 16.

¹⁷⁴ European Commission, "Proposal for a Regulation of the European Parliament and of the Council establishing the European Defence Fund," article 13, para. 1. Projects at the Development stage must also guarantee common requirements to avoid interoperability problems (this is another key element in avoiding non-standardization and lack of interoperability).

¹⁷⁵ D'Ubaldi, "Il Fondo Europeo di Difesa: Il ruolo dell'Italia," 28.

crowds-out national spending."¹⁷⁶ Therefore, the Fund – as it had been conceived by the Commission – acts to support, and not to substitute, national plans and budgets; additionally, the Fund's mechanism should strategically allow it to self-reinforce itself by leading States to co-invest in the projects.¹⁷⁷

In general, economic support will be secured on a competitive basis. Now, let us give some of the envisioned figures in terms of percentage financing for different types of projects (on top of these, different bonuses may then apply, see below). According to the proposal, all activities related to the R&T phases of projects are eligible for a 100% financial support from the Fund.¹⁷⁸ For development, funding ratios are generally lower: the rates "vary between 20% and 100% of the eligible costs depending on the particular phase that is supported and on the applicability of funding rate bonuses."¹⁷⁹ To be more specific, we should also note the formerly mentioned phases (i.e. those following initial R&T) can receive a 20% financial support in the case of prototyping activities, whereas they are eligible for an 80% funding rate in the case of test, qualification and certification.

Bonuses apply to projects which see the participation of SMEs and mid-caps, especially if these partnerships are cross-border: an effort in the attempt to foster cooperation by enhancing the smooth interaction of European clusters of companies. In these instances, "the bonus percentage is proportional to the share of costs related to the participation of the SMEs, not exceeding the 30% fraction, in any case," whereas another kind of bonus (10%) is available for proposals which are related to PeSCo projects.¹⁸⁰

Another innovative element of the EDF's approach is that it is structured to overcome the *juste retour* principle, which inhibited many of the previous European efforts towards collaborative defense. "Juste retour" practices are based on the idea that any Member State should basically get back a proportional return for its budgetary efforts. The problem with such perspective applied to the common European industrial strategy for the defense sector is that it may be opposed to a competence-based mechanism. In other words, "labor allocation" – so to speak – runs the risk of being managed, first and

¹⁷⁶ Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," 17.

¹⁷⁷ As also pointed out by Ianakiev (Idid.), "For a yearly investment of EUR 1.27 billion from the EU budget, the amount of the necessary co-founding will range between 0 and more than EUR 5 billion. The EDF has thus the potential to also structure and guide a very significant part of the defence development spending of the Member States."

¹⁷⁸ European Commission, "Proposal for a Regulation of the European Parliament and of the Council establishing the European Defence Fund."

¹⁷⁹ Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," 16-17.

¹⁸⁰ D'Ubaldi, "Il Fondo Europeo di Difesa: Il ruolo dell'Italia," 30.

foremost, on a proportional rationale vis-à-vis initial financial contributions (juste retour), instead of following a division based on the peculiar advanced competences of each partner. This point is particularly important, if the Union wants to secure relevant "efficiency gains", and thus get important advantages in terms of pay-offs.¹⁸¹

A further point, which is still being debated by the Member States is the one concerning participation to the projects by States which are not part of the EU. According to the current proposal, members of the European Free Trade Association (EFTA), which are also part of the European Economic Area (EEA) should be eligible for the Fund.¹⁸² Further discussions are still ongoing to find an accord on possible participation for US-based businesses as well.

This and other points are yet to be agreed upon; nonetheless, the potentially groundbreaking changes brought about by the EDF are quite evident. The described mechanisms should help the Union to foster the innovative power of its defense industrial base (sustaining Research & Development), create a more cohesive set of cross-national industrial clusters (reaping the benefits of a varied set of peculiar competences), and find common ground both in an economic and operational sense (maximizing not only collaboration per se, but also its possibilities to provide *efficiency gains throughout shared supply chains*).

In these difficult times, even a downsized version of the European Defence Fund would constitute a major victory. We opened this thesis by mentioning the "failing forward" model of European integration: an integration that is – almost paradoxically – thriving throughout a series of stressing phases. This may well be another instance in the series of the concretizations of that model. As mentioned by the previous sub-section, the European defence and security budget for the 2021-2027 Multiannual Financial Framework (MFF) is sure to receive a relevant cut. Nevertheless, the simple fact that European defense is going to survive in such a trying conjuncture is a quite evident demonstration of the importance and necessity of this plan, which go beyond the wishful thinking of the Junker and Von der Leyen Commissions. Indeed, the necessity is a structural and persisting imperative, based upon the urgency of creating a stronger financial support and a more cohesive industrial base for competitive innovation and efficiency maximization.

¹⁸¹ Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," 13-14.

¹⁸² European Commission, "Proposal for a Regulation of the European Parliament and of the Council establishing the European Defence Fund," article 5.

2.4 Case Study: The Eurodrone (European MALE RPAS) Project

2.4.1 Origins and History

The European Medium Altitude Long Endurance Remotely Piloted Aircraft System (MALE RPAS), also known as Eurodrone or EuroMALE, is a European collaboration project for conducting the research and development phases towards a continental Unmanned Aerial Vehicle (UAV). The common initiative would allow European nations to increase their defense independence, since at the moment the countries that took part in the project rely on the use of American UAVs (such as the *GA-ASI Predator* and the MQ-9 Reaper). Due to this peculiar strategic relevance and the large efforts required, the MALE RPAS has effectively become a flagship project of European defense. With this case study we aim to describe the history of the initiative alongside its mechanism, potential, and remaining difficulties. Financial figures are already available only for the Research part of the initiative, yet we will be able to describe the general rationale of the project, the role of European collaborative platforms and agencies, EU Commission's financing, and – last but not least – the kind of cooperation that may be expected from this sort of European cross-national consortia.

The MALE RPAS project was started in May 2015 exactly by the three nations which were described in more detail by the last part of chapter 1: France, Germany, and Italy (with Germany acting as the leading country, to coordinate the group). Spain joined the project shorty after. That year, "the MALE RPAS Programme was integrated into OCCAR [the Joint Organisation for Armament Cooperation] and the Definition Study contract was signed on 26 August 2016."¹⁸³ Since then, OCCAR took charge of the supervision of the program. A two-year study began in 2016, with a consortium composed by companies of the three main partners: *Airbus Defence and Space* (which, indeed, is a European group), *Dassault Aviation* (a French company), and *Leonardo* (an Italian company); to this day *Airbus* remains the prime contractor, with *Dassault* and *Leonardo* acting as major subcontractors. That original plan foresaw a first flight for "early 2023,"

¹⁸³ OCCAR, "MALE RPAS – Medium Altitude Long Endurance Remotely Piloted Aircraft System," *Programmes*,

yet – as will be explained by the next sections – the project is doomed to encounter delays (and perhaps even suspension).¹⁸⁴

Interesting, the MALE RPAS is a good example of how European cooperation can be advantageous, while at the same time difficult to completely carry out. On the one hand, the project saw collaborative research, an efficient cross-national partnership, and a role for OCCAR, PeSCo (and the EDA), it also received financial support from the Commission through the European Defence Industrial Development Programme (EDIDP) and may get further resources from the full-fledged European Defence Fund (EDF); on the other hand, the Eurodrone is afflicted by the difficulty to agree on the final characteristics of the product – a divergency that is slowing down and endangering the very feasibility of the initiative.

2.4.2 Characteristics and Opportunities

%20month.

The Eurodrone was conceived as a heavy Unmanned Aerial Vehicle (with a maximum weight of 11t) for use in non-segregated spaces, this required – among other things – two twin engines for technical and redundancy reasons. In particular, "[t]he Participating States endorsed in July 2017 the baseline configuration 'twin-engine turboprop' for the further Definition Study activities."¹⁸⁵ The vehicle should be developed with two different configurations: an armed version and an ISTAR (Intelligence, Surveillance, Target acquisition, and Reconnaissance) one.

To begin with the international consortium was quite cohesive, with *Airbus* working on the main structure of the UAV, *Dassault* in charge for the systems, and *Leonardo* focusing on the equipment of the vehicle. This "division of labor" – so to speak – should be considered as the first advantage of a cross-border project of this sort, with the major contractors pooling their technical excellence from specific areas. To the Prime contractor and major subcontractors, we shall then add several minor subcontractors

¹⁸⁴ Chris Pocock, "Euro-MALE Unmanned System Study Is Finally Launched," *AINonline*, October 4, 2016, <u>https://www.ainonline.com/aviation-news/defense/2016-10-04/euro-male-unmanned-system-study-</u>

finallylaunched#:~:text=A%20long%2Dawaited%20definition%20study,System)%20finally%20started%20last

¹⁸⁵ OCCAR, "MALE RPAS – Medium Altitude Long Endurance Remotely Piloted Aircraft System."

working on the subsystems of the drone: for example, "Germany's Hensoldt [...] designs avionics."¹⁸⁶



Figure 2.9: European MALE RPAS. Source: AIRBUS.

A second advantage was the pooling of funds for research by the three starting nations of the initiative and Spain: "the Eurodrone project required an initial study of \in 60 million (US\$67m) over two years. Germany paid for 31% as the leader nation while the three other participating countries each shouldered 23% of the sum."¹⁸⁷ As we mentioned in previous sections, shared research projects are widely beneficial since they allow participating States to commit only a fraction of the total resources, thus allowing to reduce risk-taking vis-à-vis the possibility of failure (i.e. the project ending up in the so-called "valley of death," and the financiers seeing their investments turn into *sunk costs*).

Thirdly, the case of the EuroMALE is also a good exemplification of the intervening role of the European agencies and international organizations previously analyzed. As we have mentioned, the project became an OCCAR "programme" in 2016; subsequently (in November 2018), the project was also included in PeSCo (by the European Commission) to facilitate financing. The PeSCo "priority" pursued by the Eurodrone was, of course, that of "air superiority." PeSCo's effectiveness has often times

¹⁸⁶ Lucie Béraud-Sudreau, Yvonni-Stefania Efstathiou and Conor Hannigan, "Keeping the momentum in European defence collaboration: an early assessment of PESCO implementation," *International Institute for Strategic Studies*, May 2019, 7.

https://www.iiss.org/blogs/research-paper/2019/05/pesco

¹⁸⁷ Ibid, 9.

being questioned, yet the Cooperation can surely help to support already existing projects: "PESCO for now is mainly an extraneous and reassuring label, a means to provide extra funding to existing programmes," acting "as a mechanism for bringing more countries on board."¹⁸⁸ The Eurodrone – by becoming a PeSCo project – was thus able to enlarge its basis of participating Member States (pMS), as well as that of its financial resources (see next point). Czech Republic's involvement is a clear example of the former kind of enlargement with the nation joining the project as a PeSCo participating MS: the Czech company *Aero Vodochody* became another subcontractor of the MALE RPAS, other countries are currently observers (these include Greece, Belgium, Poland, Portugal).¹⁸⁹ Moreover, the European Defence Agency (a branch of the PeSCo secretariat) received a coordinating role for the RPAS:

While OCCAR managed the procurement aspects of the programme, the EDA for its part is in charge of determining how the Eurodrone can be integrated into air traffic in European skies. It therefore manages the development of a mid-air collision avoidance system.¹⁹⁰

Fourth, as anticipated, the platforms of the EU also provided the possibility for additional funding, to the point that EuroMALE has become one of the "flag-ship" projects of European defense (the other one being the ESSOR interoperable and secure military communications project). To be more specific, the MALE RPAS received €100 million from EDIDP resources with direct award, representatives of the European Commission considered the allocation as an act "to support the Eurodrone, a crucial capability for Europe's strategic autonomy."¹⁹¹

Therefore, the Eurodrone is a fine instance to show how European shared initiatives, Member States, EU agencies and tools, and cross-border consortia of companies can work together towards common goals. Nonetheless, the road to reaching

https://ec.europa.eu/growth/content/european-defence-fund-track-%E2%82%AC525-million-eurodroneand-other-joint-research-and-industrial_en

ESSOR received €37 million through the EDIDP.

¹⁸⁸ Ibid, 2, 7.

¹⁸⁹ Ibid, 7.

¹⁹⁰ Ibid.

¹⁹¹ European Commission, "European Defence Fund on track with €525 million for Eurodrone and other joint research and industrial projects," *Press Release* (Internal Market, Industry, Entrepreneurship and SMEs), March 19, 2019,

successful development still remains perilous even after the Research phase is competed: we now turn to these further difficulties, which are threatening the Eurodrone as well.

2.4.3 Problems and Disagreements

The Eurodone project case study allows us to highlight two main problems: one dealing with European financing, and the other with persisting disagreements between participating Member States concerning the specific characteristics of the vehicle (which are ultimately related not only to the strategic military use of the MALE RPAS, but also – if not especially – to the commercialization and trade opportunities the final product might provide to participating countries).

Firstly, the European resources addressed to the project saw an initial commitment of \in 100 million via an EDIDP direct award. *Prima facie*, the money allocation may seem quite limited, but one ought to consider that it may be supported by further funding from the full-fledged EDF, and that the first \in 100 million tranche must also be put into perspective with regards to the total "precursor" initiatives' assets. What we mean by the latter point is that the biennial EDIDP had a total endowment of \in 500 million: indeed, the two "flagship" projects received a major fraction of that total endowment. The EuroMALE, on its own, was afforded a fifth of the overall amount, whereas if we include the other flagship project (i.e. ESSOR), which received \in 37 million, we have more than 25% of the total funding (for the development section) flowing into just two projects, creating a trend that led someone to question the resource-draining effect of major projects vis-à-vis minor (yet very significant) initiatives conducted as PeSCo projects:

Direct funding could be allocated to the Eurodrone and ESSOR projects, with \notin 137m out of \notin 500m (US\$154m out of US\$561) for 2019-20 dedicated to what the European Commission calls 'flagship initiatives.' In other words, more than 25% of the EDIDP would be assigned to only two projects. This [...] insight into the link between PESCO and the EDF also sheds light on the rationale for why some pre-existing projects sought to acquire the PESCO label.¹⁹²

Indeed, as seen in the two previous sections, the EuroMALE did not start as a PeSCo project, but became part of that Cooperation platform at a later stage. Similarly, the

¹⁹² Béraud-Sudreau, Efstathiou and Hannigan, "Keeping the momentum in European defence collaboration: an early assessment of PESCO implementation," 10.

authors of the passage cited above go on to say that even the ESSOR initiative saw an analogous destiny: the project had started as the "object of a contract between OCCAR and six European defence companies, grouped in the consortium a4ESSOR, since 2009," only subsequently did the initiative acquire the PeSCo project label.¹⁹³ This type of dynamic casts doubt on the viability of several PeSCo projects, and would even seem to relevantly promote programs that had a non-PeSCo origin.

Secondly, and most importantly, the Eurodrone is also facing internal problems, dealing with the harmonization issues (i.e. the capacity to find a shared compromise starting from different preferences promoted by different participating Member States). Major partners of the initiative (particularly, Germany and France) still disagree about certain specifics for the final vehicle. As we anticipated, the original idea (endorsed by leader nation Germany) had foreseen a very heavy (11t), twin-engine turboprop UAV. Those characteristics would make the drone redundant and thus not only more resistant (e.g. for turbulence, adverse weather conditions, thunderstorms etc.), but more reliable for domestic and urban deployment. On the other hand, the French Ministry of the Armed Forces (and the French Senate) consider the currently proposed model as too heavy, exceedingly expensive, and thus very difficult to export.¹⁹⁴ The difficult harmonization process was the cause of the mentioned delays for the development phase (initially, development was expected to be completed by 2025, then the timeline shifted to 2027, and possibly the very late 2020s), and it is now keeping the project in stall. At the time of this writing, the participating countries' governments have not signed the development contract, thus endangering the project at large.

This latter point is particularly significant because it illustrates the difficulties of common defense and industrial efforts. It is true that several countries, with their respective industrial champions can pool resources and expertise usually unrivaled by single-nation consortia. Nonetheless, the difficulties to find crucial agreements tend to slow down and even threaten the general success of a project. We discussed at length the potential advantages of a common perspective, yet that long *excursus* should not lead the reader to believe that multilateralism is an obvious and necessarily viable option, because – in reality – this is seldom the case. It is also difficult to predict the next unfolding of the

¹⁹³ Ibid.

¹⁹⁴ Dominic Perry, "European MALE UAV will not arrive until late 2020s: OCCAR," *FlightGlobal*, August 20, 2019,

https://www.flightglobal.com/military-uavs/european-male-uav-will-not-arrive-until-late-2020soccar/133982.article

project: the German Ministry of Defence – from its part – expects the other parties to sign the contract in 2020, but France seems to still oppose the heavy solution envisioned so far, and thus stalls the process.¹⁹⁵ This turn may lead to a possible renegotiation or even endanger the project in general.

