RESEARCH BRIEF

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A Quest for Autonomy and Excellence: The Defense Innovation Systems of France and Sweden

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The defense innovation systems (DIS) in France and Sweden have long-standing traditions of domestic innovation and high self-reliance, but they differ greatly in how they have achieved these ambitions. France has almost complete self-reliance in defense technology and close government control of activities contributing to defense innovation and regarding the defense industry. In France, there is considerable state ownership, and foreign ownership is blocked. In contrast, Sweden has delimited its breadth of sovereign technology development since the 1990s, and now expresses three "essential security interests": fighter aircraft, underwater capability, and cyber. This research brief describes what characterizes the present defense innovation systems in these countries, discusses their similarities and differences, and points out factors that have led to their success.

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France and Sweden are two European countries that stand out regarding their defense innovation systems. Both countries have traditions and ambitions for world-class defense technology sophistication and for a high degree of autonomy. France initiated state-led defense innovation in the thirteenth century and Sweden in the sixteenth century. Both countries have a track record of radical domestic innovation in many technology areas dating to the 1950s.

DEVELOPMENTS SINCE THE COLD WAR

There are a few shared traits of development after the end of the Cold War. In 1989, both countries had defense procurement agencies with vast powers—Délégation General de l'Armement (DGA) in France and Försvarets Materielverk (FMV) in Sweden—but their technology expertise and powers have steadily been attenuated since then. Both countries have experienced considerable defense-industrial restructuring into border-crossing corporate entities. Both countries have experienced considerable downsizing of domestic programs. Both countries are engaged in EU harmonization and the Europeanization of defense research and planning.

There are also some clear differentiating traits in this period. France has engaged in bilateral/multilateral defense technology development since the 1950s, which Sweden did not start until the 1990s. France is presently more engaged in such collaboration. In the defense industry, Sweden ended state ownership in 1999, and foreign ownership is allowed. In France, there is considerable state ownership and state control, and foreign ownership is blocked.

CHARACTERISTICS OF THE FRENCH DEFENSE INNOVATION SYSTEM

France has almost complete self-reliance in defense technology and close government control of activities contributing to defense innovation. SME participation in defense innovation and civil-military integration are also priorities. Although the Ministry of Defense dissuades close collaboration with the United States in order to avoid dependence, the military and industry (according to several interviews) actively seek interaction and collaboration with counterparts in the United States. The present French approach and hard and soft innovation capabilities are summarized in Tables 1 and 2.

CHARACTERISTICS OF THE SWEDISH DEFENSE INNOVATION SYSTEM

Sweden has delimited its breadth of sovereign technology development since the 1990s, and now expresses three "essential security interests": fighter aircraft, underwater capability, and cyber. In comparison to most European states it has shown considerable market liberalism towards its defense industry by prioritizing off-the-shelf acquisition, ending state ownership (1999), and allowing considerable foreign ownership (starting in 1997). Sweden is, after a long period (late 1990s–2014) of cuts and lowered ambitions in defense capabilities, presently in a process of fundamentally reinvigorating and qualitatively and quantitatively upgrading its defense capabilities—driven by Russia's aggressive defense posture.

TABLE 1. France: Hard innovation capabilities

Innovation ambition	• Innovator; near autarky in many areas • Autarky in nuclear capability
Technology priorities	• Forefront in all technologies • Nuclear most prioritized, including platforms for strike
Sources of technology	• Primarily French • Strategic collaboration with European technology peers
Defense industry	• Covers all technology areas • Parts incorporated into government-orchestrated, border-crossing conglomerates
System integration	• Performed by industry on all levels
Civil-military technology integration	• Highly ambitious budget (€80 million/year), most in Europe • But the military bypasses DGA, discusses development and civil technology directly with industry
Support for SMEs	• Highly ambitious programs
Relation to others	• NATO low impact, EU rhetorically high but second to French policy and priorities
Relation to the United States	• Government/DGA restricted • Industry and military willing
Impact of doctrine	• Overall stable doctrine • Strong Gaullist tradition

TABLE 2. France: Soft innovation capabilities

Innovation ambition	• Elaborate organization for including academia, research labs, SMEs, civil technology
Technology priorities	• Innovation development shall benefit military as well as civil industry
Sources of technology	• Networks for interaction with civil innovation
Defense industry	• Europe's most developed policy and strategy for domestic defense industry • State ownership, no foreign ownership • Firm state control of industrial restructuring
System integration	• Large projects created for big firms
Civil-military technology integration	• National and regional centers of excellence
Support for SMEs	• Extensive networking between SME, large firms, labs, and academia
Relation to others	• Member of EU, NATO • Strong link to UK • Collaboration with European technology peers
Relation to the United States	• Similar security policy • Tradition of not becoming dependent on any other country—and cooperation with the United States by definition means not being in charge
Impact of doctrine	• Ministries (Finance and Defense) have for a long time decreased DGA mandate and influence

The present Swedish approach and hard and soft innovation capabilities are summarized in Tables 3 and 4.

