

Six decades of consolidation in the European defense industry (1960-2022)

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Abstract

In the present security environment, the capabilities of the European defense industry and the impact of restructuring over the years have become issues of concern. Researchers have found considerable consolidation when looking at the overall industry, but have failed to consider that this might understate the loss of national capabilities in subsectors. This article investigates the effect that restructuring has had on twenty subsectors of the defense industry in thirty one European countries from 1960 to 2022. It finds that since the 1960s, the number of major European defense firms has contracted by between 29% and 80% across subsectors, implying the loss of a range of capabilities. It suggests that while Europeanization is inevitable, it is likely be accompanied by further diminishing capabilities at the national level.

In these times of heightened international tension, European institutions (notably the European Commission) and policymakers call for an intensification of Europe's defense-industrial integration efforts. The "Strategic Compass" is the latest expression of the aim to increase cross-border collaboration and consolidation to strengthen the industry and ensure the security of supply of armaments.¹ Consolidation² is a prominent feature in the evolution of defense industries, as many arms firms face high fixed costs, particularly R&D, and operate in decreasing-cost industries wherein larger production runs offer economic gains.³ In times of low demand, rising costs, growing competition, and other challenges, consolidation can reduce overcapacities and industrial fragmentation.⁴ Smith (2013) defines five strategies for defense firms facing demand downturns, three of which can lead to supply-side consolidation.^{5,6}

Based on the existing literature and available data, it is argued that taking an aggregate view on the European defense industry understates the historical restructuring within the individual countries and (sub-sectors). Following an assessment of 20 subsectors in 31 European countries⁷ over the period ranging from 1960 to

1 European External Action Service (2022).

2 In this article, 'consolidation' refers to supply-side consolidation, which we define as the concentration of defense production within fewer suppliers (e. g., due to mergers, acquisitions, or market exits).

3 Hartley (2017, 2013, 2011a); Hartley et al. (2008); Dunne et al. (2007).

4 Kleczka et al. (2020).

5 Commercial diversification, conversion toward civilian production, divestiture of defense divisions, cooperation among rivals, and concentration on core defense activities.

6 In several European countries, the decline in defense budgets following the end of the cold war has been slowed down, and sometimes even reversed, in recent years. Since we provide a historical assessment, our main findings are not affected by this development.

7 In this article, 'Europe' is defined as the EU27 plus Iceland, Norway, Switzerland, and the United Kingdom (U.K.).

2022, this article examines how the structure of Europe's defense industry evolved at both levels. First discussing how market structure and national production capabilities have changed since the 1960s before comparing the leading defense firms which have emerged from this restructuring process. The rising importance of the defense electronics sector is then briefly debated. The final section offers concluding discussions, highlights some limitations, and outlines opportunities for future research.

Our long-term disaggregated view on European defense industry consolidation makes three contributions to the existing literature. First, an outline of the heterogeneous impact of the restructuring processes since the 1960s on the number of defense firms for the most important subsectors of the aircraft, naval and land sectors. Second, a highlight of the different experiences with consolidation between Western Europe and East-Central Europe (i.e., the former Warsaw Pact countries). Third, a discussion of the industrial structure that has emerged from past restructuring and the implications for the individual countries' industrial capabilities. Taken together, the findings highlight facets of the restructuring process that are commonly overlooked—the existing literature being mostly confined to specific countries or sectors and to a more limited period.

Trends in the European defense industry

Europe's defense industry is the result of decades-long consolidation processes. All major European defense firms have emerged from mergers and acquisitions, with market exits of former competitors having further shaped industrial concentration. The end of the cold war with its budget cuts created over-capacities in most arms-producing countries and production became increasingly concentrated within fewer firms. Nevertheless, it is often argued that European restructuring did not go far enough. The United States (U.S.) with its much larger defense budget sustains significantly fewer defense firms and competing programs than Europe.⁸ European fragmentation reflected its collection of independent countries which are often reluctant to enter transnational ventures for reasons of national security and sovereignty⁹, export earnings, and the preservation of employment and industrial capabilities. As budgetary pressures increased, the further consolidation of Europe's defense industry was to be expected.¹⁰

A considerable body of research has been published on this topic. It can be separated into: company studies which analyze the evolution, strategy, or prospects of specific firms¹¹; country studies, which are by far the most numerous

In the present security environment, the capabilities of the European defense industry following years of restructuring is concerning. Researchers have found considerable consolidation when looking at the overall industry, but have failed to consider that this might understate the loss of national subsector capabilities. Disaggregate information highlights that the consolidation process experienced by Europe's defense industry is likely to be understated if only aggregate analyses are undertaken. For example, as of 2022, no single European country builds heavy transport aircraft independently.

8 On consolidation in the US, see Hensel (2015), Gansler (2011), Dunne et al. (2007), and Guay and Callum (2002). For a comparison of the number of major defense firms in Europe and the US, see Hartley (2017, 2011a) and Kleczka et al. (2020).

9 See Mölling (2015), Fiott (2015), Briani et al. (2013), and James (2002) on the link between national defense production and perceived sovereignty or security.

10 Bellais (2017), Bitzinger et al. (2017), Dunne and Smith (2016), Briani et al. (2013), and Hartley (2011b) are among those who discuss further consolidation as an option for Europe's defense industry.

11 For example, such publications exist for BAE Systems (Hartley, 2012; Bélanger and Hébert, 2001), Airbus (formerly EADS: Hartley, 2019; Engler, 2016; Fache, 2005; Thornton, 2003), Leonardo (formerly Finmeccanica: Caruso, 2019; Caruso and Locatelli, 2013; Felice, 2010) and Thales (Som, 2009). The consolidation processes which created BAE Systems, EADS, and Thales are summarized by Dunne and Surry (2006).

group comprising thousands of publications on sectoral developments within individual European nations¹²; and European level studies, which offer sectoral analyses without being limited to specific countries¹³. Reviewing these and other studies leads to two conclusions. First, that Europe's experience with defense industry consolidation has varied among individual countries and sectors, and second, that despite differences among countries, common sectoral trends have shaped the industries across Europe.

In the aircraft sector, successive mergers and acquisitions from the 1960s onwards established just one or two industrial leaders in most European countries. In parallel with these national consolidation processes, "*rapidly increasing R&D costs and shorter production runs made cross-border cooperation [...] a financial imperative*".¹⁴ Esposito (2004) separates this evolution of cooperation into distinct phases: An "*in-house production phase*" until the late 1950s, characterized by no cooperation across borders; a "*first collaboration phase*" in the 1960s, as technological advances spurred some joint projects; a "*European consortia phase*" in the 1970s, which established major trans-European ventures (e.g., Airbus and Tornado); and a "*worldwide co-operation phase*" in the 1980s, characterized by growing collaboration with non-European firms.¹⁵ When demand fell in the 1990s, European integration followed on the fundamentals of existing consortia and joint programs.¹⁶ As a result, Europe's aircraft production capabilities are now largely concentrated within a few system integrators (Airbus, BAE Systems, Dassault, Leonardo, and Saab).