Therefore, the case of the Eurodrone is still featuring lights and shadows: it is a rather effective representation of the margins for European defense, potential efficiency gains are significant, common platforms already exist, yet it remains difficult, for Member States, to agree on how to extract those efficiency gains.

To conclude, a certain level of skepticism is almost mandatory, since the continent is at risk of witnessing the sinking of its – arguably – most important "flagship" project. In describing the main European initiatives and programs that are currently being carried out, we have thus noticed that many of these tools are yet at an initial, sometimes suspended state, but still able to considerably contribute to the value added of the defense industrial base. Albeit the evident difficulties and dangers must be recognized, they do not – as a matter of principle – annul the possibilities that European cooperative efforts might unleash, especially in terms of innovation and the capacity to achieve it via more effective industrial policies. It is to these aspects that we shall now turn with chapter 3.

¹⁹⁵ Ibid.

Chapter 3

Innovation Perspectives for the Defense Sector

The present chapter discusses the innovation-related aspects of the defense industry, and applies them to the European context, which is also object of a comparison with the United States' scenario.

Section 1 provides the reader with a general analysis concerning innovation systems, and how such concepts apply to the defense industry. Particular attention is addressed to the relation between innovation and competition; furthermore, specific subsections scrutinize the role of risk-taking in defense innovation, and the general evolution trends that Defense Industrial Bases (DIBs) are encountering in the twenty-first century.

Section 2 introduces the peculiar industry of the United States, posing the bases for a more practical scrutiny of defense innovation dynamics, as well as allowing a fruitful comparative analysis vis-à-vis the European scenario. For instance, the United States is the perfect case to provide a concrete example of a more integrated industry, but also a country that features interesting and detailed data to study Mergers & Acquisitions (M&A) within the aeronautics and defense market (something which is explored in subsection 3.2.2), plus a context where the value of Research & Development (R&D) and the role of regulatory agencies have rarely been underestimated (something which is pointed out in subsections 3.2.3 and 3.2.4 respectively).

Section 3 closes the chapter by applying the aforementioned points to the European case at the center of this thesis. These last sub-sections complement the comparative analysis with the United States, illustrate the possibility of fostering innovation by integration and, lastly, expose possible policy recommendations for European, national and supranational, policymakers.

3.1 How Defense Industries Evolve

3.1.1 The Conceptual Bases of Innovation

Following a framework constructed by Freeman et al., we might consider their general definition of innovation:

Innovation can be understood broadly as the creation and application of new products, services and processes. It encompasses new technology as well as new ways of doing things.¹⁹⁶

We might also distinguish two main types of innovation: namely, "radical" and "incremental" innovation, with the latter "involv[ing] the refinement over time of existing products and processes to provide gradual improvements in quality or value."¹⁹⁷ While, on the other hand, radical innovation tends to lead to what we have referred to as "disruptive" effects, in the previous chapters.

Furthermore, one ought to realize that innovation systems are very complex in nature – and this holds true not only when they are set in an international context (such as the European Union), but also when they are strictly national in character. To this regard, the aforementioned model states:

Systems [...] account for variables such as: the R&D structure of a region or country; available skill sets within a society or locale; access to funding and investment capital available; and the surrounding policy environment. They also involve a range of actors playing complementary and interlinked roles in the innovation process.¹⁹⁸

The authors affirm that the model is general, but apply it to the defense sector, hence it should be considered as particularly suited for our specific field of analysis. Moreover, it should be added that within the realm of defense a strategic understanding and – subsequently – a strategic way of approaching and utilizing innovation systems is peculiarly pertinent. This is due both to the sensitivity of the sector and to the fact that "unsolicited innovation does occur in defence but is very much the exception rather than the rule because of the significant timescales, costs and risks involved."¹⁹⁹

Innovation systems feature several key actors identified by Freeman et al.: alongside the specific firm, there are usually "other businesses and firms, [...] universities

¹⁹⁶ Jon Freeman, Tess Hellgren, Michele Mastroeni, Giacomo Persi Paoli, Kate Robertson and James Black, *Innovation Models: Enabling new defence solutions and enhanced benefits from science and technology*, (Santa Monica: RAND Corporation, 2015), 9. Also see Michael E. Porter, *The Competitive Advantage of Nations*, (New York: The Free Press, 1990).

¹⁹⁷ Freeman et al., *Innovation Models: Enabling new defence solutions and enhanced benefits from science and technology*, 9.

¹⁹⁸ Ibid, 10.

¹⁹⁹ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 7.

and public research organisations, [...] government and public bodies [...] investors [...] intermediary actors who provide other interactions that facilitate the innovation process, including actors such as suppliers, patent lawyers, technology transfer organisations and other service providers."²⁰⁰ To complete their general framework, the authors enumerate "eight key interactive factors" involved in innovation processes, they are: 1) Talent, 2) Capital, 3) Knowledge assets, 4) Culture, 5) Structure, 6) Drivers, 7) Infrastructures, and 8) Networks/Connections.²⁰¹ Notwithstanding its general and theoretical character, the mentioned model is a good introduction to innovation systems in the field of defense: it accounts for the full variety of actors and factors involved, providing a useful starting basis to tackle the last part of our thesis, and it assumes several features of the economic literature concerning innovation studies (see next sections).

The previous chapters have already anticipated some seminal points, such as the characteristics and role of competition in the defense sector, or the point of risk-taking with regards to Research & Development. We must stress that these aspects are particularly related in the field of defense, since "most businesses cannot afford to spend billions on R&D from their own shareholders' funds in the hope that government may wish, in the future, to buy products [since] risks of failure are simply too great for companies to invest in this manner."²⁰² Therefore, innovation is the one facet that best illustrates the important role of public investments in defense; to this regard, States' involvement may be direct or indirect. In other words, it may also be a reflection of previous public involvement, perhaps even conducted in other sectors, as the increasing cross-pollination of military and civil technologies is now demonstrating. For instance, the mentioned dynamics were highlighted by Mariana Mazzuccato, in her studies concerning the "Public vs. Private Sector" cleavage.²⁰³ A good example of this is noted by Heidenkamp et al., who observe that "[Mazzuccato's] work includes a case that demonstrates how Apple has made great use of defence-funded technologies."204 Moreover, these influences can happen in the opposite direction as well: it has correctly

²⁰⁰ Freeman et al., *Innovation Models: Enabling new defence solutions and enhanced benefits from science and technology*, 10. As the authors specify (ibid.), investors "may take the form of private venture capitalists and angels, public sector investment bodies, or large institutional investors such as pension funds." ²⁰¹ Ibid, 11.

²⁰² Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 67.

²⁰³ Mariana Mazzuccato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*, (London: Anthem Press, 2013).

²⁰⁴ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 28.

been underlined that the relation between civil-military spin-offs and spin-ins has encountered a quite clear inversion over time.

In the past, military R&D funded *spin-off* developments in computer technology, touch screens, global positioning systems, freeze dried food, [etc.]. Today, however, the defence development and procurement has become extraordinarily complex and interconnected and civilian firms in the high-tech sector are of importance given their pioneering work on spin-in technology areas such as artificial intelligence, robotics, miniaturisation and additive manufacturing.²⁰⁵

This general introduction to innovation should provide the reader with the basic coordinates of defense novel creation and an initial understanding of the peculiarities of this field. In the next sections, we will provide a more detailed analysis of competition and risk-taking in the realm of innovation.

3.1.2 Innovation and Competition

In section 1.2, we briefly referenced the potential positive effects which competition may have on innovation. This is not (always) necessarily the case, since – in defense as in many different industries – "[c]ompetition has differing effects upon innovation depending upon the relative strength of the competing firms;" more specifically, "when competing firms are of equal strength then innovation is incentivized [by higher competition]; when firms are of diverse strength [...], competition may reduce the incentive for smaller firms to invest in innovation."²⁰⁶ The cited authors get this insight from an economic model developed by Aghion et al.: this latter research deserves further attention.

The model finds an empirical relationship with an "inverted-U" shape between competition and innovation, further, it theoretically explains and supports the conclusions consistent with the data.²⁰⁷ The basic idea behind the model is that firms that are lagging-behind will be discouraged from innovating if competition increases, whereas firms in leveled industries (particularly those within "neck-and-neck" industries) will be

²⁰⁵ Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 25.

²⁰⁶ Freeman et al., Innovation Models: Enabling new defence solutions and enhanced benefits from science and technology, 29.

²⁰⁷ Philippe Aghion, Nicholas Bloom, Richard Blundell, Rachel Griffith and Peter Howitt, "Competition and Innovation: An Inverted-U Relationship," *Quarterly Journal of Economics* 120, no. 2 (2005): 701-728.

stimulated to innovate more as competition increases. Behind this point there is the rationale that "innovation incentives depend not so much on postinnovation rents [...], but upon the *difference* between *postinnovation* and *preinnovation* rents of incumbent firms," [emphasis in the original]:

[M]ore competition may foster innovation and growth, because it may reduce a firm's preinnovation rents by more than it reduces its postinnovation rents. In other words, competition may increase the incremental profits from innovating, and thereby encourage R&D investments aimed at 'escaping competition.' This should be particularly true in sectors where incumbent firms are operating at similar technological levels; in these 'neck-and-neck' sectors, preinnovation rents should be especially reduced by product market competition. On the other hand, in sectors where innovations are made by laggard firms with already low initial profits, product market competition will mainly affect postinnovation rents, and therefore the Schumpeterian effect of competition should dominate.²⁰⁸



Figure 3.1: Innovation and Competition. Source: Aghion et al. (2005).

²⁰⁸ Ibid, 702.

It is thus worth noticing that – theoretically – there are different kinds of innovation-driving rationales behind the curve represented in figure 3.1. On the one hand, there is the standard effect of strong competition inhibiting innovation (see the decreasing section of the inverted U), which is a trend compatible with previous models for product market competition (PMC).²⁰⁹ On the other hand, innovation is increased by two different kinds of effect: either via a "Schumpeterian effect" (fostering competition mainly via increased post innovation rents, typical of more disruptive forms of innovation), which sees competition introduced by the lagging-behind firms when the industry is "in the unleveled state where the Schumpeterian effect is at work on the laggard, while the leader never innovates;"²¹⁰ or by means of the "escape-competition effect" whereby "competition may increase the incremental profit in innovation;" (thus explaining the first part of the inverted-U curve, upward-sloping and middle sections).²¹¹

Within the industry of defense, both of the above mechanisms may apply, depending on the specific niches that are analyzed. It is now time to explore defense-related innovation.

3.1.3 Innovation within the Defense Sector

In a strictly strategic realm such as the defense sector, the first point to keep in mind is that "[c]ompetition and innovation are not ends in themselves, but rather are means to attain certain benefits in the context of weapon system design, development, production, and support."²¹² In the market for defense, the strategic use of competition must be managed in a careful way, since "[States] have to balance the often legitimate need for non-competitive tendering with their political preferences for increased competition."²¹³ Furthermore, we shall add that – under specific circumstances – competition possesses its own strategic value, since it may foster innovation gains (via the "Schumpeterian" and "escape-competition" effects described in the previous section).

²⁰⁹ For a case in point about previous models see, for instance, Avinash Dixit and Joseph Stiglitz, "Monopolistic Competition and Optimum Product Diversity," *American Economic Review* 67 (1977): 297-308.

²¹⁰ Ibid. 716, 720. Joseph Schumpeter, *Capitalism, Socialism and Democracy*, (London: Allen Unwin, 1943).

²¹¹ Aghion et al., "Competition and Innovation: An Inverted-U Relationship," 720.

²¹² Jeffrey A. Drezner, *Competition and Innovation under Complexity*, (Santa Monica: RAND Corporation, 2009), 31.

²¹³ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 40.

Defense innovation happens within an industry characterized by a peculiar degree of complexity, a *complexity* which is multifaceted and consistently increasing. Indeed, systems' complexity in defense has "three overarching dimensions": *Technical* complexity (i.e. that form of complexity related to "system functionality and capability"), *Organizational* complexity (i.e. the one related to "the structures and interactions of the government and industry organizations"), and *Environmental* complexity (i.e. the component due to "the political and economic context of the acquisition process, the threat environment, and the operational environment").²¹⁴ Overall complexity has not only been increasing, but also doing so at a much faster pace, if compared to the past: combat aircraft projects such as the Future Combat Aircraft System (FCAS) and the Joint Strike Fighter program (JSF, for the Lockheed Martin F-35) are probably the most evident exemplifications of this recurring trend.

Nevertheless, when we consider defense innovation, complexity is only one side of the equation. Competition, together with the resulting innovation, is also conditioned by some standard microeconomic conditions correctly enumerated by Jeffrey Drezner (e.g. "large viable industry base," "some degree of industry or product sector maturity," "product substitutability," "many programs," and "minimal barriers to entry").²¹⁵ These considerations lead the author to conclude that:

One of the more important observations is that factors affecting competition the most – fewer programs, budget pressures, industry consolidation – have little to do with complexity per se. Although complexity may change the nature of a competition by emphasizing large-scale systems engineering and integration rather than strict cost and performance variables, these other factors will still limit how competition can be applied in mature defense industry sectors. In contrast, complexity appears to have provided more opportunity for competition and innovation in relatively newer defense industry segments.²¹⁶

These conclusions point exactly to the kind of distinction anticipated at the end of the last subsection: the defense industry must actually be considered in terms of subsectors (sometimes – as we previously called them – niches, or *segments*) that feature different economic scenarios and, consequently, quite diverging innovation dynamics. In

²¹⁴ Drezner, Competition and Innovation under Complexity, 32.

²¹⁵ Ibid, 36.

²¹⁶ Ibid, 44.

general, it is true that "[f]irms remaining in the defense market are relatively larger than they used to be and are themselves more complex (vertically and horizontally)."²¹⁷ Nonetheless, many niches – especially those concerning subsystems and systems of systems (SOS) – allow opportunities for smaller firms, which are often able to explore newer and, sometimes, more disruptive technologies. Moreover, disruptive innovation is increasing its importance within the defense sector, due to the relevant cost escalation with "incremental defense R&D innovations within existing technologies trajectories [that] are increasingly difficult to achieve."²¹⁸ Hence complexity may, indeed, open-up opportunities for smaller and more flexible players (UAVs might, to some extent, fall within this category), whereas consolidated areas of the market (e.g. complete aircraft or naval systems) usually see a small set of players capable to deal with stronger budget restrictions and more established political sponsorship (to this regard, also see section 1.2).

3.1.4 Innovation and Risk-Taking: State-Firm Codependency

As we briefly mentioned with regards to Research & Development (R&D), innovating is an inherently risky endeavor. The economic basis of that risk is represented by the possibility of incurring in *sunk costs*, whenever investments in research do not lead to actionable knowledge/competences. The literature utilizes the term "Valley of death" for epitomizing the *locus* "where research projects perish without further development."²¹⁹



Figure 3.2: The "Valley of death." Source: Fiott (2019).

²¹⁷ Ibid, 40.

²¹⁸ Renaud Bellais and Daniel Fiott, "The European defense market: Disruptive innovation and market stabilization," *The Economics of Peace and Security Journal* 12, no. 1 (2017): 38.

²¹⁹ Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 4.

To successfully avoid the Valley of death a project must receive a sufficient amount of capital, as well as get the support of a good commercialization strategy.²²⁰ This is even more so in the defense industry, where the required amount of investing is usually very significant, and projects are especially difficult to carry out, in each and every sub-phase of the process. Thus, the industry of defense has developed two relevant tendencies: firstly, the one to receive above-average financing from public authorities and, secondly, a generally strong sponsorship which often ensures the firms *ex ante*, in terms of pre-established product acquisition. More specifically, governments have to promote firms' involvement via specific and targeted industrial policies:

[T]o engage industry in the research, development and production of highly technical, high-risk weapons systems, government has to sponsor both the initial research, the applicability of technological development and – sometimes post-competition – a high-risk development programme encompassing manufacture, military use, through-life support arrangements and eventual disposal. This starts, however, with government's commitment to the research expenditure that companies operating under financial constraints and treasury parameters cannot bear themselves.²²¹

As we notice from the passage above, there is a sort of life-long support involving both *ex ante* and *ex post* sponsorship by the State. Furthermore, one shall not be led to overestimate the role of the governments while underrating that of the companies. Rather, the relationship sees a peculiar co-dependency. The State is – as we have said – a fundamental sponsor for taking the amount of risk which is inescapable in this industry; nonetheless, "it ultimately rests with defence firms to develop and employ technical and technological means to produce capabilities," in an evident situation of information asymmetry, companies "are able to potentially extract extra profits by offering advanced

²²⁰ The innovation studies literature features other similar models such as the so-called "Darwinian Seas;" however, we find the "Valley of Death" to be a peculiarly useful and effective conceptualization of risk-taking in defense invention and innovation processes. Also see Philip E. Auerswald and Lewis M. Branscomb, "Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States," *Journal of Technology Transfer*, 28 (2003): 227-239.