COMPARISON BETWEEN THE FRENCH AND SWEDISH DEFENSE INNOVATION SYSTEMS

A comparison between the two countries reveals both stability and instability in their defense innovation systems. They are stable in that their technology priorities and ambitions on a larger scale do not change. Although the Swedish doctrine has shown considerable change since the Cold War, France has been firm in its prioritization of its nuclear capabilities. Both are stable in their relationship with the United States, with Sweden being close and French doctrine avoiding dependence on the United States.

Sweden used to strive for world-class innovation in most defense technology areas and considerable autonomy. Presently such high ambitions remain solely in fighter aircraft and underwater capabilities. From the 1950s onwards, Sweden has received considerable technology transfers from the United States, especially in sensor and fighter technology, a close relationship that remained undisclosed until the 1990s. In a period of European détente after the Cold War, this technology transfer decreased, but has intensified in recent years.

France still retains considerable self-reliance in defense technology. The state has decreased its grip over its DIS by allowing cross-border mergers, transferring large parts of design and system integration to industry, decreasing the DGA's centralized power, and opening up for EU collaboration. At the same time, however, most French military equipment and systems are produced in France, to a large part developed and integrated by domestic industrial constellations.

The French DIS still holds a position as a highly independent and explorative innovator. To a large extent, it provides the technologies, systems, and products from domestic sources needed to meet the French military's capability needs. Sweden used to have the same posture, producing most of its defense equipment (tanks and helicopters being the clear exceptions). But in defense R&T, the Swedish government has exited some technology areas since 2006 (especially missiles and radar), or chosen to leave technology development to industry. The declaration of the essential security interests (fighter aircraft and underwater capabilities) has clarified critical technology and capability areas. Cyber capabilities was declared a third essential security interest in late 2017. Added to this, the 'Armed Forces' Strategic Alignment' (2016) identified Space and Autonomy as strategic technology areas.

Both countries are active in international arms collaboration, especially France. Sweden has in recent years started a small number of such collaborations—the largest were initiated in the late 1990s and early 2000s (the Meteor and Iris-T missiles and the NH90 helicopter). Both countries rely on foreign input of strategic technology, especially Sweden. Sweden has allowed more globalized supply chains than France.

Both countries have awarded considerable transfer of responsibility for development and system integration from the state to industry. France keeps stronger domestic control over this than Sweden does.

TABLE 3. Sweden: Hard innovation capabilities

Innovation ambition	• World class in fighter aircraft and underwater technology • Innovator • Almost self-reliant in underwater vessels
Technology priorities	• Fighter aircraft, cyber and underwater technology • Critical defense capabilities for national defense (e.g. Patriot procurement 2017)
Sources of technology	• Swedish, and foreign through collaboration and firms' supply chains • Strong US interaction • International research and technology (R&T) collaboration (bilateral, EU)*
Defense industry	• Covers many technology areas (not tanks, helicopters) • Saab dominant (75 percent of production) • 85 percent of defnse acquisition from domestic firms
System integration	• Performed at most levels by industry, but not in certain critical capabilities
Civil-military technology integration	• Overall limited, but strong in aerospace • New (2017), industry-led initiatives in underwater and robotics
Support for SMEs	• Limited
Relation to other	• Increasingly close to NATO • Prioritized bilateral collaboration with Finland, Denmark, and the United States
Relation to the United States	• Very close • Statement of Intent (2016)
Impact of doctrine	• Pronounced priority for homeland defense capabilities since 2014