In contrast, land weapons systems have lower R&D costs and sufficient domestic demand for consolidation to be more limited. Demand downturns and changing demand patterns¹⁷ did lead to several important cross-border projects (including ASCOD, Fennek, Boxer, and the Main Ground Combat System) and to transnational firms such as General Dynamics European Land Systems (GDELS), KNDS, and Rheinmetall BAE Systems Land.

The naval sector followed a different path. Until the 1960s, surface warships and submarines were commonly built by "mixed" shipyards which faced increasing competition, particularly from Japan and South Korea.¹⁸ Government responses saw action to consolidate shipyard groups and to stimulate specialization, and following the global decline in demand for commercial ships after the 1970s "oil crises", Europe's naval industry was significantly transformed

12 The evolution of Sweden's defense industry, for example, was assessed by Lundmark (2019), Eliasson (2017), Ikegami (2013), Andersson (2007) and Hagelin (1997). Consolidation in the U.K. has been for the aircraft analyzed industry (Nuttall et al., 2011; Hartley, 2010) and the naval sector (Johnman and Murphy, 2001). Similar studies are available on France (Belin et al. 2019; Serfati, 2001, 1997; Hébert and de Penanros, 1995; Hébert, 1995), Germany (Brzoska, 2019), Spain (Fonfría and Sempere, 2019; Casellas, 2003; Molas-Gallart, 1997, 1995, 1992a,b), and the naval industries of Italy (Sasco, 2017; Fragiaco, 2012) and the Netherlands (van der Velden, 2017; Lemmers, 2015; Smit, 2010). Kiss (2014, 1999, 1997) surveys the restructuring of East-Central Europe's major defense industries in much detail. Among the many other scholars covering individual countries in East-Central Europe are Markowski and Pieńkos (2019), Chovančík (2018), Bochniarz et al. (2016), Behr and Siwiecki (2004), Nelson (2003), Dimitrov (2002), Smith (1994) and Fučík (1991).

13 More recent examples include Esposito (2004), Braddon and Hartley (2013) and Droff (2017) on the aircraft sector, Andersson (2001), Fleurant et al. (2014), Caralp (2017) and Masson (2010) on the land sector, Bellais (2017) and Smit (2003) on the naval industry.

14 Andersson (2001). See also Guay and Callum (2002).

15 Besides Esposito (2004), see also Hartley (2019), Droff (2017) and Braddon and Hartley (2013) on collaborative programs in Europe's aircraft industry.

16 Esposito (2004). On pre-existing collaboration as a precursor for transnational integration, see also Sköns and Baumann (2003), Andersson (2001), and Schmitt (2000).

17 Kleczka et al. (2021). See also Guay (2007), Sköns and Baumann (2003), Guay and Callum (2002), James (2002), Andersson (2001), and Cornu (2001) on the limited scope of land sector consolidation until the early 2000s.

18 Cho and Porter (1986). See also Bruno and Tenold (2011), Poulsen and Sornn-Friese (2011), Lorenz (1991) and Lammers (1988) on Western Europe's diminishing market share.

in size and structure.¹⁹ Further consolidation after the end of the cold war was mostly national in scope.²⁰ Despite a few cross-border takeovers and some common designs (including Horizon, FREMM, Enforcer, Type 212A, Type 212CD), Europe's naval sector remains fragmented along national lines.

These broad trends naturally had different implications for individual countries. Notably, their impact varied between Western Europe and East-Central Europe, whose defense industries were largely unaffected by trans-European restructuring until the 1990s. In East-Central Europe, domestic production (often under Soviet license) prevailed until the 1990s, then collaborative production and European integration took place in the aircraft industry (which also experienced some transatlantic integration) and the naval sector. The land sector witnessed national consolidation, but relatively little European integration.²¹

While U.S. acquisitions in Western Europe were partly matched by European takeovers of U.S. defense firms (including important naval yards and armored vehicle producers), East-Central Europe's experience was rather "unidirectional". For example, Poland's leading aircraft producers were taken over by Leonardo, Lockheed Martin, and Airbus, and Romania's largest naval yards are now controlled by Damen and Fincantieri. However, some of these integration moves were recently scaled back. For example, Polska Grupa Zbrojeniowa (PGZ) are re-acquiring Poland's largest aircraft engine plant from Pratt & Whitney, and the Czechoslovak Group now controls a large share of the Czech and Slovak defense industries.

One common explanation for the different speed and scope of consolidations is that economic pressures varied across the industries. The aircraft industry was forced into cooperation in the 1960s, providing the foundation for later cross-border integration moves. Such pressures were less severe in the naval and land sectors in part due to lower R&D costs and longer production runs, thereby permitting national approaches to persist well into the 21st century.^{22,23} Further, Smit (2003) also identifies a weaker link between civilian and defense production, strong historical ties between naval forces and domestic shipyards, and small-batch supply in warship production. Bellais (2017) emphasizes higher degrees of state ownership, unwillingness to accept rationalizations after cross-border mergers, specific national requirements, perceived indispensability of naval yards and their in-service support for sovereignty reasons, and the strengthening of competitive positions of naval shipbuilders via vertical integration.

For the land weapons sector, Andersson (2001) identifies national prestige, varying national requirements, incompatible industrial incentives, limited experience with cross-border programs, persistent fragmentation within countries, lower pressure from commercial markets (due to higher defense dependency), and scant political support for trans-European consolidation. Other factors include the presence of highly specialized firms and the small size of

19 See Murphy and Tenold (2017) on the overall impact of the 'oil crises'. Concerning national naval restructuring, see Poulsen (2013) and Poulsen and Sornn-Friese (2011) on Denmark, Teräs (2017) on Finland, Lebailly and Bidaux (2017), Bourque (1996) and Domenichino (1991) on France, Strippoli *et al.* (2017), Fragiocomo (2012), Galisi (2011) and Melelli (1983) on Italy, van der Velden (2017), Lemmers (2015) and de Voogd (2007) on the Netherlands, Ågotnes and Heiret (2017) on Norway, Karlsson (2017) on Sweden, Wolf (2017) de Voogd (2007), Lammers (1988) and Fante (1983) on Germany, Murphy (2017), Johnman and Murphy (2001), Johnman (1996), Slaven (1992), Todd (1984) and Daniel (1980) on the U.K.