²²¹ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 67-68.

technologies to militaries, yet the technical know-how possessed by firms is indispensable to the production of cutting-edge technologies."²²²

Therefore, if we look at defense innovation systems through the lenses of the general model described in section 3.1, we should emphasize the strong relation between government and firm. These two are certainly the most important "actors" (to use Freeman et al.'s category), further, they live in a sort of co-dependency, with the former necessitating the latter and vice versa. The company and the State are pushed by different "drivers," yet they both pursue their own interests: the former is motivated by the fact that innovation "provides additional profits by introducing a new design, service, approach or way of doing business that establishes a temporary monopoly in a given market," whereas the latter "is driven by the need to respond to public challenges," more specifically (in this sector), "by the primary demand of enhancing the [...] operational military capability."²²³

As the reader will already have grasped, market mechanisms are extremely distorted in a situation where policy activism from the States must be so intense and consistent. Nonetheless, the industry is still guided by economic rationales, which must be correctly considered when calibrating industrial policies. In section 3.2 we will have the chance to unpack some of these points for the United States industry, whereas in section 3.3 we will study the innovation opportunities for a reformed European defense industry. Now, let us turn to more specific characteristics of the Defense Industrial Base and examine how they affect innovation processes.

3.1.5 Innovation and Structural Aspects of the Defense Industrial Base

Nowadays, most countries need to update basic structural characteristics of their Defense Industrial Bases (DIBs): this is necessary, if they want to maximize their competitive and innovative edge in an age where industrial activities are being affected by a crucial shift in terms of methods and rationales. We thus might say that innovating the traits of the DIB is becoming the first challenge for allowing the industry to create cutting-edge products.

²²² Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 32.

²²³ Freeman et al., Innovation Models: Enabling new defence solutions and enhanced benefits from science and technology, 12.

The first structural problem affecting the Defense Industrial Base in European countries, as well as in North America, is the isolation they face, vis-à-vis other areas of the economy. As explained by Renaud Bellais and Daniel Fiott:

[T]he defense technological and industrial base (DTIB) can no longer operate in a vacuum whereby it develops capabilities with limited interaction with the rest of the economy. Many commercial sector innovations possess potential applications to defense systems.²²⁴

Additionally, if we look at the mutual crosspollination between defense and commercial sectors, we notice unprecedented possibilities of boosting defense via transferring civil technologies into it. As we pointed out in section 3.1.1, while the past was usually characterized by military spin-offs entering the civil markets, nowadays there is a different reality, one marked by a relevant quantity of spin-ins following an opposite path (i.e. technologies that move from the civilian sectors into the realm of defense, something which is especially true with innovative Information and Communications Technology).

The discussed shift would also require a change of paradigm for the defense industry, which has historically been driven by a "technology-centric" rationale, i.e. a logic according to which the players of the sector were pushed to foster technological innovation even if that meant overlooking the exorbitant cost escalation successfully captured by Augustine's Laws.²²⁵ In other words, we may affirm that such logic pushed the industry towards an increasingly pronounced bias in favor of quality at the cost of sacrificing quantity (think about Augustine's Law number XVI, referenced in section 1.2), the biased affected military planners as well as policymaking throughout the globe:

Specific market features lead armed forces to struggle with a situation in which raising costs result in a symmetrical reduction of quantity [...] A systematic bias in defense procurement favors quality even if this results in a reduced quantity of systems. An industrial environment is nurtured in which enterprises are encouraged to promote advanced technology rather than minimize unit costs. Much of the blame

²²⁴ Bellais and Fiott, "The European defense market: Disruptive innovation and market stabilization," 39.

²²⁵ Norman R. Augustine, *Augustine's Laws*, (Renton: American Institute of Aeronautics and Astronautics, 1997).

should be put on the technology-centric paradigm that defines the essence of this industry.²²⁶

Therefore, the necessity to change paradigm is also dictated by anachronistic mechanisms that require a pragmatic re-calculation of cost-benefit analyses towards a more effective way of nurturing defense innovation. Nonetheless, the paradigmatic shift is very difficult to actualize, especially when it comes to integrating commercial firms into the Defense Industrial Base. Firstly, there is a problem of public image: "it is not always easy for defense ministries to work with civilian firms owing to the fact that companies want to protect their image and perceived reputation."²²⁷ Secondly, there is a rather delicate issue concerning Intellectual Property Rights (IPRs): not only are civilian firms (obviously) eager to protect their IPRs, but they also "fear that governments may seize or restrict the use of technologies on national security grounds."²²⁸

At this point, the role of the regulator comes into play: States – and perhaps the EU in the European context – will have to create clear norms if they want to reap this type of efficiency gains: "it would [...] seem necessary that states set up industry and technology policies that support both the transformation of current defense-oriented firms and that attract purely commercial ones to the field of defense capabilities."²²⁹ The lowering levels of defense R&D expenditure are an additional incentive towards this strategy.

Behind this general re-alignment there would be a shift in terms of innovation dynamics as well. Whereas innovation used to be mostly incremental and based on impressive economies of scale, now it might be on the way to becoming more disruptive and flexible: namely, an innovation based upon new forms of technologies and – relatedly – upon an industrial base characterized by *lower barriers to entry*. The paradigmatic shift, according to Bellais and Fiott, might be linked to the possible dawn of Industry 4.0 on the sector of defense, "Characteristic features of Industry 3.0 [...] have become a legacy, or even an outright burden, as DTIBs generally do not rely on the best industrial approach and practices to address military needs," in such scenario:

²²⁶ Bellais and Fiott, "The European defense market: Disruptive innovation and market stabilization," 39.

 ²²⁷ Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 25.
 ²²⁸ Ibid.

²²⁹ Bellais and Fiott, "The European defense market: Disruptive innovation and market stabilization," 42.

[L]arge sunk costs associated with system conception and production set up due to the complexity and specificity of related technologies imply that efficiency relies on industrial techniques of mass production whereby homogeneous products are produced in large quantity, leading to volume-based barriers to entry [which favor] incumbent companies.²³⁰

Here lies an evident contradiction of the inefficient industrial model utilized nowadays: while quality is preferred over quantity (by the national purchasers), the obsolete industrial bases (composed by the producers) still run on mechanisms developed for carrying out large volume-based production.

Cost escalation and low budgets are becoming (most evidently in Europe) quite inescapable realities which require a serious change of framework in terms of DIB and industrial strategy: the potential payoffs hidden behind a successful civilian-military integration and the dual-use of high tech solutions can no longer be disregarded.²³¹

3.2 A Comparison with the United States

3.2.1 An Advanced and Integrated Industry

The United States features both the largest military budget in the world and the most advanced example of a successful and integrated industry of defense. Of course, we know that the European Union relevantly differs from the USA, both for institutional and economic characteristics; nonetheless, a comparison with the North American country provides us with an effective example of the pay-offs that might come from a more integrated market for defense. We are not implying that the European Member States shall become a single federal entity *tout court* (this point exceeds, by far, the perimeter of our thesis), only that the American example constitutes – to a significant extent – a good approximation of some consequences one should expect from a continental-level industry.

With total revenues of \$239.6 billion for the defense sector in 2017, the US represents the most important country in terms of its defense industry.²³² The cited report

²³⁰ Ibid.

²³¹ Also see Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration."

²³² Deloitte, 2018 Global aerospace and defense industry financial performance study: Commercial aerospace sector performance decelerates, while defense sector continues to expand, 2018,

gathered data indicating a global revenue of \$361.5 billion in 2017 (\$685.6 billion if we include commercial aerospace, "US-based companies account for most of the revenues of the industry representing 60.0 percent of global A&D revenue. Companies headquartered in Europe represent 31.4 percent of the global revenues, while companies domiciled in Canada, Brazil, Japan, China, India, Australia, and others account for the balance"), with Europe accounting for \$95.8 billion in total.²³³



Figure 3.3: United States military spending/defense budget. Source: *Macrotrends*, World Bank data.

The United States is also the country with the largest trade surplus in the aerospace and defense sector. The national industry registered a surplus close to \$90 billion in 2018 ("the second largest [surplus] on record for A&D, and the largest of any U.S. industry," a time-line of the surplus throughout the current decade is shown by figure 3.4, on the next page), according to the estimations compiled by the American Aerospace Industries Association (AIA).²³⁴ AIA also reported a total of 881,000 direct jobs, and "1.67 million supply chain jobs."²³⁵ More generally, "in 2018 alone, A&D contributed over \$374 billion

https://www2.deloitte.com/global/en/pages/manufacturing/articles/gx-mnfg-aerospace-and-defense-finan-performance.html

²³³ Ibid, 20.

²³⁴ Aerospace Industries Association, 2019 Facts & Figures U.S. Aerospace & Defense, 2019, https://www.aia-aerospace.org/2019-facts-and-figures/

Note that both cited reports include figures for civil aerospace as well: the Deloitte report also states that global A&D revenues were at \$685 billion in 2017.

²³⁵ Aerospace Industries Association, 2019 Facts & Figures U.S. Aerospace & Defense.

to the GDP of the United States, representing 1.8% of the entire GDP [with] more than \$208 billion of A&D's total contribution [attributable] to the industry's supply chain."²³⁶

Additionally, the American industry is also supported by the most extensive public Research & Development expenditure (R&D). The sum for expenditure in defense-related R&D was at \$55.4 billion in 2017, by far exceeding the commitments of the other OECD countries, as we underlined in section 2.1.1.²³⁷



Figure 3.4 United States' total trade balance in A&D industry. Source: Aerospace Industries Association (AIA).

This initial descriptive analysis of the US defense industry suffice to highlight the self-sustaining character of a strategic sector funded upon effective innovation (financed via large R&D expenses and promoted by high-level scientific and technological research centers), integrated supply chains, effective public sponsorship and regulation, as well as a set of public agencies which have been coordinating and guiding the industrial players in a tactful way. When explaining the logics behind innovation systems we mentioned factors and drivers that contribute to their dynamics: the American case sees rather efficient players, and a regulator which recognizes the importance of supporting firms and reinforcing positive "drivers". To this regard, the concept of "industrial triptych" has long been epitomized by the US government's behavior vis-à-vis the American industry, as the creators of the model recognized in their own work:

²³⁶ Ibid, 2.

²³⁷ John F. Sargent, "Government Expenditures on Defense Research and Development by the United States and Other OECD Countries: Fact Sheet," *Congressional Research Service*, January 2020, <u>https://fas.org/sgp/crs/natsec/R45441.pdf</u>

In the US, there is a correlation and interdependence between a strong economy, federal expenditure on national security, investment in defence R&D, and defence technological spin-off into the commercial world and non-defence markets. [...] Government has to step in if the US is to deliver its core policy of maintaining its technological advantage in defence.²³⁸

This is a fundamental point, and it is why we use the US as the perfect paradigm for defense innovation efforts. Maintaining the upper hand from a technological point of view has been a basic objective of the country especially since the Cold War. Hence, the American industry and governmental agencies (first and foremost, the Department of Defense) found a fine-tuned state of their relation, one which was able to stimulate innovative excellence:

[T]here are, in essence, three core objectives for DoD investments in R&D if this strategic outcome is to be met. First, the DoD must stimulate innovation. Second, government must avoid surprises. Third, and as a culmination of the successful accomplishment of the preceding two objectives, the US must stay ahead of others. The US has a good record of stimulating technological innovation, paradoxically, as both the champion of free-market economics and as a government funder – and possibly also champion – of research.²³⁹

In the next subsections we are going to scrutinize certain aspects of the US defense industry, which may account for its relevant innovative power, we will also compare certain characteristics with the European counterparts, before studying the possibility for an improved European defense industry in the last section of the chapter.

3.2.2 Firms Within and Beyond the US Defense Industrial Base: Increasing Mergers & Acquisitions

The US defense industrial base (DIB) is quite wide and dynamic: it includes both public companies and private commercial firms providing services and products to the Department of Defense (DoD). The DoD has a clear role in coordinating the DIB, with

²³⁸ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor* and Regulator, 68.

specific political posts, such as the Under Secretary of Defense for Acquisition and Sustainment, and the Deputy Assistant Secretary of Defense for Industrial Policy.

The United States features a myriad of defense firms, divided into various tiers and sub-tiers, as well as diversified for the kinds of products or services they offer:

The commercial companies that contract with the Department of Defense are diverse, ranging in size from small businesses to some of the world's largest corporate enterprises. These commercial companies provide a wide variety of products to DoD, encompassing everything from complex military-unique platforms (such as aircraft carriers) to common items sold commercially (such as laptop computers, clothing, and food). These companies also provide a wide variety of services, including everything from routine services [...] to highly specialized services.²⁴⁰

Within this heterogeneous scenario, defense firms are often protagonists of mergers and acquisitions (M&A) and, as we pointed out in section 1.2, the United States has been the theater of a series of important mergers in the sector throughout the last decades. Those operations made the industry perhaps less dynamic but more sustainable for the DoD's budgets. A first interesting point of comparison with the European industry deals exactly with such trait. In fact, supporting merging processes can be a governmental strategy, a strategy that has been applied more effectively – and perhaps even excessively – in the United States: "across Europe, in sectors including naval shipbuilding and tracked armoured vehicles, the problem is that there are still too many suppliers (unlike the US, where there are often too few)."²⁴¹ Indeed, one shall refrain from encouraging an exceedingly "merged" industry, since small firms tend to make the industrial base more dynamic, they usually concern themselves with niches that are often overlooked by major players and prime contractors, while also exercising a relevant level of "disruptive" innovative power, something that has been recognized by pundits as well: "US policy-makers believe that smaller firms and new entrants are liable to generate new solutions

 ²⁴⁰ Heidi M. Peters, "Defense Primer: U.S. Defense Industrial Base," *Congressional Research Service*, February 2020,

https://fas.org/sgp/crs/natsec/IF10548.pdf

²⁴¹ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 128.

and refreshed technologies, thereby offering battlefield advantages and commercial efficiencies."²⁴²

The Mergers and Acquisitions trends of the defense sector deserve further scrutiny. In general:

Global M&A activity in the aerospace and defense industry reached its highest level ever in 2015. Total transactions for the year amounted to \$51.8 billion in the value [...] While 2016 aerospace and defense M&A activity declined relative to this 2015 peak, the 235 transactions announced in 2016 actually represented an increase over 2015 transaction volume, and the \$17.2 billion in total transactions still indicates a healthy, robust aerospace and defense M&A market.²⁴³





In reality, M&A processes are not subsiding, rather they are changing in nature: "specifically, the aerospace and defense industry is moving away from megamergers aimed at generating cost savings and synergies toward acquisitions that deliver new products and new markets," the persistency of such robust merging processes is made possible by conditions like the large availability of capital for acquirers in the industry, the high level of attractiveness to private equity acquirers, and a consistently increasing national defense budget (which the current US Administration has clearly supported,

²⁴² Ibid, 92.

²⁴³ Deloitte, Merger and acquisition trends in aerospace and defense: A closer look at value creation, 2017, 4,

https://www2.deloitte.com/content/dam/Deloitte/tw/Documents/manufacturing/tw-aerospace-defensetrends.pdf

announcing efforts in this direction since the moment it came in charge).²⁴⁴ Figure 3.5 above provides a graph for the Mergers and Acquisitions trends, in the aerospace and defense industry at the global level (aerospace data include civil aerospace, of course); figure 3.6 pertains the US case.



This kind of intensive M&A activity is less frequent in Europe, where political concerns characterizing the different Member States often led to the use of veto powers. Such oppositions from the States may be legally pursued thanks to article 346 of the TFEU, limiting the monitoring role of the Commission for this strategic sector.²⁴⁵

We should also mention an increasing trend in cross-border acquisitions. The cited report states that while in 2011 US cross-border acquisitions (in the sector of aerospace and defense) represented 14% of total acquisitions, the fraction had risen to 32% in 2016. This increasing trend is expected to persist, while – at the same time – non-US acquirers are interested in American acquisitions as well:

We anticipate this trend toward cross-border deals continuing in the near term, as aerospace and defense companies seek to increase their access to new channels and customers beyond their core markets. In fact, [...] in 2017 we have already observed

²⁴⁴ Ibid, 2. More specifically – considering new products – "communications equipment, surveillance, and unmanned aerial vehicles may attract particular M&A interest within the defense sector; in aerospace, aviation systems and component manufacturing are well positioned to attract strong M&A activity."
²⁴⁵ In other fields, the European Commission expressly acts as the supervisor of M&A processes at the Union level, applying the EU Merger Regulation (i.e. Council Regulation No. 139/2004).

that non-US clients show an increased interest in acquiring manufacturing capabilities within the US in order to support US-based defense programs.²⁴⁶

The complicated context of Defense cross-border operations will be analyzed with a focus on the European and trans-Atlantic processes in the final section of this work.