TABLE 4. Sweden: Soft innovation capabilities

Innovation ambition	• Declaration of three "essential security interests" (fighter aircraft, cyber and underwater technology) with world-class ambition
Technology priorities	• Forced domestic (Saab) takeover of Kockums from German owner in 2015
Sources of technology	• Supports globalized supply chains • Exports shall support prioritized national capabilities • Academia important in a small number of areas, but largely not in larger, government-orchestrated programs—rather through networks
Defense industry	• Foreign ownership allowed, no state ownership • Implicit, market liberal defense industry policy
System integration	• Industry denied access to government-financed defense R&T and innermost system integration for "integrity-critical" capabilities
Civil-military technology integration	• Rhetorically prioritized, but practiced to a low extent • Industry leads the way
Support for SMEs	• Rhetorically prioritized, but practiced to a low extent
Relation to other	• EU defense R&T collaboration • Lowered priority with EU/EDA in practice, but not in rhetoric • Gradually closer to NATO since 2014 (without joining)
Relation to the United States	• Prioritized allocation of DIS resources to Swedish-US collaboration
Impact of doctrine	• Drastic swings in doctrine, financing, and priorities since late 1990s; caused shifts in research, procurement, and priorities • Now firm focus on national defense

*In this paper R&T and R&D are differentiated. R&T denotes government-financed research and technology to designated research programs in defense research institutes and academia. R&T is a subset of R&D. R&D also includes financing to industry.

TABLE 5. Autonomy versus interdependence

	Strategic autonomy	EU pooling and coordination	NATO	Bilateral versus United States
France	• High ambitions, especially in nuclear • Domestic capability to produce platforms delivering nuclear missiles	• High profile, wants to benefit • Always subordinate to French autonomy priorities	• Limited pooling, but re-emergence in NATO structures in recent years	• Fundamental closeness in security policy • Separation in sensitive technologies in order to preserve French autonomy • Industry strives for closer bonds, but government resists it
Sweden	• Previous breadth in autonomy decreased • Now three prioritized "essential security interests" (fighter aircraft, underwater capabilities, and cyber); probably more underway	• Since 2014 less priority on European Union and more on national capabilities • Still rhetorically a firm EU/EDA supporter	• Higher priority on troop and capability interoperability with NATO since 2014 • More involvement in NATO groups in recent years (but not member)	• Renewed bilateral closeness after 2014, stepped up since 2016 • Prioritized bilateral relationship occupies resources from the DIS

France and Sweden both have had highly influential government authorities (DGA and FMV) with mandate over defense export support, design, and procurement (and in DGA also defense R&T and defense industry management). FMV in Sweden has been transformed more into a procurement-oriented organization with very limited design competence. DGA has been much more influential than FMV, but has seen its influence decrease gradually since the 1997 reforms. The French ministries (Finance and Defense) and the large companies have received more influence and power, and the military increasingly interact directly with industry, thereby circumventing DGA's official role in the progression over the technology readiness levels (TRL).

Both countries have complex relations with the European Union, NATO, and the United States. The European Union and the European Defense Agency (EDA) strive to "Europeanize" EU defense research, capability development, markets, and procurement. European states are in a quandary as to which defense innovation strategy to support: 1) to be independent and achieve strategic autonomy; 2) to pool the EU's national defense innovation resources in a shared innovation structure under EDA; 3) to primarily organize under NATO priorities (like Denmark and Norway); or 4) to a certain extent develop and nurture a close bilateral relationship with the United States. France and Sweden do a bit of all four, balancing between autonomy and interdependence in the overall functioning of their defense innovation systems (see Table 5).

SUCCESS FACTORS

Over a long period from WWII through the late 1990s, both countries have shown:

- Strong leadership support for their DIS.
- A well-functioning government-industry collaborative system.
- Shared commitment (military, political, industrial, defense administration).
- Government research programs benefitting military and civil innovation.
- High ambitions and substantial resources allocated over long periods.

This stability has largely been maintained in France until today.

In Sweden, there were substantial swings in defense priorities and doctrine from the late 1990s until 2014. Since 2014, however, the commitment to military capabilities and the DIS is much firmer. There is presently a process in Sweden of modernization and transformation and an understanding in Parliament that the defense budget must receive a considerable increase. Over the period from 2016 to 2020, the government's planned increase of the defense budget is 18 percent. Regarding defense innovation and defense R&T, the Armed Forces and the Ministry of Defense show a clear determination to prioritize and fund more defense R&T and R&D. The dominant driver for this aggregate transformation is the worsened threat perception due to Russia's military actions in Ukraine and elsewhere, and its overall aggressive military and security posture.

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