20 Bellais (2017), Guay (2007), Smit (2003), Guay and Callum (2002), James (2002).

21 'East-Central Europe': Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia, and the Baltic states. 'Western Europe': all other EU Member States (except Croatia and Slovenia) plus Iceland, Norway, Switzerland, and the U.K. Croatia and Slovenia are covered by our country studies in the Online Appendices A and B, but otherwise not included in the East/West country groups. For further information, we refer to the supplementary Online Appendices A and B, in which we chart the experience with consolidation for the individual countries and sectors. See Appendices section for URL.

22 Caralp (2017), Fleurant and Quéau (2014), Braddon and Hartley (2013), Briani (2013), Hartley (2011b), Esposito (2004), Guay and Callum (2002) and Andersson (2001).

23 'Cost escalation', as described by Augustine (1983), is notably severe for military aircraft. For further discussions and applications to Europe, see Hartley (2020, 2017), Bellais (2020), Hove and Lillekvelland (2016), Keating and Arena (2015) and Braddon and Hartley (2013).

most European land systems suppliers.²⁴ Success in export markets has also been argued to have eased the economic pressures on the naval and land sectors.²⁵

As a result of these trends, Europe's defense-industrial capabilities are now largely concentrated in a few countries. Briani *et al.* (2013) estimated that France, Germany, Italy, Poland, Spain, Sweden, and the U.K. together accounted for about "90% of the defense (industrial) turnover in Europe". In 2021, these countries accounted for 28 of the 30 largest European defense firms.²⁶ Other countries may have significant capabilities in selected areas (for example the Dutch naval sector), but otherwise mostly serve as suppliers to foreign defense firms and as providers of maintenance, repair and overhaul (MRO) services to national armed forces.²⁷ These seven leading countries accounted for almost 80% of Europe's total defense expenditure and equipment procurement spending in 2021. By the same year, Europe's defense R&D spending was even more concentrated, with 93% of it falling to France, the U.K., and Germany. The countries with the largest defense expenditure were also Europe's leading exporters during the last decade (except for Poland). On a sectoral level, the principal exporter of military aircraft was France, followed by the U.K., Spain, Italy, and Germany. Germany was the largest exporter of naval vessels (ahead of France, the Netherlands, Spain, Italy, and the U.K.) and, more noticeably, tops the list of land weapon systems exporters with 34% of all European exports.

Foreign sales are highly concentrated, with the seven leading countries accounting for 95% of aircraft, 98% of naval, and 85% of land systems for all European exports between 2012 and 2021—but care must be taken in interpreting the data as exports are cyclical, sectoral exports may not necessarily reflect capabilities at the sub-sectoral level,²⁸ and the inclusion of second-hand sales also distorts the ranking.²⁹ Trans-European firms must be considered when interpreting defense exports (for example, Spain's position as Europe's third largest aircraft exporter reflects the presence of Airbus).

This defense spending and exports are shown by country in Tables 1 and 2 below. Despite their limitations, the data do deliver a key conclusion—even among Europe's leading arms-producing countries, major differences in defense-industrial capabilities exist.

24 Cornu (2001).

25 This argument was delivered by Caralp (2017) and Fleurant and Quéau (2014) for the land sector and by Smit (2003) for the naval industry. See also Bellais (2017) on the importance of naval exports.

26 SIPRI (2022c), Defense News (2022) and own research based on Bureau van Dijk's (2022) ORBIS database.

27 Briani *et al.* (2013). Struys (2004) presents a similar distinction between 'large' and 'small and medium' defense industries.

28 For example, while Germany was the leading naval exporter in 2012–2021, its naval industry lacks capabilities possessed by other European countries (for example, the means to build nuclear-powered submarines, aircraft carriers and large amphibious ships).

29 The Netherlands, for example, decommissioned and sold its entire main battle tank fleet during the observed period and thus became the third largest European land systems exporter, far ahead of several countries with much larger land systems industries. For similar reasons, Poland and the Czech Republic (two countries with indigenous aircraft industries) reported lower aircraft exports than some countries which no longer produce military aircraft (for example, the Netherlands and Portugal).

Table 1: European countries' defense expenditure

	<i>Defense expenditure in EURm (2021)</i>		
	<i>Total</i>	<i>Equipment procurement</i>	<i>Defense R&D</i>
United Kingdom	57,059	10,328	2,523
Germany	52,431	7,355	1,995
France	47,900	6,800	6,500
Italy	27,365	5,907	62
Poland	12,765	4,326	79
Spain	12,546	2,766	116
Netherlands	12,300	3,300	148
Norway	7,130	2,000	82
Greece	6,578	2,519	23
Sweden	6,000	1,500	88
Belgium	5,358	903	17
Switzerland	5,253	n/a	n/a
Finland	5,124	1,983	47
Romania	4,477	973	58
Denmark	4,458	646	n/a
Czech Republic	3,331	651	16
Austria	3,299	391	8
Portugal	3,282	531	3
Hungary	2,591	963	5
Slovakia	1,731	564	2
Croatia	1,150	345	1
Lithuania	1,105	243	5
Bulgaria	1,078	218	5
Ireland	1,046	114	0
Latvia	696	199	5
Slovenia	648	96	3
Estonia	647	180	5
Cyprus	458	97	0
Luxembourg	341	135	1
Malta	61	4	0
Iceland	0	0	0
Total	288,208	56,037	11,797
CR ₃	55%	44%	93%
CR ₅	69%	62%	96%
CR ₇	77%	73%	97%

Notes: n/a=no data available; CR3/5/7=cumulative shares of the 3/5/7 major countries. Numbers are rounded to the nearest million. If reported in a different currency, expenditure was converted into EUR.

Sources: Own construction based on SIPRI (2022a), European Defense Agency (2022) and governmental publications.