3.2.3 Defense Research and Development in the United States

As we have mentioned before, nowhere is the financial commitment to defense Research and Development as strong and profound as it is in the American case. Other OECD countries are generally far behind the figures displayed by the United States, as it may be seen from table 3.1 below. The United States, with a public expenditure of \$55,441.0 million (in 2017), represents 81.2% of total government-funded defense R&D spending in OECD countries (accounting also for purchasing power parity). According to the American Congressional Research Service, the US is also the first country in terms of "government defense R&D funding as share of GDP" (0.285% of its GDP, followed by Korea which invests only 0.169% in an analogous manner).²⁴⁷ Additionally, the US is also the country with a higher relative commitment to governmental expenditure in defense R&D as a share of "total governmental R&D funding," (to this regard, see figure 3.7).²⁴⁸

 ²⁴⁶ Deloitte, *Merger and acquisition trends in aerospace and defense: A closer look at value creation*, 7.
 ²⁴⁷ John F. Sargent, "Government Expenditures on Defense Research and Development by the United States and Other OECD Countries: Fact Sheet," 1-4.
 ²⁴⁸ Ibid, 3.

Country	R&D			
United States	\$55,441.0			
South Korea	3,377.3			
United Kingdom	2,379.4			
Germany	1,530.2			
France	1,431.1			
Turkey	1,350.9			
Japan	1,199.1			
Poland	379.2			
Australia	358.7			
Canada	183.1 ª			
Other OECD Countries	675.5			
Total, OECD	\$68,305.5			

Table 3.1: Governmental expenditure for defense R&D, in 2017 (in US\$ million). Source: OECD, Congressional Research Service.



Figure 3.7: Governmental expenditure for defense R&D as a share of total governmental R&D expenses. Source: OECD, Congressional Research Service.

Therefore, not only do we encounter the highest absolute sum among OECD countries, but also the most marked relative commitment both in terms of GDP share and total governmental R&D share.²⁴⁹ Outside of the OECD group, the question would be more complicated to evaluate, especially since Chinese defense R&D has been facing a

²⁴⁹ Govini, America's eroding technological advantage: National defense strategy RDT&E priorities in an era of great-power competition with China, 2019.

https://www.govini.com/wp-content/uploads/2020/01/Govini_NDS-RDTE-Priorities-1.pdf

spike in recent years. According to a *Govini* report, Businesses' defense R&D in China surpassed the American counterpart in the middle 2010s, whereas total R&D spending in constant 2010 dollars remained slightly larger in the US ("As of 2017, it spent just \$40B less than the United States," with the total US sum nearing \$500 billion that same year, see figure 3.8).²⁵⁰ It must be noted that the R&D estimates provided by the Congressional Research Service feature substantially lower figures: the large discrepancy is due to methodological differences, and particularly to a new (more restrictive) way of classifying defense R&D employed by US public institutions (something we have previously pointed out in section 2.1.1). This difference does not detract value from the methodology utilized by the latter report (*Govini*), which – by contrast – provides very interesting analytical and practical points in the detailed way it scrutinized US defense R&D at its different stages and in its different efforts.



Figure 3.8: Chinese and US defense R&D (total, business and governmental) expenditure, 2000-2017, in 2010 dollars. Source: Govini (2019).

As we notice from the graphs in figure 3.8, the majority of defense R&D is conducted at the business level. Nonetheless, this characteristic does not deny the planning and coordinating importance assumed by public authorities such as the United States DoD: the resources that such authorities can assign via contracts do remain enormous and, consequently, have the power to incentivize further (and compounded, so

²⁵⁰ Ibid, 7.

to speak) action by industrial players.²⁵¹ Therefore, a discussion of the DoD's R&D funding may shed light on the way institutional entities can and do steer innovation possibilities. Let us close this subsection by turning our attention to certain specific characteristics of public R&D expenditure in the United States.

To begin with, the United States constitutes a particularly interesting case study for R&D since the country is undergoing a strategic reformulation, in a transitional phase which should move its priority concerns from anti-terrorism commitments to technologies more focused on the contrast of traditional threats and great-power competition. These reshaping processes are conducted by following a general National Defense and Security Strategy (NDS). To be more specific:

The NDS provides the DoD with a list of priority technologies to cultivate and capabilities to develop. It guides DoD to harness the National Security Innovation Base (NSIB) – the primary source of U.S. innovation in business, academia, and national laboratories – to provide a more coherent nationwide effort in developing these technologies.²⁵²

The mentioned report is also very useful to unpackage R&D by looking at its different subsectors and their respective financing entities. The interesting trend to register – and perhaps generalize – is the fact that the early phases of research (i.e. "Basic Research") are mostly promoted by public investments, the balance is inverted for later-stage research (i.e. "Applied Research," meaning "an expansion and application of knowledge to develop useful materials with a specific practical aim or objective,") which sees businesses as its major investors, and even more crucially at the Development stage (the one "directed at producing or improving product or processes") where businesses' investment surpassed, reaching fivefold multiple, the US federal funding throughout the 1960-2017 period.²⁵³

²⁵¹ This point has been illustrated for the European continent by Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," whereas a compelling analysis of the self-reinforcing potential of the European Defense Fund for innovation has been discussed by Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration."

²⁵² Govini, America's eroding technological advantage: National defense strategy RDT&E priorities in an era of great-power competition with China, 2.

²⁵³ Ibid, 7.



Figure 3.9: R&D funding, by different sources and for different R&D stages; 1960-2017, in 2012 dollars. Source: Govini.

The first three graphs highlight the aforementioned trends in terms of resources channeled, whereas the bottom graphs are useful to notice the mentioned inversion of commitments in terms of percentages. It is, thus, almost physiological to have the government and research institutes financing the starting phases of new research projects; and this is one of the basic points behind the need of a committed and clear guidance by the public institutions (in the US particularly – but not only – by the DoD, more on this in the next subsection). In general and also in absolute terms, "R&D spending has shifted toward later stage research and was largely funded by business rather than government," in a way that could complicate the "United Sates' ability to pioneer groundbreaking technology."²⁵⁴

Additionally, innovation – especially in the case of the new and more disruptive technologies that we have just mentioned – is particularly dependent on the flexibility of smaller businesses.²⁵⁵ To this regard, the US shows a structural trend in the way it tends to favor larger firms while assigning public R&D funding. The degree of concentration upon very large players is extremely significant. According to the Govini report we have so far referred to, DoD's funding is "highly concentrated (59%) among the top ten vendors":

²⁵⁴ Ibid.

²⁵⁵ Heidenkamp, Louth and Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, 92.

This raises the question about whether DoD, either directly or through the large system integrators, is appropriately tapping into the most innovative technologies developed across a wider segment of the NSIB. [...] if the DoD is to invest successfully in emerging technology areas it will likely need to rely on a broader set of partners in the NSIB that extends beyond its traditional vendors. [...] It also has to develop new key vendor relationships in emerging fields.²⁵⁶

Figure 3.10 provides a quantitative assessment of the trend favoring large contractors (that still persisted in the 2015-2019 period), including the distribution of resources among the different "priorities" that have been fixed. Notice that sectors such as Advanced Autonomous Systems (which, as pointed out by the authors, "includes emerging technologies such as Artificial Intelligence and High Powered Computing for which vendors outside the top ten captured at least 70% of the awarded amount") see a more marked role for smaller contractors.²⁵⁷ Interestingly, the DoD is now relying on "nontraditional contracting mechanisms" to award R&D funding in a more flexible way: i.e. using new mechanisms (such as the "Small Business Innovation Research program and Other Transaction Authority" that "expand DoD's access to small businesses").²⁵⁸

	Total	Advanced Autonomous Systems	Air & Missile Defense	C4ISR	Cross-Cutting	Lethality & Resilience	Nuclear Forces	Resilient & Agile Logistics	Space & Cyber
Lockheed Martin	\$26.1B	\$0.5B	\$7.5B	\$1.1B	\$0.3B	\$11.3B	\$0.3B	\$0.5B	\$4.6B
Raytheon	\$13.6B	\$0.6B	\$4.6B	\$4.3B	\$0.3B	\$3.2B	\$0.3B	\$0.0B	\$0.2B
Northrop Grumman	\$13.5B	\$2.4B	\$3.4B	\$3.4B	\$0.2B	\$1.5B	\$0.7B	\$0.0B	\$1.9B
Boeing	\$12.3B	\$0.8B •	\$6.1B	\$0.5B	\$0.1B	\$2.6B	\$0.8B	\$0.4B	\$0.9B
General Dynamics	\$5.6B	\$0.3B	\$0.1B	\$0.7B	\$0.5B	\$1.9B	\$2.0B	\$0.0B	\$0.2B
Bechtel	\$5.4B		\$0.0B		\$0.5B		\$4.8B		
МІТ	\$4.8B	\$0.0B		\$0.0B	\$4.8B				
Analytic Services Inc.	\$4.5B	\$0.0B		\$0.4B	\$0.0B	\$3.7B			\$0.4B
BAE Systems	\$2.7B	\$0.1B	\$0.3B	\$0.7B	\$0.1B	\$1.1B	\$0.2B	\$0.0B	\$0.2B
Mitre	\$2.6B	\$0.0B		\$0.0B	\$2.6B				
Top Ten	59%	41%	80%	41%	40%	71%	87%	39%	50%
Other	41%	59%	20%	59%	60%	29%	13%	61%	50%

Figure 3.10: DoD vendors distribution, 2015-2019. Source: Govini.

²⁵⁶ Govini, America's eroding technological advantage: National defense strategy RDT&E priorities in an era of great-power competition with China, 18. The report uses the acronym NSIB to refer to the National Security Innovation Base.

²⁵⁷ Ibid.

²⁵⁸ Ibid, 19.

The point we highlighted, with regards to emerging Advanced Autonomous Systems, is a further confirmation of the dynamic nature behind small-firm-driven innovation. To stay ahead of the curve, expanding and re-modulating their DIB according to the economic and military necessities of the twenty-first century, regulators will increasingly have to confront this two-faced reality: on the one hand, there is a need to expand the vendors base, on the other, there is a compelling call to promote – also through the action of such newly-contracted vendors – the development of disruptive technologies that may successfully allow to control new threats even in an age of relative budgetary austerity. It is an overview of the regulatory agencies activated by the United State that will be the subject of the next subsection.

3.2.4 Innovation and Public Policies: Regulatory Agencies and Their Role in the United States

Public spending commitment in terms of Research and Development is a necessary but insufficient effort on the part of public actors. Indeed, as one may have anticipated by looking at the model of innovation system presented at the beginning of this chapter, a relevant task for the States resides in their ability to grant a smooth interaction between innovation systems' players (i.e. research centers, universities, different types of investors, firms, and so on). To this regard, even sectoral research analyses, dedicated to the realm of aerospace and defense, have already shown that:

[T]raditional inputs, such as spending on research and development (R&D) or science and technology (S&T) [...] are important and necessary [yet] they are not sufficient in explaining the range of innovation 'impact' outcomes that various countries achieve including in the security space.²⁵⁹

In other words, vast R&D expenditure is not necessarily leading to successful innovations, unless it is also supported by an effective ecosystem, capable to fund

²⁵⁹ Phil Budden and Fiona Murray, *Defense Innovation Report: Applying MIT's Innovation Ecosystems & Stakeholder Approach to Innovation in Defense on a Country-by-Country Basis*, MIT Innovation Initiative, Working Paper, May 2019, 5. The paper is also correct in noticing that invested Venture Capital (VC) may be used as a proxy, but it is not completely reliable especially in the sense that it "probably understates innovation in countries less dependent on open market systems" (ibid, 4).
breakthroughs with those amounts of capital. Thus, we now discuss the public agencies which try to promote a smooth innovation system within the United States defense market. In this case, it seems proper to reason – at least to some extent – in terms of "Entrepreneurial States," since public regulators (who are often former private-sectors executives) are trying to design institutional relations that can promote the most effective public-private partnerships.²⁶⁰

In the case of the US, the agencies (some hosted by the Department of Defense, others completely 'extramural') that deserve particular attention are the Defense Innovation Board, the Defense Advanced Research Projects Agency, the Strategic Capabilities Office, and the Defense Innovation Unit. There are other, smaller innovation players at the public level, but we limit our discussion to the most influential and famous ones.

The *Defense Innovation Board* was established in 2016 by Defense Secretary Ash Carter, with the idea of remodeling the US defense innovation base and making it more suitable to the innovative characteristics of the contemporary *high-tech* industry. As highlighted by Phil Budden and Fiona Murray:

As Secretary of Defense from 2013 to 2016, Ash Carter faced an innovation challenge. With the rise of digital technologies, agile working practices and adversaries better able to harness these previous two elements, he and the DoD leadership found the well-established defense innovation system lacking in terms of 'Innovation' [meaning] new technologies and agile practices (e.g. in rapid acquisition/procurement).²⁶¹

This also relates to the general challenge of embracing new technologies, that is now being faced by the American defense industrial base, as described by the previous subsection. Indeed, such modernization would constitute a decisive gamechanger for three reasons: firstly, the dual-use of technology in terms of civil-military intermingling has been increasing its importance in the military realm throughout the last decades. Secondly, modern digital technologies could provide the defense industry with a better business model (and a more efficient set of battlefield practices as well). Thirdly, as also captured by the cited paper, the wealthiest companies in terms of R&D resources are often

²⁶⁰ Mazzuccato, The Entrepreneurial State: Debunking Public vs. Private Sector Myths.

²⁶¹ Budden and Murray, Defense Innovation Report: Applying MIT's Innovation Ecosystems & Stakeholder Approach to Innovation in Defense on a Country-by-Country Basis, 13.

part of the advanced sectors of digital technology, biotechnology, and the like: this would also favor a reinforcement of defense R&D which may be suffering some degree of downsizing in its more traditional forms. The most important companies in terms of R&D spending are displayed in figure 3.11. The Defense Innovation Board has been exercising, quite successfully, the role of "change agent' [that] works closely with the new formal agencies, to accelerate defense innovation."²⁶²



Figure 3.11: The 2018 Top 20 companies by Research & Development expenditure, in US\$ billion. Source: Statista.

The *Defense Advanced Research Projects Agency* (DARPA) is an older agency (founded, under the name of ARPA, by US President Dwight Eisenhower in 1958); nonetheless, it has always remained at the forefront of defense innovation, especially in the more "disruptive" sense, and by doing so it gained an almost mythical aura, to the point that European policymakers have begun to long for an EU equivalent of such

²⁶² Ibid, 14.

institutional body.²⁶³ With an annual budget of \$3.4 billion (2019), this agency is also the most funded of the sector. The objective of DARPA is aiming at high-risk but highly disruptive innovation: as we have mentioned, risky research can easily lead into the "Valley of death," hence the necessity for State agencies to step in and promote such efforts directly. In other words, DARPA:

[H]as traditionally focused on very early-stage 'advanced' research, but with an emphasis on the long-term development of technology-based capabilities albeit with low 'readiness levels' (TRLs). [...] Its mission was (and is) to make pivotal investments in breakthrough technologies for national security.²⁶⁴

Therefore, DARPA is not only focusing on early research and projects, at very *basic Technology Readiness Levels*, but it is also specifically focusing on projects that feature particular risk.²⁶⁵ The general point we made, about funds being necessary but insufficient by themselves, holds true with the case of DARPA, spending (and even spending in a rather "disruptive" way) is not enough if you do not nurture a smooth innovation system. To this regard, DARPA deals with external talents and stakeholders, "Working with innovators inside and outside of government [...] to create new strategic opportunities for external researchers who, in collaboration with one another, and through engagement with DoD, strive to make transformational change instead of incremental advances."²⁶⁶ The great majority of DARPA's investments are directed towards the US domestic industry (70% in FY2016), then there are universities (receiving 13.6%), and the remaining share is divided between intramural investments, other federally funded projects, foreign investments, and additional non-profit initiatives.

The *Strategic Capabilities Office* is an interesting follow-up, because it is somehow complementary to DARPA, in the sense that it focuses on research at more advanced Technology Readiness Levels (using the terminology of the aforementioned Govini report, we could draw the line between "Basic Research" and "Applied

²⁶³ Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 25.

²⁶⁴ Budden and Murray, Defense Innovation Report: Applying MIT's Innovation Ecosystems & Stakeholder Approach to Innovation in Defense on a Country-by-Country Basis, 16.

²⁶⁵ For a discussion of Technology Readiness Levels and the "Valley of Death," see Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," chapter 3.