Table 2: European countries' defense exports

<i>Defense exports (major systems only) in TIVm (2012–2021)</i>				
	<i>Total</i>	<i>Aircraft</i>	<i>Naval</i>	<i>Land</i>
France	23,457	11,415	4,509	871
Germany	13,789	1,911	5,726	2,081
United Kingdom	10,473	5,149	1,692	423
Italy	7,853	3,402	2,643	553
Spain	6,532	3,411	2,843	87
Netherlands	5,487	298	2,921	606
Sweden	2,714	874	366	141
Switzerland	2,389	1,283		329
Norway	1,278	15	26	
Czech Republic	620	278		253
Finland	461	22		340
Belgium	322	89		52
Portugal	316	313		
Poland	247	198		20
Bulgaria	243	56		159
Romania	216		216	
Denmark	160	4	44	
Austria	157	26		86
Ireland	125	14	10	101
Slovakia	72	19		41
Lithuania	62	2		
Hungary	41	41		
Greece	30		30	
Slovenia	9			
Malta	5	5		
Croatia	3	3		
Cyprus				
Estonia				
Iceland				
Latvia				
Luxembourg				
Total	77,071	28,828	21,026	6,143
CR3	62%	69%	63%	58%
CR5	81%	88%	89%	74%
CR7	91%	95%	98%	85%

Notes: Exports are reported based on a ten-year period due to their high year-on-year volatility. CR_{3/5/7}=cumulative shares of the 3/5/7 major countries; TIV=trend-indicator value. Numbers are rounded to the nearest million

Source: Own construction based on SIPRI (2022b).

Sectoral and sub-sectoral restructuring

To make a more detailed analysis feasible, we first focused on system integrators and suppliers of complete defense equipment—thereby largely omitting tier suppliers and providers of MRO or upgrading services. Second, we restricted the analysis to 20 subsectors related to “major” types of armaments. Of these, eight subsectors fall into the aircraft sector,³⁰ seven into the naval realm,³¹ and five into the land industry.³² For each of the 31 European countries covered, we first conducted country studies outlining consolidation in the 20 subsectors from 1960 to 2022, using information from the economic literature, corporate and governmental publications, research institutes and think tanks.³³

Market structure

As Figure 1 shows, Europe’s aircraft sector experienced large-scale consolidation since the 1960s and the impact of this process has varied among the subsectors. Concerning heavy military transport and tanker types, Airbus (created from the leading French, German and Spanish aircraft firms) is now the sole European supplier, while in the market for medium-sized transport and tanker aircraft, only Airbus and Leonardo remain active after the demise of Fokker (Netherlands) and the withdrawal of BAE Systems (U.K.) and Saab (Sweden). From nine major suppliers in the 1960s, Europe’s helicopter industry is now a duopoly of Airbus (heir to the German and French industries) and Leonardo (which has absorbed the helicopter manufacturers of Italy, the U.K., and Poland). The number of European producers of combat and jet trainer aircraft fell from 23 in the 1960s to six in 2022, of which five (Airbus, BAE Systems, Dassault, Leonardo, and Saab) supply advanced combat types.³⁴

As the development and production of combat, jet trainer, heavy and medium transport/tanker, and rotary-wing aircraft is becoming increasingly complex and costly, these markets no longer witness the emergence of new European competitors. Instead, they were characterized by consolidation among the established producers during the preceding decades. In contrast, European producers of less costly or complex types (light transport and piston/turboprop trainer aircraft) remain far more numerous, and market entries still occur.³⁵

In the naval sector, the number of suppliers fell from more than 30 to 10 for destroyers and frigates, and from 19 to 5 for conventionally powered submarines. In most countries with large naval industries, Germany being the exception, a sole “national champion” now dominates: BAE Systems (U.K.), Naval Group (France), Navantia (Spain), Damen (Netherlands), Saab Kockums (Sweden), and Fincantieri (Italy). The markets for less complex and costly vessels (including patrol ships and minehunters) remain characterized by many smaller competitors and by new market entrants.³⁶ Aside from nuclear-powered submarines, no monopolistic or duopolistic structures were established at a European level and only few major cross-border mergers took place. The 1999 takeover of Kockums

30 Strategic bomber aircraft, advanced combat aircraft, light combat and jet trainer aircraft, rotary-wing aircraft, heavy transport or tanker aircraft, medium transport or tanker aircraft, light transport aircraft, and piston/turboprop trainer aircraft. Specialized variants are included (such as electronic warfare or maritime patrol types), but ultralight aircraft are not.

31 Nuclear-powered submarines, conventionally powered submarines, aircraft carriers and large amphibious ships, destroyers, frigates, corvettes and offshore-patrol ships, and mine-countermeasure vessels (offshore or coastal). Producers of smaller types (such as inshore minesweepers, landing craft, patrol boats) or auxiliary ships are excluded.

32 Main battle tanks and assault guns, other tracked armored fighting vehicles, other wheeled armored fighting vehicles, guns and howitzers (self-propelled or towed), and turrets or weapon stations (major suppliers only). Other segments (such as ammunition or non-armored logistics vehicles) are not assessed.

33 While the scope of this article does not permit presenting the country studies in full, they are provided in the supplementary Online Appendices A and B. See Appendices section for URL.

34 The sixth firm, Aero Vodochody, is much smaller and produces light rather than advanced combat aircraft.

35 Additional European aircraft producers with moderate capabilities are listed in Online Appendix C. See Appendices section for URL.

36 Additional European naval shipbuilders with moderate capabilities are listed in Online Appendix C. See Appendices section for URL.

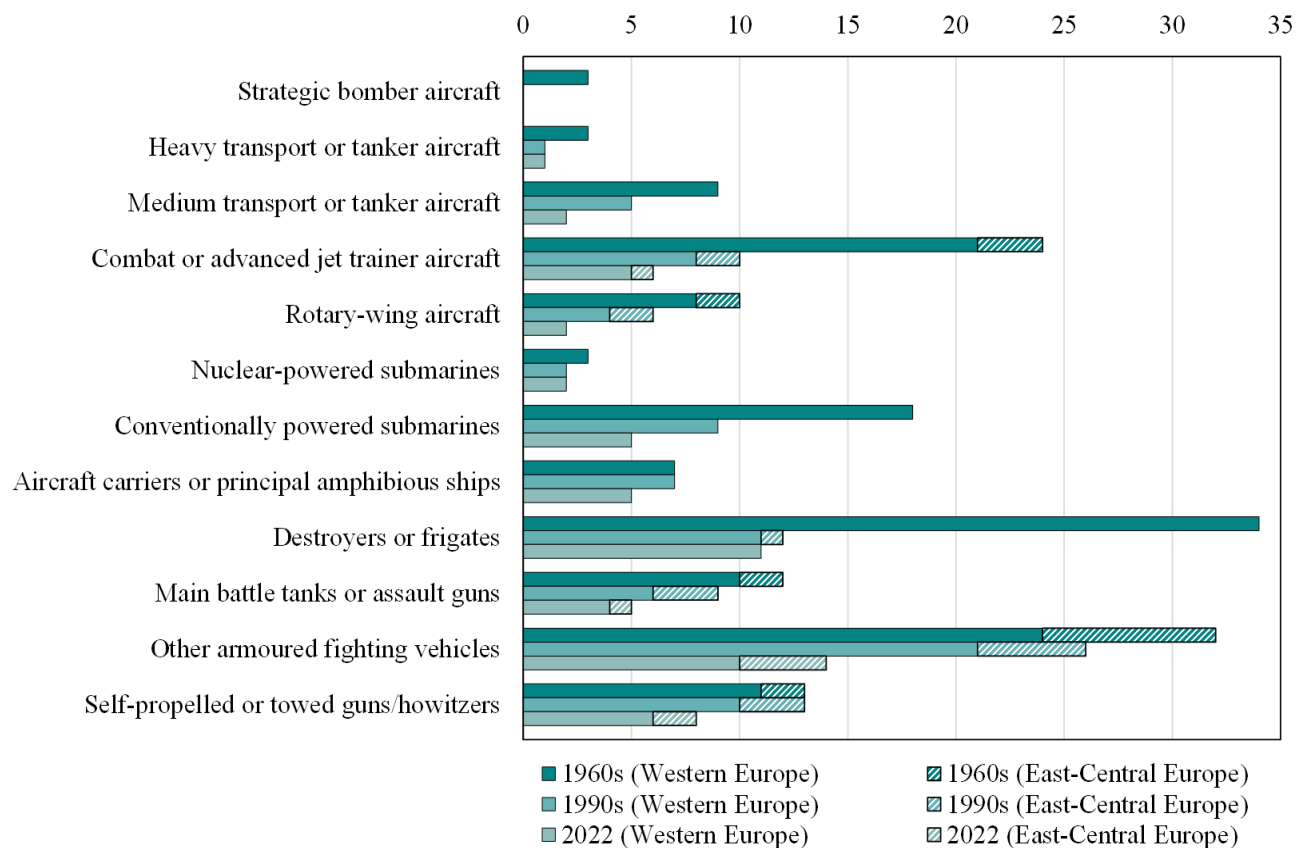


Figure 1: Change in the number of major European suppliers.

Notes: Only selected categories. Companies are reported at the highest level of consolidation and restricted to major established producers (for some categories, notably for armored vehicles, the number of suppliers would otherwise be higher). The former Yugoslavian countries (Croatia, Slovenia) are not included.

Source: Own construction based on data collected from the economic literature, and corporate and governmental publications (see online Appendices A and B for further information—the link is found in the Appendices section of this document)

by HDW was revoked in 2014,³⁷ and Fincantieri's intended acquisition of Chantiers de l'Atlantique fell through in 2021. New competitors do still enter the markets however—an example being Damen which now builds amphibious ships and aims to revive the Dutch submarine industry together with Saab Kockums (which has regained its independence from ThyssenKrupp). German Naval Yards and Lürssen now engage in the supply of destroyers and frigates. Babcock (U.K.) and Rauma Marine Constructions (Finland) have won contracts to supply frigates.

Decades of restructuring have integrated most armored vehicle and artillery systems industries into a single “national champion” or into a maximum of two major firms per country. However, even when small suppliers and licensed producers are not counted,³⁸ this still leaves about five (potential) European producers of main battle tanks, at least fourteen major suppliers of other armored fighting vehicles, and eight producers of artillery systems.

³⁷ Bellais (2017).

³⁸ Additional European land systems producers with moderate capabilities are listed in Online Appendix C. See Appendices section for URL.

		Prevalent type of production	
		Entirely or predominantly domestic (including licensed production of foreign designs)	Transnational programmes with major (but not predominant) domestic participation
Ownership of leading domestic company	Domestic	A	B
	Foreign	C	D

Figure 2: A categorization of domestic production modes.
Source: Own construction.

Examples of multiple national suppliers are Rheinmetall and Krauss–Maffei Wegmann (Germany), Nexter and Arqus (France), Leonardo and Iveco Defense Vehicles (Italy), and General Dynamics UK and BAE Systems (U.K.).

National production capabilities

Figure 2 provides a classification system based on production activities and the ownership of the leading firm. It distinguishes type A, domestic production under domestic ownership; type B, partial domestic production under a transnational project with major participation of a domestically owned company; type C, domestic production under foreign ownership; and type D, partial domestic production under a transnational project with major participation of a foreign-owned domestic company. “Production” distinguishes whether a specific equipment type is mainly produced on a domestic basis (local production of a national design or of a foreign design under license) or under a transnational program (such as Eurofighter, Tiger, and the A400M).³⁹ “Ownership” specifies whether the leading domestic firm is either domestically owned or controlled by a foreign company (including trans-European corporations such as Airbus).⁴⁰

For the aircraft sector, Figure 3 shows that most national industries have withdrawn from some segments since the 1960s. Six countries no longer produce advanced combat aircraft, while a similar number discontinued the domestic supply of jet trainer or light combat aircraft. The production of strategic bomber aircraft in Europe has ceased entirely. Furthermore, most remaining producers of advanced combat, rotary-wing, heavy or medium transport/tanker aircraft now conduct these activities within transnational consortia or as an integral part of a foreign or trans-European firm. Only France and Sweden still build advanced combat aircraft independently, though Italy produces medium-sized military transport aircraft. Light transport and piston/turboprop trainer aircraft remain in production in a much larger number of countries.

Figure 4 shows that Europe maintains a national approach toward naval construction, with the U.K., France, Germany, Italy, the Netherlands, and Spain still possessing the capabilities to produce most surface craft; apart from the Netherlands, all these countries also sustain indigenous submarine industries, as does Sweden. Submarine construction has ceased in the Netherlands, Denmark, and Croatia, and five countries no longer build frigates or

39 In Figures 3-5, ‘production’ refers to entire systems (including licensed production) or to a major participation in transnational consortia, but not to the tier supply of subsystems and components or the final assembly of foreign-made systems.

40 Based on corporate publications, defense industry associations, news releases, and specialized literature.

	Prevalent production mode in the 1960s								Prevalent production mode in 2022							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
United Kingdom	A	A	A	A	A	A	A	A		B	A	C	D	D	A	
France	A	A	A	A	B	A	A	A		A		C	D	D	A	A
Italy		A	A	A		A	A	A		B	A	A		A	A	A
Germany		A	A	A	B	A	A	A		D		C	D	D	D	A
Sweden		A	A					A		A	B					
Spain		A	A			A	A	A		D			D	D	D	
Poland		A	A	A			A	A				C			A	A
Czechoslovakia Czech Republic		A	A				A	A			A				C	A
Switzerland		A					A	A							A	A
Romania		B	B	A			A	A			A	D				
Belgium		B	B													A
Netherlands		B	B			A	A									
Finland			A					A								

Figure 3: Change in prevalent aircraft production modes.