²⁶⁶ Budden and Murray, Defense Innovation Report: Applying MIT's Innovation Ecosystems & Stakeholder Approach to Innovation in Defense on a Country-by-Country Basis, 16.

Research").²⁶⁷ The Office usually aims at applying known expertise to enhance new capabilities: it "is intended to draw 'advanced capabilities' from that more long-term 'research and technology' side of the Pentagon."²⁶⁸

To conclude, we rapidly review the *Defense Innovation Unit*. This agency is particularly concerned with the new contract solutions we have cited in the previous subsection. To be more precise, the Unit uses Other Transactional Authority (which is one of those non-traditional contract solutions, already mentioned in subsection 3.2.3). The innovative point of the Unit is to bring in new cooperation with companies that are not used to take part in the Defense Industrial Base, this point is crucial in an age where the expansion of dual-use products and the involvement of civil sector businesses are becoming some basic innovation "drivers".

As highlighted by the aforementioned MIT innovation paper:

DIUx [the paper utilizes the new acronym for the Unit] works with companies which might not usually work with the military by contracting swiftly for solutions that can be effectively adapted to military needs in a range of areas [...] DIUx provides nondilutive capital in exchange for commercial products that solve national defense problems. There are clear advantages: DIUx does not have to fund R&D, as the companies have already incurred the costs, and it does not have to pay the full procurement and support costs, as those are paid by the military service that agrees to put the product in the field.²⁶⁹

Of course, the guiding actor of these coordination processes is the Department of Defense, which is enabled to act by specific pieces of legislation. Following the 1956 Manufacturing Technology (MANTEC) Program, agencies and departments can operate in a synchronized way. Thus, the DIB can "reduce equipment acquisition and supportability costs," follow general strategic plans by public authorities, and receive "DoD support for the development and application of advanced manufacturing technologies that are essential to national defense."²⁷⁰ The self-reinforcing character of

²⁶⁷ Govini, America's eroding technological advantage: National defense strategy RDT&E priorities in an era of great-power competition with China, 7.

²⁶⁸ Budden and Murray, Defense Innovation Report: Applying MIT's Innovation Ecosystems & Stakeholder Approach to Innovation in Defense on a Country-by-Country Basis, 19.

²⁶⁹ Ibid, 20. Other innovation-related agencies mentioned by this work include: the National Security Innovation Network (which "links the military and entrepreneurial worlds"), SOFWERX, AFWERX (both emphasizing "collaboration, ideation, and facilitation with the best minds of industry, academia, and government"), and In-Q-Tel (a not-for-profit firm acting as a venture capitalist).

²⁷⁰ Heidi M. Peters, "Defense Primer: U.S. Defense Industrial Base," 3.

the American DIB also assumes an evidently mercantilist flair thanks to laws such as the 1933 Buy American Act: the Trump Administration is yet trying to increase the United States' level of self-reliance, after having identified "surprising levels of foreign dependence on competitor nations."²⁷¹

This *excursus* is helpful to realize how coherent policies can foster the pursuit of innovation, not only in terms of financing resources, but also – if not especially – by means of creating an effective innovation system. With the next and last section of the chapter we complete the comparison between this landscape and the European one. At this point, we can already anticipate that the state of fragmentation characterizing the old continent is not just hampering the possibilities of better-funded common projects, but also preventing the European Union from creating a set of agencies such as the one deployed by the United States, and described throughout these pages. If such state of limitations were to be overcome, increasing integration could well act as the fuel for unprecedented innovation opportunities.

3.3 European Opportunities: Innovation by Integration

The European industry of defense is at a peculiar, and to some extent unpredictable, crossroads. Before the 'black swan' of the coronavirus crisis, the sector was going through a very positive period, not only in terms of seminal integration ideas, but also in terms of public spending increases: as affirmed by Daniel Fiott, "[Defense spending in] Europe has witnessed a growth worth some EUR 15 billion from 2013 to 2017."²⁷²

With the outburst of Covid-19, it is now especially hard to predict the future moves of European integration and the future trends of the defense industry: the sector will be affected, but perhaps not as intensely as others (e.g. the related one of commercial aerospace), since certain geopolitical challenges remained unchanged (or, maybe, became more complicated) through the last months. Notwithstanding the unprecedented level of uncertainty, we may still analyze the developments of European defense integration and innovation processes: the final subsections of this work are dedicated to completing the comparison of the European innovation landscape with its United States counterpart, described in the previous section. We also question the opportunities for further

²⁷¹ Ibid.

²⁷² Daniel Fiott, "What Does It Mean to Be a European Defense Company Today," *Éditoriaux de l'Ifri*, Ifri, November 2019.

integration and, in particular, ask whether the current crisis might foster Europeanization dividends as exemplified by the "failing forward" argument.²⁷³

3.3.1 Defense Research & Development in Europe: Innovation Potential at a Crossroads

In chapter 2, we have analyzed the current state of fragmented Research and Development (R&D) efforts within the European Union (see section 2.1.1), as well as briefly referred to works which point out the generational problem of defense innovation in the continent. By using the word 'generational', we mean that the relative success and competitiveness of European innovation is still being achieved thanks to research efforts that were put into play at the times of the Cold War. As indicated by Ianakiev, relying on those old progresses may put the EU Member States in an unfavorable position for the next, imminent steps of defense innovation: the lack of an effective research and innovation plan in the current landscape "would be disastrous, particularly when emerging developments in fields such as cyber or artificial intelligence have the clear potential of causing a revolution in defence technologies."²⁷⁴

A sort of corollary to the previous point is the fact that, for European countries, it will be increasingly difficult to succeed individually in the next innovation challenges.²⁷⁵ To put it simply: resources will not be sufficient; the R&D funding is not only fragmented, as already shown, it is also scarce on a national basis and yet declining in a consistent way (because of relevant cost escalation affecting the products, see below).²⁷⁶ We can be more precise by noting that the "R&D Defence" value of the Eurostat's "General government expenditure by function" (COFOG) database recorded the value of €5,421.2 million for the EU28 (a total that still included the largest 'share' of the United Kingdom, which is no longer a member of the Union).²⁷⁷ Such total amount pales in comparison

²⁷³ Jones et al., "Failing Forward? The Euro Crisis and the Incomplete Nature of European Integration." See section 1.1.

²⁷⁴ Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," 5.

²⁷⁵ Ibid. Also see Bellais and Fiott, "The European defense market: Disruptive innovation and market stabilization," 41. The authors state that "most arms-producing countries have become progressively unable to sustain a purely domestic defense industrial base. In Europe, this is reinforced by decreasing domestic budgets for defense R&D since the end of the Cold War."

²⁷⁶ Renaud Bellais, "The Economic Imperative of Europeanizing Defense Innovation," in *The Emergence* of EU Defense Research Policy: From Innovation to Militarization, ed. Nikolaos Karampekios, Iraklis Oiknomou and Elias G. Garayannis (Cham: Springer International Publishing AG, 2018), 105.

²⁷⁷ See table 2.1 for the complete data. Eurostat, General government expenditure by function (COFOG) <u>https://ec.europa.eu/eurostat/web/products-datasets/product?code=gov_10a_exp</u>

with the US counterpart, which is about ten times higher – depending on the different methodologies utilized to measure it (see sections 2.1.1 and 3.2.3).

A further point arises when we take into account the phenomenon of *cost escalation*, which was explained at length and is making it gradually more expensive (in real terms) to update defense systems. Following Ianakiev's analysis:

Defence equipment unit costs' growth rates substantially exceed general inflation levels. The available literature provides strong empirical evidence of this trend, with estimates often showing cost escalation rates over 5% or even 10% in real terms.²⁷⁸

For example, we can refer to the case of French fighter aircraft, studied by Bellais: the different generations of such planes met an "exponential increase of unit costs" and reduction in "purchasing power" for the national Air Force (in a fashion quite similar to that predicted by Augustine's Law XVI), the phenomenon is illustrated by figure 3.12.²⁷⁹ As noticed by the author, the stunning cost escalation is largely due to rising R&D costs, in the intergenerational leaps between different models of units. Therefore, this instance goes back to the core of our argument: the EU is at a crossroads with regards to its potential in innovating defense technologies, the more costs escalate, the less will single countries be able to remain at the cutting edge of the industry. Here lies the economic rationale – an "imperative", to reference Bellais' more dramatic word choice – behind the need to overcome fragmentation.

²⁷⁸ Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," 6.

²⁷⁹ Bellais, "The Economic Imperative of Europeanizing Defense Innovation," 98.



Figure 3.12: French fighter aircraft cost escalation in 1975 francs (millions), and respective "purchasing power". Source: Bellais (2018).

Cost escalation is indeed very pervasive, since it affects most of the phases, from basic research to long-term maintenance. Within this frame, R&D is facing the heaviest toll because a reduction in budgetary efforts, alongside a cost-escalating maintenance, is forcing defense policymakers into a position where they will be unable to sustain the large *fixed costs* usually encountered at the early stages of products design and development. Moreover, those costs are continuing to rise: "fixed costs represent a larger and larger share of defense programs, and R&D constitutes a key element of these costs [...] It is not surprising that R&D absorbs between 25% and 50% of acquisition costs, depending on the volume that is produced throughout the lifecycle of a program."²⁸⁰

Furthermore, the cooperative initiatives attempted so far have been very limited in their success, both Ianakiev and Bellais share the evaluation we anticipated in chapter 2.²⁸¹ On the one hand, cooperative R&T (i.e. the early segment of R&D) remained far below the goals that had been set by the European Defence Agency (see figure 3.13). On the other hand, against any economic rationality, budget constraints were not necessarily met by a lowered degree of armaments duplication throughout Europe: "when budgets

12.

²⁸⁰ Ibid, 98-99, 102.

²⁸¹ Ibid, 103. Collaborative R&T efforts have generally been very limited, even shared projects were often afflicted by specifications which multiplied along the way (according to the different priorities of participating nations). To summarize with Bellais' words, "these R&T initiatives do not constitute the primary vector of R&D efforts and they have remained pretty marginal in defense innovation." Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration,"

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decrease, cooperative programs do not increase; on the contrary, they are even more supplanted by purely domestic projects."²⁸²



Figure 3.13: Collaborative funding for Defense R&T for the EU. Source: EDA, Ianakiev (2019).

The enumerated points (and several more benefits that have been illustrated in chapter 2) seem to provide a quite evident economic rationale in favor of a more integrated European defense industry. The US also provided a case in point for showing the effectiveness of a more cohesive defense industrial base. Thus, one ought to ask why fragmentation has proven to be so persistent in the old continent. At this stage, economic considerations begin to intertwine with more political ones.

First and foremost, controlling a domestic and exclusive defense industrial base has been considered the *sine qua non* of national sovereignty. As mercantilistic and outdated as it might seem, the connection of economic control and political power is at its apex in the case of the defense industry: the first asset can promote the latter and vice versa. The problem with this line of thinking is that – as it follows from the arguments developed above – in the era of high-tech research, the Cold War model of (almost) exclusively domestic arms production is no longer available to single European countries, even those ones – like France – that were priding themselves on the idea of "technological autonomy".

²⁸² Bellais, "The Economic Imperative of Europeanizing Defense Innovation," 103.

Second, politics actually blends with economics when we consider that the European defense industry which came out of the Cold War is certainly oversized: this is just an inescapable by-product of decades of "duplication" fostered by the autarchic mindset behind defense independence. At the current stage, the sort of restructuring proposed by many defense analysts and economists would require its own labor division with inevitable layoffs (smaller countries risk paying the highest prices, since their economies of scale are scarce and could be wiped out) and strategic concerns for the different Member States. Without the shadow of a doubt, a renewed defense innovation model would not only foster growth for the sector but also exert a multiplier effect on other areas of the European economies (especially if an advantageous level of connectivity with the civil sectors is reached and sustained, as the US counterparts have been trying to do with the described Ash Carter's strategies). Nevertheless, a common defense industrial policy would have to deal with a series of complicated trade-offs. This point deserves further attention: we will deal with the industrial policy aspects in the final part of this chapter.

To conclude, the real challenge for EU institutions and for policymakers in the different European capitals resides in finding an acceptable compromise to overcome their Westphalian dependence on domestic DIBs. Pessimists may be right in underlining that sovereignty is incomplete without a State's own defense capacity, but optimists certainly cannot be wrong in claiming that a stagnant independence will prove less desirable than a resource-pooling paradigm capable to face the innovation and strategic demands of the future.²⁸³

3.3.2 Defense Firms: Innovation Capacity, M&A Prospects, and Business Opportunities

We now turn to discussing innovation capacity from the European firm's perspective. The firm is, quite evidently, the essential brick of the defense and technological industrial base. Therefore, an analysis of the European DIB shall start from this type of player. This subsection will look at the Post-Cold War defense firms of the old continent, provide a comparison with the United States' counterparts, describe the main Merger & Acquisition activities, examine intra-European clusters, and look at enduring limits as well as business opportunities.

²⁸³ To use Bellais' incisive expression, "indeed, expecting to enforce sovereignty without the means to achieve it is nonsense" (Ibid).

As we mentioned in previous sections (see, in particular, subsections 3.1.5 and 3.3.1), the end of the Cold War dictated an important change for the defense industrial scenario. On the one hand, European countries relaxed their efforts in terms of military spending: they wanted to reap peace dividends in a more permissive international arena. On the other hand, they were soon confronted by the "new paradigm" described by Bellais and Fiott: a context in which industrial processes and their innovation dynamics were moving towards a completely different model, with less extensive production, and – more recently – a model pointing towards different innovation dynamics and emphasizing a new series of instruments and methods, which to some extent may be captured by the popular expression "Industry 4.0".²⁸⁴

The aforementioned authors' argument has two main elements. Firstly, this new industrial era features an unprecedented level of disruptive innovation, that becomes essential for remaining at the cutting edge of defense technology. Second, the most disruptive R&D now resides within the civilian sectors; hence the subsequent need to fine-tune an effective "dual-use" industry, capable of thriving thanks to what we previously referred to as civil-military (or defense) 'crosspollination'.

Given that most disruptive technologies now emanate from the commercial side, emphasis should be placed on breaking into the commercial R&D realm. Crucially, defense industry and governments must refocus their energies on *technology integration* rather than *technology production*.²⁸⁵

Here there is an important point to highlight: not only did the European industry remain more fragmented on a national basis (with many competing governments sponsoring their own industrial bases towards short-term advantages), it also remained more divided on an intersectoral basis (whereas the United States started the crucial remodulation strategies described before), as well as on a sectoral firm-to-firm basis (where different companies diversified their preferences in terms of national and supranational industrial policies). This triple cleavage represents the complex conundrum of the European defense industry at the level of the State-firm and State-firm-Union relations.

 ²⁸⁴ Bellais and Fiott, "The European defense market: Disruptive innovation and market stabilization," 37.
²⁸⁵ Ibid, 38.

The post-Cold War period was an important phase, since EU Member States lost momentum in the possibility to reform their industrial policies, and thus try to overcome their uncomfortable divisions and ineffective innovation capacity. As shown by the previous subsection, the Cold-War innovation model is no longer functional, and now it shall be said that what we stated for the macro level holds true for most individual firms, which are indeed losing the capacity to remain at the cutting edge of defense technology:

Industry has made it clear that it needs programmes in Europe otherwise skills and investments will dry out, meaning that firms will not be able to meet any future sudden demand for armaments production or have a sustained reason to design or develop cutting-edge defense technologies.²⁸⁶

By contrast, businesses in the US started an effective transition at the correct moment: "American firms reacted [...] quickly to the declining markets by restructuring and rationalizing."²⁸⁷ In chapter 1, we mentioned the aggressive pro-merging policies espoused by the DoD in the 1990s, in that case "in order to help push mergers even more, [the government] offered subsidies to cover merger costs and started a vigorous export drive, which was supported at all levels."²⁸⁸ This kind of restructuring is exactly what European countries failed to achieve (and what they still necessitate nowadays, to some extent).²⁸⁹ Throughout the EU, the transition was rather managed by single enterprises (especially the very large ones), here lies the reason of the more pluralistic industry, with the multiple cleavages we mentioned.

Larger firms took the initiative and started to push the process themselves [...] The new European champion defense firms were more flexible and efficient and able to adapt to survive in an increasingly competitive market. Their thinking was no longer purely national, which challenged their relationship with 'their' government.²⁹⁰

²⁸⁶ Fiott, "What Does It Mean to Be a European Defense Company Today," 1.

²⁸⁷ Mawdsley, *The European Union and Defense Industrial Policy*, 10.

²⁸⁸ Ibid.