Notes: Only selected countries and categories. ‘Production’ refers to entire systems (including licensed production) or to a major participation in transnational consortia, but not to the tier supply of subsystems and components or the final assembly of foreign-made systems. ‘Germany’ in the 1960s refers to the Federal Republic of Germany. Information on Romania’s historical production refers to the 1970s since its industry had not been fully established in the 1960s. Categories: (1) strategic bomber aircraft; (2) advanced combat aircraft; (3) jet trainer or light combat aircraft; (4) rotary-wing aircraft; (5) heavy transport or tanker aircraft; (6) medium transport or tanker aircraft; (7) light transport aircraft; (8) piston or turboprop trainer aircraft. See figure 2 for lettered categorization.

Source: Own construction based on data collected from the economic literature, and corporate and governmental publications (see online Appendices A and B for further information—the link is found in the Appendices section of this article).

destroyers. So again, European level developments can conceal the true impact of consolidation at the national level.

In the land sector, Figure 5 shows that more than a dozen European states still maintain production capabilities for armored fighting vehicles other than main battle tanks. This is roughly comparable to the 1960s (although the magnitude of the production capabilities may have been reduced). On the other hand, the number of countries with main battle tank industries has halved. Overall, the restructuring of the land sector was largely national, although some important cross-border mergers and acquisitions have taken place. These were mostly takeovers by much larger foreign competitors,⁴¹ with some mergers between competitors of more comparable size also happening. In 2003, the leading armored vehicle producers of Austria (Steyr–Daimler–Puch Spezialfahrzeug), Spain (Santa Bárbara Sistemas) and Switzerland (Mowag) were consolidated into GDELS.⁴² In 2015, the Franco–German KNDS alliance of Nexter and Krauss–Maffei Wegmann was formed, followed in 2019 by the establishment of Rheinmetall BAE Systems Land.

41 Such as the consolidation of the Dutch armored vehicle industry into Rheinmetall and Krauss–Maffei Wegmann (Caralp, 2017), Rheinmetall’s acquisition of Oerlikon–Contraves Defense (Switzerland), the integration of Hägglunds and Bofors (Sweden) into BAE Systems, and the transfer of Slovakia’s MSM Group to the Czechoslovak Group.

42 Followed by further acquisitions and partnerships in Germany, the Czech Republic, Denmark, Portugal, and Romania.

	Prevalent production mode in the 1960s							Prevalent production mode in 2022						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
United Kingdom	A	A	A	A	A	A	A	A		A	A	A	A	A
France	A	A	A	A	A	A	A	A	A	C	A	A	A	A
Germany		A		A	A	A	A		A		A	A	A	A
Italy		A		A	A	A	A		A	A	A	A	A	A
Spain		A		A	A	A	A		A	A	A	A	A	A
Netherlands		A		A	A	A	A			A	A	A	A	A
Sweden		A		A	A	A	A	A					A	A
Denmark		A			A	A							A	
Norway					A	A	A						C	A
Portugal					A		A						A	
Finland						A						A		
Poland							A						A	A
Croatia		A					A							A
Belgium					A	A	A							D

Figure 4: Change in prevalent naval shipbuilding modes.

Notes: Only selected countries and categories. ‘Production’ refers to entire systems (including licensed production) or to a major participation in transnational consortia, but not to the tier supply of subsystems and components or the final assembly of foreign-made systems. Information on Germany and Croatia in the 1960s refers to the Federal Republic of Germany and the Socialist Republic of Croatia (within Yugoslavia). Categories: (1) nuclear-powered submarines; (2) conventionally powered submarines; (3) aircraft carriers or large amphibious ships; (4) destroyers; (5) frigates; (6) corvettes or offshore-patrol ships; (7) mine-countermeasure vessels (offshore or coastal). See figure 2 for lettered categorization.

Source: Own construction based on data collected from the economic literature, and corporate and governmental publications (see online Appendices A and B for further information—the link is found in the Appendices section of this article).

Taken together, these assessments show that national capabilities have often disappeared even though the supply of almost the entire range of aircraft, naval, and land systems is maintained on a European level. Production is now concentrated in fewer countries as compared to earlier decades, and national programs have often been replaced by collaboration.

	Prevalent production mode in the 1960s					Prevalent production mode in 2022				
	(1)	(2a)	(2b)	(3)	(4)	(1)	(2a)	(2b)	(3)	(4)
Germany	A	A	A	A	A	A	A	A	A	A
France	A	A	A	A	A	A		A	A	A
United Kingdom	A	A	A	A	A	A	C	A	A	A
Italy	A	A		A	A	A	A	A	A	A
Poland	A	B	B	A	A	A	A	A	A	A
Spain	A		A	A	A	C	C	C	C	B
Sweden	A	A		A	A		C	C	C	C
Switzerland	A	A	A	A	A			C		A
Romania	A		A	A	A			A		A
Czechoslovakia	A	A	B	A	A					
Czech Republic								A		B
Slovakia								C	A	A
Finland				A				A	A	A
Austria		A			A			C		C
Belgium			A	A	A					A
Norway				A						A
Netherlands			A							B
Portugal			A		A					

Figure 5: Change in prevalent land systems production modes.

Notes: Only selected countries and categories. ‘Production’ refers to entire systems (including licensed production) or to a major participation in transnational consortia, but not to the tier supply of subsystems and components or the final assembly of foreign-made systems. ‘Germany’ in the 1960s refers to the Federal Republic of Germany. Information on Romania’s and Spain’s historical production refers to the 1970s as their industries had not been fully established in the 1960s. Categories: (1) main battle tanks or assault guns; (2) other types of armoured fighting vehicles (a: tracked; b: wheeled); (3) self-propelled or towed guns/howitzers; (4) armoured vehicle turrets or weapon stations. See figure 2 for lettered categorization.

Source: Own construction based on data collected from the economic literature, and corporate and governmental publications (see online Appendices A and B for further information—the link is found in the Appendices section of this article).

Leading defense firms resulting from consolidation

Companies with high defense dependency are potentially at higher risk if domestic budgets fall or foreign defense market competition increases.⁴³ On the other hand, diversified firms with low defense dependency may be less committed to promoting their defense business⁴⁴ and experience larger commercial consolidation pressure.⁴⁵ State-ownership can inhibit necessary corporate restructuring and cross-border consolidation,⁴⁶ but as Hartley (2019) points out, cross-border mergers may require governmental support even if the participating defense firms are not state-owned.

⁴³ Mölling (2015).

⁴⁴ Fleurant and Quéau (2014).

⁴⁵ Andersson (2001).

⁴⁶ Belin et al. (2019); Balis (2013); Briani et al. (2013).

Table 3: Leading European aircraft manufacturers (2021)

<i>Company</i>	<i>Country</i>	<i>Defense sales (aircraft segment, in USD million)</i>	<i>Defense dependency in %</i>	<i>State ownership in %</i>	<i>Capabilities</i>
Airbus	Trans-European	9,872	18	25.9	2/3/4/5/6/7/8
BAE Systems	United Kingdom	8,380–8,860	97	0	2/3
Leonardo	Italy	6,840–7,610	83	30.2	2/3/4/6/7
Dassault Aviation	France	6,250	73	0	2/7
Saab	Sweden	1,340–1,380	90	0	2/3
Pilatus Aircraft	Switzerland	484	33	0	7/8

Notes: Sales are approximate. Since the definition of “aircraft” or “aerospace” operations varies among the firms, column 3 states maximum values. Where possible, revenues unrelated to military aircraft have been excluded. The British Government holds a “special share” in BAE Systems. Capabilities: (2) advanced combat aircraft; (3) jet trainer or light combat aircraft; (4) rotary-wing aircraft; (5) heavy transport or tanker aircraft; (6) medium transport or tanker aircraft; (7) light transport aircraft; (8) piston or turboprop trainer aircraft. Includes licensed production and major participations in national or transnational consortia. *Source:* Own compilation based on SIPRI (2022c), Defense News (2022), corporate and governmental sources.

Table 4: Leading European naval shipbuilders (2021)

<i>Company</i>	<i>Country</i>	<i>Defense sales (naval segment, in USD million)</i>	<i>Defense dependency in %</i>	<i>State ownership in %</i>	<i>Capabilities</i>
BAE Systems	United Kingdom	5,160–6,440	97	0	1/3/4/5/6/7
Naval Group	France	4,740	99	62.3	1/2/3/4/5/6/7
Fincantieri	Italy	2,980	36	71.3	2/3/4/5/6
ThyssenKrupp	Germany	1,800–2,390	6	0	2/4/5/6
BIG	United Kingdom	1,280	55	0	3/5/6
Navantia	Spain	1,080	70	100	2/3/4/5/6/7
Lürssen	Germany	600–700	40–50	0	4/5/6/7
DSG	Netherlands	400–700	15–25	0	3/4/5/6/7
Saab	Sweden	390–400	90	0	2/6/7
CdA	France	200–300	10–15	84.3	3/5/6
Prininvest	Trans-European	130–200	n/a	0	4/5/6

Notes: Sales are approximate. Since the definition of “naval” operations varies among the firms, column 3 states maximum values. Where possible, revenues unrelated to military vessels have been excluded. Defense sales of Prininvest include German Naval Yards and Lindenau in Germany, CMN in France, and Isherwoods in the U.K. The British Government holds a “special share” in BAE Systems. Capabilities: (1) nuclear-powered submarines; (2) conventionally powered submarines; (3) aircraft carriers or large amphibious ships; (4) destroyers; (5) frigates; (6) corvettes or offshore-patrol ships; (7) mine-countermeasure vessels (offshore or coastal). n/a=no data available; BIG=Babcock International Group; CdA=Chantiers de l’Atlantique; DSG=Damen Shipyards Group.

Source: Own compilation based on SIPRI (2022c), Defense News (2022), corporate and governmental sources.

As Table 3 shows, Europe’s capabilities in military aircraft are concentrated in just five leading firms (Airbus, BAE Systems, Leonardo, Dassault, and Saab). BAE Systems is by far the largest European defense firm in total defense sales, but ranks below Airbus if only the aircraft-related turnover is considered. Indeed, Airbus’ defense-related aircraft sales exceeded those of Dassault by almost 60 percent, and those of Saab and Pilatus Aircraft by a factor of 7 and 20, respectively. Governmental ownership was reduced to a minority stake in Airbus and Leonardo,

and to a “golden share” in BAE Systems. The companies also vary in their defense dependency, ranging from 18% (Airbus) to 97% (BAE Systems), and in their diversification (with Airbus and Leonardo having broader aircraft portfolios). If the proposed EADS/BAE Systems merger had happened, it might have marginalized Dassault and Leonardo.

Europe’s naval sector is likewise very unevenly distributed, as relatively few shipbuilders account for most naval-related defense sales. While there are some limitations to the available information, Table 4 suggests that BAE Systems was the largest European naval supplier in 2021, followed by Naval Group, Fincantieri, ThyssenKrupp, Navantia, Lürssen, Damen Shipyards Group., and Saab. Babcock’s position is difficult to assess due to the particularly large share of maintenance and service activities in its naval revenues. In contrast to Europe’s largest aircraft firms, three leading naval shipbuilders (Naval Group, Fincantieri, Navantia) still operate under governmental control.

Table 5 shows that Rheinmetall, KNDS (comprising of Nexter and Krauss–Maffei Wegmann), BAE Systems, and General Dynamics’ major European subsidiaries (GDELS and General Dynamics U.K.) are the largest European producers. Most of BAE Systems’ land-based revenues, however, are generated by its U.S.-based subsidiaries. In 2019, Rheinmetall acquired a majority in BAE Systems’ U.K.-based military vehicle business. The size differential vis-à-vis Europe’s next-largest armored vehicle suppliers (Arquus, Iveco Defense Vehicles, PGZ, Leonardo, Czechoslovak Group, and Patria) is substantial. The data also shows that firms with higher land sales usually have more diversified portfolios (although there are some exceptions).

Table 5: Leading European land systems manufacturers (2021)

<i>Company</i>	<i>Country</i>	<i>Defense sales (land segment, in USD million)</i>	<i>Defense dependency in %</i>	<i>State ownership in %</i>	<i>Capabilities</i>
Rheinmetall	Germany	2,860–3,570	67	0	1/2a/2b/3/4
KNDS	Trans-European	3,030	95	50	1/2a/2b/3/4
BAE Systems	United Kingdom	2,750–3,180	97	0	1/2a/2b/3/4
GDELS & GDUK	Trans-European	730–1,270	69	0	2a/2b/3/4
Arquus	France	620	1	0	2b/4
IDV	Italy	560–730	2	0	1/2a/2b/3
PGZ	Poland	500–700	90	100	1/2a/2b/3/4
Thales Group	France	n/a	51	25.7	2b/4
Leonardo	Italy	250–580	83	30.2	1/2a/2b/3/4
John Cockerill	Belgium	370–420	35–40	0	4
Kongsberg	Norway	210–280	37	50.001	4
CSG	Czech Republic	140–210	60–75	0	2b/4
Patria Group	Finland	140–200	93	50.1	2b/3/4
RUAG MRO	Switzerland	120–210	86	100	3/4