²⁸⁹ Some de-fragmentation was achieved, but the amount of duplication remains a relevant obstacle, as shown in chapter 2. As also noted by the European Commission, "since 1986, there has been a reduction in the number of major European arms firms. The number of main battle tanks producers declined from 13 in 1986 to 6 in 2016; for combat aircraft, numbers declined from 16 firms in 1986 to 6 in 2016; and for warships the corresponding numbers were from 16 firms in 1986 to 8 firms in 2016. Keith Hartley, "The Economics of European Defense Industrial Policy," in *The Emergence of EU Defense Research Policy: From Innovation to Militarization*, ed. Nikolaos Karampekios, Iraklis Oiknomou and Elias G. Garayannis (Cham: Springer International Publishing AG, 2018), 81.

²⁹⁰ Mawdsley, The European Union and Defense Industrial Policy, 5.

Therefore, the European defense firms developed different strategies, whence derived the diversification of industrial policy preferences (that persists to this day). It has been noted that among large-sized companies there are "trans-national defense players [...] fully invested in EU steps to support the defense market," as well as "a number of national defense giants [which] are either fully dependent on national government demand, which means that they are loath to open up supply chains, or they went global decades ago and are able to operate in a competitive environment and in non-European markets."²⁹¹ This is the sort of consolidation which was defined "patchy" by academics.²⁹² The differentiation extends to the smaller players as well, "some favor the chance to compete for Europe-wide contracts because national demand is not high enough, while others are afraid that integration into larger European supply chains will crush their ability to protect intellectual property rights."²⁹³ Therefore, the European firms are still lagging behind, compared to their American counterparts: EU defense-related businesses remain more fragmented, more dependent on domestic industrial policies and less able to innovate.

We have already stated (and shown with data) that European defense is characterized by too much duplication, the general political rational behind this point has already been identified as the States' sovereign prerogative to protect their domestic DIBs. The economic consequence of such point has been the difficulty in fostering successful intra-European mergers, so as to favor a healthy set of continental players (with more innovative capacity and flexibility). Now, let us have a look to some of the most important developments across the European defense industry.

As explained above, while US firms' merging was also sponsored by the administration, European merging activities where rather firm-led processes. The most important ones started in the late 1990s and were those that led to the consolidation of the 'big 3' of European defense *BAE Systems*, *Thales Group* and *EADS Company* (now *Airbus*); another giant of European defense is *Leonardo* (formerly, *Finmeccanica*), which was also active in the mergers market (see subsection 1.5.3) and has risen to revenue levels comparable to those of *Thales*. To be sure, several European governments tried to

²⁹¹ Fiott, "What Does It Mean to Be a European Defense Company Today," 4.

²⁹² Mawdsley, *The European Union and Defense Industrial Policy*, 10. This work illustrates how the dichotomy was clear (the situation has been getting more nuanced with more recent M&As conducted by European champions), "while aerospace and defense electronics are now dominated by BAe Systems, Thales and EADS, land industry or shipbuilding are still characterized by large numbers of medium-sized nationally based firms."

²⁹³ Fiott, "What Does It Mean to Be a European Defense Company Today," 4. The author identifies smaller firms as "Mid-caps and SMEs" (Ibid.).

push in favor of a "restructuring of the industry," first with a joint statement from the UK, France and Germany, and secondly with the Letter of Intent (issued by those three countries with the addition of Italy, Spain and Sweden).²⁹⁴ Nonetheless, the coordinating effort was insufficient, and State actors as well as firms started to elaborate more autonomous M&A strategies. The preferred, shared strategy, seeing BAe (British Aerospace), German DASA and French Aérospatiale merged into a European megacompany, was discarded since the British and German would-be partners did not like the large shareholder position which the French State had in Aérospatiale.²⁹⁵ From that point, BAe decided to also avoid a merger with DASA, and instead preferred to acquire British electronic-related defense firm Marconi GEC thus forming BAE Systems, since a British group was deemed to be more capable of penetrating the North American market - and rightly so, it might be added. Hence, "DASA was left with little option than to merge with Aérospatiale-Matra and CASA of Spain to form EADS."²⁹⁶ The latter has then changed the name into Airbus Group (according to a recently-reached New Shareholder Agreement, an 11% share is assigned to the French State and an equivalent share to the German State; the Spanish counterpart holds 4.2%, while the remaining 73.8% is freefloating). Thales group, by contrast, originated from Thomson-CSF's acquisition of Racal.

These quite impressive megamergers should not convince the reader that such trends represent the rule in the European defense industry. In reality, we should repeat that they are rather the exception and that (excessive) fragmentation remains the normal, often with explicitly rejected "cross-border mergers."²⁹⁷ Europe features a myriad of small industrial clusters, often too small to 'go global' and sell on more competitive markets, and even too limited to survive within the European one, without domestic government support. Below, figure 3.14 displays that type of clustering pattern, the numbers represent cluster members derived "from association registration with the European Defence Agency's Regional Industrial Portal and Clusters list, and the European Commission's European Network of Defence-Related Regions," hence the picture provides an extensive, yet possibly not all-encompassing, record.²⁹⁸ Furthermore,

²⁹⁴ Mawdsley, *The European Union and Defense Industrial Policy*, 10.

²⁹⁵ Ibid.

²⁹⁶ Ibid, 11.

²⁹⁷ Bellais, "The Economic Imperative of Europeanizing Defense Innovation," 107. The author explains that "by preventing cross-border mergers and acquisitions, European countries seem to preserve the security of supply for their armed forces but with capabilities less and less adapted to their missions."

²⁹⁸ Fiott, "Strategic Investment: Making geopolitical sense of the EU's defence industrial policy," 33.

European firms, despite the cooperative initiatives described in chapter 2 – such as the 'defence package' – are still finding it hard to operate in an integrated pan-European set of supply chains.

Additionally, we should remember that certain subsectors have experienced more M&A activity than others:

[W]hile the aerospace sector [...] is concentrated in the hands of relatively few players, this is not the case in all sectors, most notably the land industry or in naval shipbuilding [...] Domestic concerns about jobs, a desire to maintain national capacities (particularly in shipbuilding) and some security concerns have prevented further consolidation in these areas.²⁹⁹

One last problematic is that in terms of export opportunities many European firms are still lagging-behind. In particular, going back to the comparison with the US, it has been noticed that "the European market is home to intra-EU competition and competition from American firms too – the US market is still overwhelmingly close to European or other global firms." Indeed, business opportunities in North America are already improving to some extent (as shown, for example by the recent FREMM frigates deal, reached by Italian *Fincantieri* and the US Navy). Nevertheless, the disparity remains large and constitutes another point of concern for European defense-related business and a further call to a more cohesive industrial policy, which will be the central subject of the following subsection.

²⁹⁹ Mawdsley, *The European Union and Defense Industrial Policy*, 12. To be more precise, Mawsley provides practical instances, "for example, [...] despite efforts by the German government to increase cooperation Krauss Maffei Wegmann and Rheinmetall still compete in Germany."



Figure 3.14: Clusters of EU Defense. Source: European Commission, European Defence Agency, Fiott.

3.3.3 Innovation and European Industrial Policies for Common Defense

It is very difficult to frame European industrial policy in the field of defense; in reality, the Member States are still developing their national industrial policies, also supported by the lack of a single market for defense (under the aegis of the aforementioned Article 346 TFEU). Nonetheless, European strategies have been delineating – although with a limited and still evolving amount of success – we conclude the chapter by analyzing this evolution and the future perspectives in an age of perhaps unprecedented uncertainty.

As noted by Jocelyn Mawdsley, "the European political economy of defense can currently be characterized by relationships between the key protagonists that are often conflictual and contradictory, and based on an uneasy compromise between preferences for a neo-liberal free market system and a mercantilist 'strategic trade' perspective."³⁰⁰ According to the author, the achieved compromise is based on the creation of an "intracommunity" market, where major firms can conduct their M&As, while they also remain subject to a certain degree of protectionism (i.e. a middle-ground solution, between the French preference for protective intervention and the Anglo-German priority of "value for money").³⁰¹

Indeed, the European approach to defense industrial policy, as incomplete and precarious as it might have been, has already focused on a conditional common market priority, with a particular concern placed on innovation possibilities. Especially in the 2000s, the EU has looked with increasing interest at the realm of defense research policy, introducing the Preparatory Action on Security Research (PASR) with a "full-scale introduction of security in FP7 (2007-2013) [i.e. the seventh Framework Programme for research and innovation]," as well as "the European Security Research Programme (ESRP) focused in developing security technologies," and – perhaps most importantly – the inclusion of defense-related research in Horizon2020 "as one of the seven societal challenges."³⁰²

Such efforts were the precursors of the most recent ones, which have been described in detail in chapter 2, and which derived from the European Defence Action Plan (EDAP) delineated in November 2016. It has been observed that EDAP featured three main goals.

³⁰⁰ Mawdsley, The European Union and Defense Industrial Policy, 26.

³⁰¹ Ibid.

³⁰² Nikoaos Karampekios, Iraklis Oikonomou, and Elias Carayannis, "Introduction," in *The Emergence of EU Defense Research Policy: From Innovation to Militarization*, ed. Nikolaos Karampekios, Iraklis Oiknomou and Elias G. Garayannis (Cham: Springer International Publishing AG, 2018), 2.

The Plan has three main components: first, a European Defence Fund to fund collaborative research projects and joint development of defense equipment and technologies; second, supporting investments in defense supply chains, especially through finance for SMEs, and encouraging the development of regional clusters of excellence; and third, ensuring that Europe has an open and competitive Single Market for defense.³⁰³

We have already discussed point one at length, and the EDF might indeed constitute a major novelty on its own, especially for its research and innovation-related aspects (see section 2.3).³⁰⁴ The second and third points are also very ambitious and potentially ground-breaking. But they may be even more difficult to achieve. Let us unpack them individually and then consider the complete architecture of European defense industrial policies, with the interactions among the different parts.

The idea to promote SMEs and thus favor the creation of better European supply chains and more effective regional industrial clusters was certainly not new. The point has considerable repercussion on the innovation systems, since the European DIB features a plethora of SMEs (refer back to figure 3.14 for a bird's eye view of this characteristic), and because these firms are usually unable to undertake costly research projects on their own. As we highlighted before, on the one hand, SMEs do possess the capacity to innovate, particularly in a disruptive way; on the other hand, they would do so much more effectively if R&D costs were to be shared by clusters which include research centers and universities.³⁰⁵ Thus, the second point of the EDAP is, at least in principle, a very intelligent goal. The problem arises, again, in terms of regional allocation of capabilities: it is inherently difficult to structure efficient regional clusters, while seeking a compromise between so many different national industrial policies and military priorities. On an economic basis, it would be tempting to argue in favor of "applying the principles of substitution and specialization by comparative advantage," yet a way towards an intergovernmental compromise is still far from being delineated.³⁰⁶ Furthermore, another yet unresolved obstacle to efficient intra-European supply chains lies in the incomplete

³⁰³ Hartley, "The Economics of European Defense Industrial Policy," 81.

³⁰⁴ Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration."

 $^{^{305}}$ At this level, the objective intertwines with the previous one because – as we explained in depth in section 2.3 – the discussed version of the EDF foresees specific benefits for projects involving SMEs and Mid-cap firms.

³⁰⁶ Hartley, "The Economics of European Defense Industrial Policy," 91.

success registered by the Directives of the so-called 'Defence package' (see the data analyzed in section 2.1).

The last point, i.e. creating a European single market for defense, is perhaps the most ambitious one, the majority of this thesis has been concerned with that question; hence, we can now provide a recapitulatory discussion of the issue. Firstly, we should state once again that the defense realm remains exempted from the common market by virtue of article 346 TFEU (former article 296). Member States may be (and actually are) willing to discuss cooperation projects and new agencies for enhancing them, but they can ultimately shield their DIBs via article 346 (and they frequently do so). Secondly, it has been noticed that there is something like a contradiction in terms faced by the Single-Market ideal, in the current framing of the supranational defense industrial policy.

European defense industrial policy has two components, namely, the creation of a Single Market for defense equipment and the formation of an EDTIB. Immediately, there are potential conflicts between these aims. A genuinely competitive Single Market will conflict with the aim of creating an EDTIB. Competition will allocate scarce resources between different regions and nations within the Single Market, but this might mean some regions losing defense technology and production capabilities, and such losses might be regarded as socially undesirable.³⁰⁷

Ultimately, the European conundrum remains the same, and a general solution remains lacking. Nevertheless, a partial solution may rest exactly in the policy compromise described at the beginning of this subsection. Since policymakers in European capitals are clearly not ready to allow free competition in the market for defense, there will be a need to keep finding middle-ground solutions. In other words, State protectionism and (semi)free market will have to coexist again. Nonetheless, Member States will also get caught in the trap of cost escalation which becomes more daunting on a year-by-year basis.³⁰⁸ The latter threat, as noted by several academics should eventually act as a booster for some degree of defense de-fragmentation. It is worth noting that the most feasible and beneficial starting place should be R&D programs.

³⁰⁷ Ibid, 91.

³⁰⁸ Ianakiev, "The European Defence Fund: A Game Changer for European Defence Industrial Collaboration," 7. Bellais, "The Economic Imperative of Europeanizing Defense Innovation," 94. We have already discussed the trend at length, see subsections 2.3.2, 3.1.3, 3.1.5, and 3.3.1.

Indeed, European 'industrial policy' initiatives are yet at an early stage, but – interestingly – they intertwine at the research and development crossroads. It seems that both national and supranational institutions are starting to realize the usefulness of a common R&D resource pooling and sharing. To begin with, the EDF, as we specifically highlighted in chapter 2, has a special focus on research first and foremost (in this phase, economic incentives are up to 100%), but also on projects development. Second, the promotion of common supply chains, as well as the financing of European SMEs and Mid-caps should start from research incentives, helping those firms to avoid the 'Valley of death,' especially with the support of research centers within their own clusters. Third, the objective of forming a common market, with its common DTIB, may contain its own paradox – as highlighted above – yet, it must pass through the empowerment of the continental innovation base, which also starts from an improvement of the European R&D efforts.

Moreover, it is no secret that the great liability of European defense throughout the last decades has been represented by an underrating and consequent downsizing of R&D spending (data in chapter 2 has shown that expenditures were insufficient both at the single-MS level and in terms of European Collaborative R&D, nay R&T, registered by the European Defence Agency). Such declining trend needs to be corrected swiftly, otherwise Europe will lose the technology edge: the continent is already lagging-behind, but it is not too late to avoid definite marginalization.

Even though precious time has already been lost, an effective solution to relaunch European competitiveness may rest in enhancing dual-use technologies, and the Union is taking the appropriate action with the mentioned extension of the *Horizon2020* program to the realm of defense.³⁰⁹ The long-standing desire for European action became a reality with the Horizon 2020 security programme (i.e. Programme 3.7), specifically focused on defense-related projects, but also other civilian yet overlapping parts (particularly Programmes 1, for 'Excellent Science,' and 2, for 'Industrial Leadership') that might critically assist it (via dual-research).³¹⁰ This trend shows that the EU is finally

³⁰⁹ Calls to action in that direction have been frequent in the past, an example comes from Ballester's work: "Treaties indeed foresee defense research as part of the European project, and give a solid legal base for military- and dual-use research to be included as part of the Horizon2020 framework."

Ballester, The Cost of Non-Europe in Common Security and Defence Policy, 68.

³¹⁰ More details can be found in Guy Bordin, Mayya Hristova, and Encarnacion Luque Perez, "Security and defense research in the European Union: a landscape review," *Science for Policy report by the Joint Research Service*, 2019,

https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/security-and-defence-research-european-union-landscape-review

overcoming its fear of subsidizing defense-related activities (both the extension of Horizon and the EDF directly supported by the Union's MFF budget are groundbreaking steps in this paradigmatic change).

Undeniably, the EU lacks the cohesive set of agencies guiding the US DIB (see subsection 3.2.4); but this does not mean that the Commission, the EDA, and the national representatives (especially those of PeSCo countries) will be unable to refine the Union's strategies and industrial policy. To be sure, it is difficult to imagine a Union which achieves complete military self-sufficiency, and is able to reach the innovation and industrial competitiveness levels displayed by the United States and China, countries that are investing much more extensive resources on defense R&D, as we have highlighted above (refer back to figure 3.8). The US remains a partner in the architecture of alliances outlined in chapter 1, and rightly so, since it is a country with an industrial-military capacity unrivalled in the EU, which can have certain degrees of spillover into the continent's capacities as well (an instance which materialized in the case of the Joint Strike Fighter Program).

To this regard, we should also add that the realities of globalization make it difficult not only to create a European Single Market for defense, but also to fence it for granting a protection from external competitors. Many recent, often dual-use, technologies are outside of the complete self-sufficiency remit of the EU, and even that of the US, for that matter.