Notes: Sales are approximate. Since the definition of “land” operations varies among the firms, column 3 states maximum values. Where possible, revenues unrelated to armored vehicles and artillery systems have been excluded. Leonardo only supplies armored vehicles via CIO (a joint venture with Iveco Defense Vehicles). Defense dependency rates for GDUK, GDELS, Arquus and Iveco Defense Vehicles refer to the parent firms (General Dynamics, Volvo Group, CNH Industrial). The British Government holds a “special share” in BAE Systems. The French Government holds a “golden share” in Nexter (which makes up 50% of KNDS) and Thales. Capabilities: (1) main battle tanks or assault guns; (2) other types of armored fighting vehicles (a: tracked; b: wheeled); (3) self-propelled or towed guns/howitzers; (4) armored vehicle turrets or weapon stations. n/a=no data available; CSG=Czechoslovak Group; GDELS=General Dynamics European Land Systems; GDUK=General Dynamics UK; IDV=Iveco Defense Vehicles; KNDS=Krauss–Maffei Wegmann + Nexter Defense Systems; PGZ=Polska Grupa Zbrojeniowa.

Source: Own compilation based on SIPRI (2022c), Defense News (2022), corporate and governmental sources.

Defense electronics warrants a brief reflection as it now accounts for a large share of European defense production.⁴⁷ As Table 6 shows, the combined sales of the five largest suppliers (about USD 22.2–25.5bn) significantly exceed those of the leading firms from the naval (USD 16.0–17.8bn) and land systems sectors (USD 10.0–11.8bn). Only the aircraft sector offers higher combined revenues (USD 32.7–34.0bn), although we cannot rule out that these sales might also include an electronics component. In contrast to the land and naval sectors, no leading defense electronics company still operates under majority public ownership.

This does not necessarily imply that the “older” industries are on the way out, as 23 of Europe’s 30 largest defense firms generate most of their revenues in segments other than defense electronics.⁴⁸ More importantly, defense electronics solutions form an integral part of equipment delivered by the “traditional” sectors, and we may expect this

Table 6: Leading European defense electronics manufacturers (2021)

<i>Company</i>	<i>Country</i>	<i>Defense sales (electronics segment, in USD million)</i>	<i>Defense dependency in %</i>	<i>State ownership in %</i>
Thales Group	France	7,800–9,300	51	25.7
Leonardo	Italy	5,500–6,700	83	30.2
BAE Systems	United Kingdom	5,960–6,480	97	0
Hensoldt	Germany	1,610	92	25.1
Safran	France	1,100–1,400	28	11.2
Saab	Sweden	1,300–1,330	90	0
Rheinmetall	Germany	1,102	67	0
QinetiQ	United Kingdom	1,000–1,300	83	0
Airbus	Trans-European	700–980	18	25.9
Ultra Electronics	United Kingdom	920	79	0
Indra Sistemas	Spain	752	19	18.7
Thales Group	France	7,800–9,300	51	25.7

Notes: Sales are approximate. Since the definition of “defense electronics” and associated operations varies among the firms, column 3 states maximum values. The British Government holds a “special share” in BAE Systems and QinetiQ, respectively. The French Government holds a “golden share” in Thales.

Source: Own compilation based on SIPRI (2022c), Defense News (2022), corporate and governmental sources.

integration to increase further in the future.⁴⁹ The rise of the defense electronics sector may therefore (at least in part) also be considered a by-product of Europe’s strong position in the more “traditional” defense-industrial sectors.

47 “Defense electronics” is defined as all military command, control, communications, computers, intelligence, surveillance, target acquisition and reconnaissance (C4ISTAR) activities, plus related electronic components and certain space systems.

48 SIPRI (2022c), Defense News (2022) and own research based on Bureau van Dijk’s (2022) ORBIS database.

49 Dowdall et al. (2004) illustrate the rising importance of avionics in combat aircraft.

Conclusion

While the end of the cold war spurred consolidation in the defense industrial sector, a complex interplay of national and trans-European restructuring processes had, in fact, started much earlier. This reflected long run pressures of rising R&D cost, rising production costs, and technological change—all driven by industrial and political factors. To see this clearly requires the disaggregated analysis undertaken here. Subsectors had varying experiences with the number of important European suppliers contracting since the 1960s by between 29% and 80%. In some subsectors, the reduction was larger from the 1960s to the 1990s than that between the 1990s and 2022. The overall reduction was somewhat larger for the aircraft sector than for the naval and land segments, but sub-sectoral developments often differed from this broad trend.

Some segments of the aircraft sector are now characterized by European duopolies and monopolies, but five European firms maintain advanced combat aircraft production. Further, although the total number of remaining land systems manufacturers and naval shipbuilders far exceeds the number of aircraft producers, there are as many European combat aircraft manufacturers as there are suppliers of main battle tanks and conventional submarines. For East-Central European countries, the reductions were even higher, as their defense industries experienced larger economic shocks with the end of the Cold War.

A degree of national autonomy has often been relinquished to preserve industrial capabilities, particularly in the aircraft sector. As of 2022, no single European country builds heavy transport aircraft independently. Only Italy produces medium transport aircraft on its own, and all national helicopter industries are controlled by Leonardo and Airbus. Besides transnational integration, consolidation has also advanced via unilateral withdrawals from specific subsectors—with the loss of individual capabilities becoming much greater if the 1960s are used as a baseline. Using disaggregate information highlights that the consolidation process experienced by Europe's defense industry is likely to be understated if only aggregate analyses are undertaken.

Further attributes of consolidation trends deserve mention. Public interest may suppress market forces that would otherwise initiate consolidation, but at other times, governments have spearheaded rapid sectoral consolidation of nationalized firms. Consolidation is often preceded by collaborative programs, which can strengthen industrial ties and provide a foundation for later mergers. However, competitors with weak industrial ties may also merge and only later align their portfolios. Finally, we can sometimes attribute disappearing capabilities to changing requirements stemming from technological progress (rather than to industrial consolidation).

It has been suggested that advances in manufacturing due to the ongoing “Fourth Industrial Revolution” could establish new modes of defense-industrial cooperation, lessen the need for centralized production, and permit shorter production runs.⁵⁰ This may result in the deceleration of the identified six-decade trend of concentrating complex defense systems production into fewer European countries and firms.

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⁵⁰ Bellais (2020); Bellais and Fiott (2017).

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Appendix

The online appendix can be found at: <https://www.epsjournal.org.uk/index.php/EPSJ/rt/suppFiles/371/0>