The revolution in military affairs has vastly increased the importance of the civilian technology to defense platforms [...] The firms that supply these key components (such as embedded software) are frequently global suppliers, thus leaving prime contractors and governments reliant on global firms with little incentive to abide by restrictive defense contracting arrangements.³¹¹

The report (ibid, 3) statistically analyzes the programmes under Horizon 2020, noticing that "the analysis of the 349 security and defence Horizon R&D projects shows that almost half of them are related to cybersecurity;" five contributing States "stand out – the UK, Spain, Italy, Germany and France – accounting for 56% of the total EU contributions." It is also interesting to report the strong involvement of private subjects: "considering the legal status of the contributors, private-for-profit companies represent a very high share, 48% of the total." Lastly, one crucial point in the perspective of this thesis is that the researchers' data confirmed very large margin for dual-use application: "the analysis shows further that the overwhelming majority (approx. 90%) of the considered research projects have potential dual-use application, i.e. their output with civil application could also be used in the defense sector."

³¹¹ Mawdsley, The European Union and Defense Industrial Policy, 27.

To conclude, even the most active industrial policy schemas may have to relent in front of the reality we face nowadays. In other words, global markets are becoming exceedingly intertwined to allow for a fully national, self-sustaining DIB: a trend that has been upsetting policymakers in Washington DC as well.³¹² In conclusion, the firms will probably get at the forefront of the global defense competition, and the countries or supranational actors with the more ambiguous sets of industrial policies could be the ones which receive the more expensive checks. Therefore, as we will see more at length with the Conclusion, the EU should support with stronger decisiveness its Defence Fund and common R&D efforts, as well as its operative commitments. This may well be the last call for European defense; therefore, signaling uncertain confidence could potentially condemn the continent to decades of competitive disadvantage.

³¹² The 2018 Defense Industrial Base Report "identified a 'surprising level of foreign dependence on competitor nations." Heidi M. Peters, "Defense Primer: U.S. Defense Industrial Base," 2.

Conclusion

The path of our study, with its multifaceted steps, has allowed us to answer the questions behind our starting hypotheses and to verify their value. Again, the testing of the first hypothesis (i.e. the point that *a common European defense industry is still a required goal of the European Union*) was our major concern; whereas the second one (i.e. *a common industry and market of defense remain difficult to achieve and they will require a vast effort in terms of industrial policy compromises and other types of trade-offs*) was intended as a way to qualify the former. In other words, the second and complementary point has the function to smooth the first one. To state that the first hypothesis must be qualified is not only a decision that comes out of intellectual honesty, but also the consequence of a literature which is excessively unbalanced towards positive opportunities and achievements, while often ignoring the worrisome limitations in terms of success secured thus far. Nonetheless, the fact that a European industry of defense remains a necessary objective and one still achievable within the remit of the European Union is a hypothesis that withstands the tests of our thesis

The necessity is particularly evident throughout all the chapters. The first chapter has highlighted the general limits posed by the current state of affairs, characterized by high continental fragmentation, notwithstanding a prolonged timeline of communitarian integration attempts. At the beginning we presented the "failing forward" model of European integration, and scrutinized the history of such continental progresses in the most sensitive policy areas (in our case the focus was placed on defense, but the recent monetary history of the EU may also provide a useful point of comparison). Additionally, we presented the most peculiar mechanisms characterizing the market of security and defense, anticipating how they see an intertwining of economic and political rationales on the part of the States which might simultaneously sponsor and regulate their own national industries, while also procuring and buying their products.³¹³ Moreover, we described the uncertain history of EU (formerly European Community) defense projects and analyzed data about the problematics of burden sharing within the North Atlantic Treaty Organization, which showed a somewhat limited cohesiveness among the Allies. To conclude the chapter, a set of international initiatives and fragmented national scenarios (those of France, Germany and Italy) have shown the persisting problems

³¹³ Henrik Heidenkamp, John Louth and Trevor Taylor, *The Defence Industrial Triptych: Government as Customer, Sponsor and Regulator*, (Abingdon: Taylor and Francis, 2013).

caused by fragmentation, including excessive duplication, conflicting defense industrial policies, insufficient defense budgets and stagnant research/innovation base.

Chapter 2 analyzed in depth the roots of continental fragmentation, trying to evaluate the potential of the most recent initiatives of the Union as a possible way out, as well. Section 2.1 has measured the levels of Research and Development expenditures throughout the continent and found out dismal results. The expenditure in R&D, according to the Eurostat COFOG database, decreased from €8,676 million in 2012 to €5,421 million in 2018 for EU28; taking *Brexit* into account, the EU27 expenditure in defense-related R&D further decreased to €3,080 million. Total defense public expenditures, on the other hand, had an increase throughout the last decade reaching a value of €207,589 million for the EU28 and €162,424 million for EU27, in 2018. This highlights the worrisome trend characterizing R&D efforts, which are the most underrated area in terms of European commitments. Thus, not only is the European innovation base divided, but also limited in terms of single national budgets. Overcoming fragmentation, via collaborative R&D may increase the achieved value for many projects (especially the ones for larger systems) and help Member States' optimize their returns on investment. It has been noticed that R&D represents one of the heaviest expenses, especially in terms of fixed costs, while also pointing out that pooling and sharing might be an effective way of reducing sunk costs, in case projects fall into the so-called "valley of death" (i.e. initial research is carried out, but there are no resources or commercialization strategies to take the project forward into the development phase).

The Chapter then moved on to analyze the weight of duplication within the EU. Citing Reports of the European Commission, we noted how stunning the difference between European and American duplication really is. For instance, the EU has 17 different main battle tanks, whereas the US only features one model (i.e. the M1 Abrams); Europeans have 20 fighter planes, while the US has 6 of them; in total the Union features 178 types of weapon systems, vis-à-vis 30 types for the American counterpart. As we have mentioned throughout the dissertation: it might not be perfectly appropriate to compare a supranational Union with a federal State, yet the discrepancies are as large as to highlight a definitively excessive redundancy. Certain estimates state that the European duplication might cost more than €25 billion per year.³¹⁴ Furthermore, section 2.1.2 also

³¹⁴ EU Commission, "The European Defence Fund: Stepping up the EU's role as a security and defence provider," *European Defence Fund - factsheet*, March 2019. https://ec.europa.eu/docsroom/documents/34509

cited certain examples of cooperative European consortia (for example, the Eurofighter Typhoon) underlining opportunities and drawbacks for this sort of collaboration. This also led us to a more complete analysis of European cooperative procurement. Researching data collected by the EDA and the Commission, section 2.1.3 tested the amount of success achieved by the "defence package" (i.e. a set of two pieces of legislation, including Directive 2009/81/EC on Defence and Security Procurement, and Directive 2009/43/EC, simplifying terms and conditions for transfer of defence-related products within the Community). The success of this initiative was mixed; on the one hand, many Member States took several years to transpose the Directives into national law; on the other hand, Commission data (see the graphs in section 2.1.3) has shown that the defense and security procurement took off quite slowly, with remaining margins for improvement in terms of contract award notices, and total money volume. Additionally, most projects awarded under the directive where smaller ones, with nation States remaining more protectionists when procuring more expensive systems and systems of systems. It is the author's opinion that the "package" also had some interference with the EDA's collaborative procurement. This instance was denied by the Commission's Staff Working Document on the effects of Directive 2009/81/EC, yet we may notice that European Collaborative Equipment Procurement peaked in 2011 (according to EDA data, refer back to figure 2.5), a time when most MSs still had to transpose the EU norms into their domestic legislation. After that point collaborative procurement decreased: indeed, the value has never reached the 35% ratio established as EDA's goal. The 'mixed' level of success is one of the main points supporting the second – less optimistic – hypothesis: the plethora of utilized tools has yet to achieve a substantial success in terms of defense market and industrial integration, and even transnational consortia feature their own difficulties and the need to meet different product "specifications" required by different States.

Section 2.2 was dedicated to the current efforts of the Union in terms of common defense actions. We described the complex and interrelated architecture of European Defense initiatives: a set of tools with the Capability Development Plan (CDP) identifying common priorities, the Coordinated Annual Review on Defence (CARD) monitoring implementation of such development, identifying and organizing cooperative projects, and the European Defence Fund providing financial support as well as fostering competitiveness, innovation, cooperation and SMEs involvement. To this regard, the complexity of the EDF required a section of its own, in which we took the opportunity to

describe the economic incentives for research (and to a lesser extent development) that should flow from the Fund. Disagreements among MSs and the Covid-19 crisis threatened the survival of the initiative, but – in the end – it was still allocated €7 billion for the next MFF. Furthermore, one should also be careful in not underestimating the Fund's self-reinforcing possibilities, with mechanisms that could incentivize the States to contribute additional resources with the intent of promoting specific projects (see section 2.3 for an in-depth examination of these points). Once again, the EU might be able to "fail forward" – so to speak – even during the hard times of the Covid-19 crisis.³¹⁵

Chapter 2 was then concluded by a case study that evaluates the interesting, although quite tormented, Eurodrone project. The project may still face the risk of definitive suspension, due to international disagreements, but it provided an interesting example to highlight how European tools and agencies may cooperate to allow a continental division of labor that leads to the development of needed products and to the cooperative procurement of the latter.

Lastly, the final chapter has focused on innovation perspectives. Section 3.1 introduced basic concepts of innovation dynamics and defense-related innovation. A particular attention was dedicated to the relationship between innovation and competition (see subsection 3.1.2), considering the "inverted-U" curve by Aghion et al., and we applied certain aspects of the model to the defense industry in the subsequent paragraph, where we went back to the "Schumpeterian" and "escape-competition" effects behind firms' innovative efforts.³¹⁶ Moreover, we analyzed the point of risk-taking for the sake of defense innovation, and described how States intervene to share this burden with firms, thus establishing a relation of co-dependency (i.e. one in which States need firms' knowhow, but the latter need some degree of protection or sponsorship from their State). Consequently, we highlighted other important characteristics of DIBs vis-à-vis innovation possibilities.

Section 3.2 drew the comparison with the United States industry and its innovation dynamics. The industry was found out to be not only more integrated – as one might obviously have anticipated – but also more active in terms of Mergers and Acquisitions (M&As), more committed in terms of research and development efforts towards maintaining a clear world leadership (a doctrine which was at its finest during

³¹⁵ Erik Jones, R. Daniel Kelemen and Sophie Meunier, "Failing Forward? The Euro Crisis and the Incomplete Nature of European Integration," *Comparative Political Studies* 49, no. 7 (2016): 1027.

³¹⁶ Philippe Aghion, Nicholas Bloom, Richard Blundell, Rachel Griffith and Peter Howitt, "Competition and Innovation: An Inverted-U Relationship," *Quarterly Journal of Economics* 120, no. 2 (2005): 701-728.

the Cold War era, but is now increasingly challenged by China, see subsection 3.2.3 for comparative data), and – lastly – much more sophisticated in its use of public agencies that promote the innovation systems (e.g. the Defense Innovation Board, the Defense Advanced Research Projects Agency, the Strategic Capabilities Office, and the Defense Innovation Unit).

The concluding section moved back to focusing on the European scenario, for an application of the innovation models explored previously and for completing the comparison with the United States. Subsection 3.3.1 explained how innovation potential is at a decisive 'crossroads' for Europe. Since the European industry is still relying on research successes achieved decades ago, it runs the risk of remaining behind for the next generations of systems. Subsection 3.3.2 went on to describe the more limited innovation capacities of European firms, the slow – and often firm-led – integration achieved thus far in terms of intra-European M&As (which yet remain much less frequent in comparison to the US counterparts), and certain business opportunities which may expand their remit if the EU finally manages to find a common stance, so that it may more successfully promote its exports on the competitive global market (for instance, notwithstanding certain improvements, for a large quantity of European actors it remains difficult to be active in the North American market). Finally, the chapter examined the innovation potential that may rest behind a more cohesive *defense industrial policy* at the European level. It described the compromises achieved so far between neoliberal stances for a free defense market and a more protectionist alternative, with a cleavage between the French preference for extensive intervention and the Anglo-German one more focused on value and not seldom favorable to off-the-shelf purchases. The last subsection also scrutinized how the European Defense Action Plan (leading to the full-fledged EDF for the next multiyear financial framework, promoting a focus on financial support to SMEs and the goal of achieving a cohesive Single Market) might pose the basis for a further evolution of European defense industrial policy. These trends shall also be considered in conjunction with a general improvement of research and the growth of dual-use solutions that will be expanded via the Horizon2020 plan. Indeed, R&D might be the right place to start, since it provides the basis for future innovation and lends itself to the pooling and sharing of funds, at a time when national (fragmented) investments are consistently decreasing.

Therefore, the results of our research point both towards the necessity of establishing a defense Single Market, and the value of certain caveats that are all too often

ignored even by the academic literature on the subject. On the one hand, the *deadweight* losses due to duplication, the decreasing R&D resources vis-à-vis a further cost escalation, and the necessity to create a more flexible, integrated and *dual-use* industry are confirmed by each part of our thesis. On the other hand, the limited amount of success achieved so far at the European level, the difficulties inherent in transnational consortia (e.g. the one described by our case study about the Eurodrone), and the difficult economic and political trade-offs behind defense integration do call for a certain degree of skepticism and for some caveats. The necessity of a European defense market and a more integrated industry is nowadays inescapable: failing to achieve any progress in such direction would probably condemn EU MSs to take a secondary role in the defense related production and innovation of the future. The EU is probably marching towards the right direction, since the commitment of communitarian budgets for defense in the next MFF and the defense-related efforts of Horizon2020 are quite unprecedented. Nonetheless, many obstacles remain. Covid-19 is already menacing further cuts to defense budgets. In addition, Brexit will definitively leave the Union without its most important defense player, and urge the other major Member States to find some common ground and to provide the smaller partners with the guarantee that a more integrated industry will not lead to the complete dismantlement of their own, more limited, economies of scale.

Only concerted action can therefore lead to a successful outcome. Otherwise, Europe may lose yet another chance of establishing a common defense industry and upgrading the present set of national Defense Industrial Bases. The challenge is tough – as recognized by economists and defense analysts alike – yet potential dividends make the attempt a worthy one. This might well be the last call, before the old continent is doomed to decades of competitive disadvantage in the sector, and hence to an era of outright military vulnerability.

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Summary

The purpose of this study was to analyze the current state of the European Defense industry and its prospects for the future. We selected this topic, since it was a timely moment to discuss the progress achieved thus far and because of the on-going introduction of the full-fledged European Defense Fund. Moreover, the subject seemed to be particularly apt for an interdisciplinary dissertation, since it could only be understood in its entirety not only taking an economic angle (which was, indeed our main concern), but also utilizing arguments from EU law and International Relations, which had a supporting function, to get a complete grasp of the trends characterizing European defense throughout the decades.

Our work had two main – complementary, so to speak – hypotheses. First, the point that a common European defense industry is still a required goal of the European Union. Second, the one that a common industry and market of defense remain difficult to achieve and they will require a vast effort in terms of industrial policy compromises and other types of trade-offs. The first hypothesis comes from economic considerations which were largely supported by the tests performed throughout our three chapters. Whereas the second hypothesis has the function to qualify the first one. Indeed, by reading the extensive literature focused on European defense integration, one may realize that a few secured progresses are often overemphasized, at the risk of underrating the many difficulties that continue to threaten European efforts. The record of quite enduring fragmentation characterizing the European Defense Industrial Bases (DIBs) should be considered as the most evident witness of such difficulties.

The present thesis followed a clear outline, which is also captured by the title: the study unfolds from a description of the persisting state of fragmentation, to an *excursus* about the innovation possibilities at the continental level, including a detailed analysis of what has been done so far. Chapter 1 was concerned with providing the reader with the basic concepts, facts and figures to understand the European industry of defense in its economic facets, but also in terms of institutional efforts undertaken up to this day. Chapter 2 built a complete analysis of the main problems caused by such state of fragmentation, as well as an extensive discussion of the present initiatives promoted by the European Union and a final case study on the Medium Altitude Long Endurance Remotely Piloted Aircraft System (MALE RPAS, also known as Eurodrone), to exemplify how intra-European consortia may or may not work. Lastly, chapter 3

proceeded to comprehensively study the possibilities of innovation. In doing so, it looked at how innovation systems work, what are the specific characteristics of innovation within the defense sector, focusing in particular on the importance of Research and Development (R&D), but also on the role of defense industrial policies and regulatory agencies. This last chapter also constructed a comparison with the United States, which was used as a benchmark for more integrated types of industry and DIB at large. Now let us unpack each of these chapters and then succinctly provide a condensed set of conclusions that have emerged from our studies.

Chapter 1 began by analyzing how the European Union (former European Community) has progressively extended towards more sensitive policy areas. We described the "failing forward" model developed by Jones et al. explaining that it is an interesting blend of intergovernmentalism and supranationalism, and that even though its authors had applied it to the subject of the Economic and Monetary Union (EMU), the template might be useful to study defense integration as well. Indeed the following sections confirmed (in each of the three chapters), that the idea of "failing forward" in the sense of a European project evolving through a series of crises (something similar to what had been predicted by the Schuman Declaration) is actually a recurring trend for the Union and may yet be repeated by the sector of defense. The initial section also provided important points of EU law, by unpacking the sui generis nature of the European supranationalism, and referring to specific legal provisions, such as article 346 (former article 296) of the Treaty on the Functioning of the European Union, which exempts the defense industry from the Single Market, at least in cases of "essential interests" (this is the formula mentioned by the Treaty, but the Member States have used a quite extensive approach to opt-out from the common market when defense and security are involved).

The second section went on to provide a general discussion on the peculiar traits of the defense industry, we focused mainly on the economic characteristics but also provided a brief presentation of the political points affecting defense markets. Five main concerns emerged throughout the pages. First, and foremost, there is the frequent presence of *barriers to entry and exit* displayed by the market. The barriers to entry are due to the very *large fixed costs* characterizing many segments of the industry, which make it easier for incumbent firms to avoid competition by new comers (this was explored in more detail in chapter three which studied at length the relationship between innovation and competition); while the latter are caused by the sponsorship role of many governments,

which tend to create enduring partnerships with incumbent firms and thus lead them to remain in the market (via public procurement) even if profitability increases in alternative civil markets. Moreover, barriers to entry can often be technological in nature, due to the high costs of R&D, which are often difficult to be carried out by private enterprises (especially, SMEs and Midcaps), unless the government steps in with sponsorship. This last trend has also been investigated, by following the "defense industrial triptych" model developed by Heidenkamp et al. who correctly see the government acting as "costumer, sponsor and regulator" at the same time. Second, and consequent to the first point, the section focused on the limited level of competition featuring the industry. Countries such as the United States explicitly favored Merger and Acquisition (M&A) processes to make their industries more sustainable in terms of public budgets. Furthermore, not only there is this mentioned tendency towards *monopolistic arrangements*, but also – on the other hand – a trend towards monopsony, since the States often act as the only buyer for an extensive series of security and defense products. Third, the innovative side of the industry is also peculiar, since R&D require very large expenditure, and unsuccessful investments lead to very heavy sunk costs (especially for projects which fall into the socalled "Valley of death," i.e. the ones which go through the research phase but fail the transition to the development stage, because of insufficient funds or lacking commercialization strategies). Additionally, with regards to innovation, the States face a policy dilemma: it is difficult to decide if one wants to promote larger firms and thus more extended and established economies of scale, or to promote more competition which (while being burdensome for public budgets) usually fosters the most disruptive forms of innovation, and allows smaller enterprises to explore niches that are often overlooked by larger firms. Fourth, the defense market is nowadays characterized by increasing complexity, also featuring players such as Private Military and Security Companies (PMSCs), and initiatives like Public-Private Partnerships (PPP) which progressively overcome what was once an exclusively Weberian remit under the control of State actors. This progressively more flexible industry is also marked by the increasing importance of dual-use solutions (with civil-military spin-offs and spin-ins). Fifth, and last, we mentioned the strictly strategic value of the sector which causes extensive policy interventionism by the States.

Section 1.3 focused on the initiatives conducted in terms of European defense integration through the decades. We briefly described the Western Union Alliance (also known as the Brussels Treaty Organisation of 1948), swallowed up by NATO in 1949,

and the failed attempt at creating the European Defence Community (1954). Subsequently, we follow the path which led to the Western European Union (Rome Declaration of 1984), the Common Foreign and Security Policy (Treaty of Maastricht 1992), the European Security and Defence Policy (Treaty of Amsterdam 1997 – legal codification followed with the 2001 Treaty of Nice) and the Common Security and Defense Policy (a reformulated ESDP that came with the Treaty of Lisbon).

Section 1.4 also studied forms of 'soft defense coordination,' but this time we focused on the realm of the North Atlantic Treaty Organization. We discussed the so-called "Transatlantic gap," distancing priorities and defense spending habits between the US and many major European allies, we referenced NATO agencies that are peculiarly relevant in the industrial dimension (i.e. NATO Science and Technology Organization – NATO STO – and NATO Support and Procurement Agency – NASPA), and we analyzed the recurrent issue of expenditure burden-sharing. The latter point was scrutinized following a correlation developed by Sandler and Shimizu, which did find out a somewhat statistically relevant level of unbalanced burden-sharing at the beginning of the 2010s. Furthermore, we looked at the more recent spending trends and took the occasion to describe certain methodological questions which make it complicated to collect consistently comparable data on defense expenditures.

Section 1.5 concluded the chapter by providing descriptions of three different defense markets within the EU (i.e. the French, German and Italian ones). For each country, we briefly highlighted market features and policy stances, while also examining the trends of their national security budgets throughout the last decades (refer back to figures 1.4, 1.5 and 1.6). This last effort provided us with an empirical description of the fragmented *status quo* of European defense and prepared the field for the subsequent study of contemporary EU initiatives to be conducted in the following chapter.

Chapter 2 began with a section dedicated to the main issues arising from continental defense fragmentation. The first subsection focused on the problem of inefficient (and insufficient) R&D. We used the Eurostat COFOG database (General Government Expenditure by Function) to show how limited and still decreasing are the resources that European countries dedicate to defense-related R&D. The expenditure in R&D, according to the Eurostat data, decreased from €8,676 million in 2012 to €5,421 million in 2018 for EU28; taking *Brexit* into account, the EU27 expenditure in defense-related R&D further decreased to €3,080 million. This is extremely limiting and worrisome, especially if we

take into account the fragmentation of such efforts (i.e. the fact that many resources are also allocated to competing and cost-inefficient projects brought forward by different Member States or groups of MSs). The thresholds which the European Defence Agency has recommended as goals for cooperative Research and Technology (with R&T indicating a subsegment of R&D) have never been reached to this day.

Subsection 2.1.2 went on to scrutinize another unhealthy consequence of fragmentation: namely, the excessive amount of military duplication throughout Europe. A brief look at the difference between European and United States armaments is a quite impressive case in point. For instance, the EU has 17 different main battle tanks, whereas the US only features one model (i.e. the M1 Abrams); Europeans have 20 fighter planes, while the US has 6 of them; in total the Union features 178 types of weapon systems, visà-vis 30 types for the American counterpart. As we have stated throughout the present thesis, the EU is not perfectly comparable to a federal State, yet the differences are so extensive that they constitute a call to action for European analysts and policymakers. Furthermore, we provided a more specific practical example looking at the multiplication of aircraft projects which saw three different and competing projects throughout the continent when the Eurofighter Typhoon was developed together with the French Rafale and the Sweedish Gripen Jets. We cited a study by Valerio Briani, showing how this type of duplication multiplied the weight of fixed costs and diminished the purchasing power of the involved countries' armed forces. European standardization, which already provides uniform certificates for a plethora of products should - where possible - be extended to the military realm, so that the EU can avoid, or at least minimize, the described sort of efficiency losses.

Subsection 2.1.3 analyzed the problem of public procurement and the possibility of cross-national acquisition processes. Firstly, we investigated the intergovernmental measures undertook by the EDA, which developed a series of *codes of conduct* that the Member States may follow on a voluntary basis (a series of initiatives that, indeed, had quite limited success). Secondly, we analyzed a more sophisticated form of integration based on Directive 2009/81/EC *on Defence and Security Procurement*, by studying the Commision's follow-up report on the implementation and the accompanying Staff Working Document, we analyzed the trends of the compliance in terms of transposition of the law into the national frameworks (which did took some years), and in terms of transactions and money volumes under the Directive. We also looked at a second Directive, which completes the so-called "Defence Package," Directive 2009/43/EC,

simplifying terms and conditions for transfer of defence-related products within the Community. Lastly, we elaborated a discussion of possible interferences between Directive 2009/81 and the European Collaborative Equipment Procurement, an instance which was denied by the Commission's Staff Working Document, but that – as we argue in the text – may be verifiable, to some extent, if we look at EDA data.

Section 2.2 described the main agencies and tools currently utilized by the European Union. The first subsection was dedicated to an illustration of the European Defence Agency (EDA), the second one discussed the Permanent Structured Cooperation (PeSCo), whereas subsection 2.2.3 expanded upon the roles of the Capability Development Plan (CDP), the Coordinated Annual Review on Defence (CARD), and the PADR (Preparatory Action on Defence Research). For each of these elements, we unpacked the main relations with the attempt to foster the Single Market for defense and the integration of the European DIB. Additionally, we cited the most relevant pieces of EU law and explained the value they retain.

Section 2.3 was entirely dedicated to the European Defence Fund (EDF), since this tool is particularly important both as a financing source and as a possible enhancer of military and defense integration throughout the continent. To begin with, we described the history of 'precursor' initiatives that gradually led towards the full-fledged Fund (i.e. the PADR for the *Research Window* and the European Defense Industrial Development Programme for the *Capability Window*). Moreover, the envisioned budgetary levels were mentioned and discussed. The subsequent subsection went on to describe the EDF's mechanisms in terms of funding allocation, self-reinforcing rationales stimulating States' own contributions, and incentives to foster intra-European cooperation especially for the Research phase, and especially for projects involving SMEs and Midcaps. Further, we highlighted the importance of the EDF for the future of innovation within the European industry of defense (something which was then explored in-depth by chapter 3).

Section 2.4 closed the second chapter by providing a case study on the Eurodrone project. The consortium behind this product can be particularly instructive because it epitomizes both the opportunities and difficulties behind cooperative research and procurement initiatives at the continental level. The project is a good instance to show the involvement of PeSCo, EDA, and even OCCAR, as well as the financing mechanism of the EDIDP (and possibly of the full-fledged EDF). Furthermore, the project shows how a multinational consortium can achieve an effective and cost-efficient division of labor among multiple contractors and subcontractors, thus activating intra-European clusters of

production. However, the project has also shown the problematics which arise from the need to satisfy diverging product-specification preferences forwarded by different nations within the partnership. In fact, while the research phase has been completed, the development one is yet to be officially launched, due to disagreements between the French and German governments (which, together with Italy, should act as the most important acquirers of the drone). Therefore, the relevant delays (and possible suspension) of the initiative are one of the examples in favor of a more moderate optimism vis-à-vis pan-European cooperation: caveats and obstacles clearly persist. From this and other points our second 'qualifying' hypothesis is definitely confirmed, and it points out a series of limitations which are all too often overlooked by the specialized literature on the subject.

Chapter 3 turned the focus on the issue of defense-innovation. In the first subsection we introduced some theoretical models to study and understand innovation systems. In subsection 3.1.2 we explored the relationships between *competition and innovation*. To this regard we followed a study by Aghion et al. who analyzed the two variables (the first measured via the Lerner index, and the latter by the number of citation weighted patents) for a vast set of industries and found an "inverted-U relationship." We described the theoretical considerations behind the resulting curve, in particular the "Schumpeterian" and "escape competition" effects motivating innovation and we applied these considerations to the defense sectors (subsection 3.1.3). Additionally, we described certain specific traits of the defense industry which condition innovation within that peculiar realm: in particular, the degree of complexity, certain microeconomic *characteristics* (e.g. product substitutability and specific barriers to entry), and in general the characteristics of different segments of the industry, which ought to be understood in different terms. The following section focused on the specific relations between firms and State, which create what we refer to as 'co-dependency,' a situation of information asymmetry where a State needs the firms' know-how, whereas enterprises need a certain degree of sponsorship and procurement by their State. Lastly, subsection 3.1.5 looked at innovation dynamics within evolving DIBs, a fact that requires a correct understanding of dual-use technologies, and possibly a rethinking of production models that are often based on a paradigm established at the times of the Cold War.

Section 3.2 constructs a comparison with the industry of the United States. Again, the main concern is placed on the innovation-related aspects (in particular, R&D).

Subsection 3.2.1 started by providing general information on the US industry, the military expenditure of public authorities and the Department of Defense's attitude towards guiding the national DIB. The following subsection looked at the US defense firms and analyzed trends in Merger and Acquisition operations.

Subsection 3.2.3 provided an in-depth analysis of the national R&D efforts, it compared such efforts to the European and Chinese counterparts, while also unpacking R&D by stages (i.e. Basic Research, Applied Research, and Development), by industrial segments and by type of promoter (i.e. R&D financed by enterprises vs publicly-financed one). Interesting trends emerged: for example, the overwhelming importance of publicled research efforts for the earliest stages of R&D (the one at the lower Technology Readiness Level), which make it necessary, for public authorities, to get involved in defense-related research.

Subsection 3.2.4 described the fundamental role played by public agencies that promote defense-related innovation in the United States. We focused on the Defense Innovation Board, The Defense Advanced Research Projects Agency, the Strategic Capabilities Office, and the Defense Innovation Unit.

Section 3.3 concluded the chapter by focusing again on Europe to complete the comparison and apply the innovation-related models and considerations to the old continent as well. Firstly, we focused on the necessity to strengthen cooperative Research and Technology (and R&D in general) to improve the armed forces' purchasing power in an age of large *cost escalation* for defense-related costs (cost escalation in this sector has been consistently larger than inflation rates, creating a situation which calls to mind Augustine's Law XVI). Indeed, Europe is now dealing with a generational problem: it still relies on a business model and production paradigm which were set up during the Cold War, and the inability to update such paradigm would condemn the Member States to lose the cutting edge of defense-related innovation. We closed the section by explaining that the state of persisting fragmentation (notwithstanding economic rationales in favor of enhanced integration) is due to political considerations by which the States prefer to preserve their national industries. In other words, the motives of economics get intertwined with those of sovereign politics. The problem, nevertheless, remains since as we argued – it is paradoxical to protect sovereignty if countries have to lose all their military edge in the process.

Subsection 3.3.2 focused on the European firms and it discussed the multiple (overlapping) cleavages featured by the continent. The enterprises are divided among

themselves on a national basis, on an inter-sectoral basis and even on a firm-to-to firm basis (the latter is due to the fact that, because of State and EU authorities' inaction, firms diversified the chosen strategies on their own, sometimes betting on domestic market and governmental support, other times "going-global" and competing in the international markets – often after extensive, transnational mergers). To this regard, we explored European firms' innovation capacity, we set up a timeline of the main megamergers which characterized the recent history of the continent (looking, in particular, at *BAE Systems, Airbus, Thales*, plus *Leonardo*), and we mentioned the European defense clusters and some problems related to business opportunities (e.g. markets for exports). In general, we found that the M&A market of Europe is active, but not as flexible and rich as the North American counterpart.

Our last subsection was dedicated to an analysis of defense industrial policy in Europe. At the moment, the continent witnesses a series of national diverging industrial policies. Nonetheless, first compromises are already emerging, as manifested by the middle-ground solution between the French preference for State intervention and the Anglo-German one favoring free market and "value for money," as described by Jacelyn Mawdsley. Furthermore, we showed how the EDF, together with the defense commitment of the *Horizon2020* research program constitutes an unprecedented possibility to promote collaborative policy efforts, especially in the crucial realm of R&D (whose importance had been argued, from different angles in each of the three chapters).

To conclude, our two hypotheses withstand the tests conducted by the three chapters of the present work. The majority of the analyses point towards the necessity of a somewhat more integrated market and industrial base for defense (hypothesis one). Nonetheless, many instances do call for some caveats and a certain amount of skepticism remains (hypothesis two). The Eurodrone case study is a good example of how difficult it is to conduct common European defense projects. The tormented history of communitarian defense institutional efforts is another case in point.

Thus, the findings of our research may be summarized by highlighting the economic and strategic necessity to bring forward European defense integration to face *increasing cost escalation, defense budget cuts* and *innovation challenges*. On the other hand, we should also refrain from underestimating the limits which remain in terms of difficulties in aligning industrial policies, transnational projects' specifications and production standardization. For example, smaller States do fear that their more limited

economies of scale might be completely dismantled, whereas the major MSs prefer different models of industrial policies and are often times trapped in a neo-mercantilist mindset of State activism, when dealing with the defense realm. Notwithstanding these persisting divergences, it is basically imperative to find a common-ground solution, if the EU Member States want to avoid a definitive destiny of strategic irrelevance. Economic constraints are simply too great to be ignored or surpassed by political rationales. Further, Europe is now at a crossroads and it has acquired some momentum due to the relevant set of initiatives that have been studied by this thesis.

Only concerted action can lead to a successful outcome. Otherwise, Europe may lose yet another chance of establishing a common defense industry and upgrading the present set of national Defense Industrial Bases. The challenge is tough – as recognized by economists and defense analysts alike – yet potential dividends make the attempt a worthy one. This might well be the last call, before the old continent is doomed to decades of competitive disadvantage in the sector, and hence to an era of outright military vulnerability.