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**DEFENCE INNOVATION: NEW MODELS AND
PROCUREMENT IMPLICATIONS**

The Finnish Case

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*The views expressed here are solely those of the author.
They do not reflect the views of any organisation.*

Policy Paper

ABSTRACT

Finland's approach to defence procurement is based on the needs of the country's defence system. Innovation is expected to arise out of daily activity, even if there are processes for creating innovations. While technical innovation emerges out of Finland, due to its relatively small size and small defence industry, much of the technical innovation comes from outside the country. The technical innovation that does emerge is frequently a result of collaboration between the Finnish Defence Forces (FDF), universities and private-sector companies; fostering these networks as a source of continuing innovation is seen as critical. Of potentially more weight is innovation that occurs in how existing technologies are used in new ways, as well as in FDF doctrine, training, procurement, and other processes. International cooperation on procurement and innovation is supported by Finland, especially when there are clear benefits of scale or it results in operational benefits.

Keywords: *Finland, European Defence Fund, innovation, procurement, cross-sectoral innovation, European cooperation*

INTRODUCTION

Defence procurement and innovation within the context of Finnish defence is aided by a relatively consistent and focused threat assessment. The sizing and capabilities-construct for what Finnish defence must be capable of is thus in general terms well understood. Finnish defence decision makers, including both politicians and the military, have therefore largely avoided the dramatic changes in national defence policies and capabilities that have plagued many European countries following the end of the Cold War. This has had a number of benefits, among them: the FDF has been able to continue its overall approach to procurement, based on long-term plans and with a view to developing the capabilities of the defence system as a whole; every procurement solves a current or anticipated future problem, or fills an existing gap. The objective of the paper is to describe the current status of Finland's procurement and defence innovation approaches and processes, and provide examples of their role in the Finnish defence system, and briefly explain Finnish views regarding the potential added value of increasing international cooperation.

BACKGROUND: INNOVATION AND PROCUREMENT IN THE FINNISH DEFENCE SYSTEM

To understand the current status of Finland's procurement and defence innovation, it is necessary to explain what Finland's defence is expected to do, the character of Finland's defence system and what its current capabilities are. Finland's defence fits within the broader rubric of comprehensive societal security that sees preparation for a range of crises (including pandemics) as necessary to increase resilience; it revolves around the maintenance of seven critical societal functions¹, one of which is national defence capability. The defence system and plans assume that Finland alone is responsible for its defence, though expanded and deepened international defence cooperation during the past decade has largely eliminated the legal, technical, and political obstacles to giving and receiving military aid. As Finland is not a member of a military alliance (NATO), making

¹ The functions vital to society are listed in the security strategy for society and form the basis of preparations, as the seven functions must be secured in normal times and crises. The functions are: 1) Leadership (political and at senior levels of other authorities); 2) international and EU activities/cooperation; 3) national defence capability; 4) internal security and rule of law; 5) the economy, infrastructure and security of supply; 6) functional capacity of the population and services; and, 7) psychological resilience.

advanced preparations for the potential to give or receive military aid is arguably the most significant defence (policy) related innovation of the past decade.

Finland's defence is based on some 8000 cadre soldiers, 4000 civilian employees of the FDF and a large reserve created through mandatory national service for men, women can volunteer. The fully mobilized field army is sized at 280 000, with a few hundred thousand more reservists available as fill-in reserves. The units can be roughly divided into three main categories, the best trained and equipped operational units, regional forces, and local units (some of which train frequently and maintain a high readiness). While the Finnish Air Force and Navy operate higher-tech equipment and are traditionally more operationally ready, all Air Force and Navy enablers and in the case of the Navy much of a ship's rotating personnel, are conscripts or reservists. The primary mission of the air force is to deny air supremacy and contribute to situational awareness, with long-range precision strike as a relatively new secondary tasking. For the Finnish Navy it is defence of Finnish territorial waters, including the extensive archipelago and the coast, but through the acquisition of the Pohjanmaa-class corvettes it continues to develop its capabilities to protect maritime trade (the majority of Finnish imports and exports are transported by ship).

Finland's defence is built around addressing one 'military problem': how to militarily defend Finland against an attack by Russia. Officially, Finland prepares to defend itself in all directions, but in practice it is Russian military capabilities that drive the development of the defence system. This means that with the limited resources of a small country, Finnish officials must approach defence planning from the perspective of optimising the entire system. In practice this means that procurement is always done with a view to maintaining or acquiring a capability. This requires a continual evaluation from planning to procurement through obsolescence of what capabilities are needed and how they might be used. Finnish Defence Forces officers thus make constant trade-offs between high-end off the shelf (but not bleeding edge) and volume deployable solutions, the relative increase in performance of cutting-edge systems over less expensive modernized ones, and innovation in process or use over technological innovation.

THE ORGANIZATION OF THE FINNISH INNOVATION ECOSYSTEMS ENABLES CROSS-SECTORAL FERTILIZATION FOR THE BENEFIT OF DEFENCE

The Finnish government does not have a defence innovation hub, because conceptually innovation is not seen as a separate process but rather a continuous one. As a specific invention (gadget) will not provide a competitive advantage for long, the FDF sees that it is more important to have a process that continually creates them – a mechanism for innovation.

Ideally and in theory the mechanism for innovation starts from the FDF telling the Scientific Advisory Board for Defence (which operates as a part of the Ministry of Defence) what issues, capabilities, or problems it is grappling with. The Board has a window into the research world (approximately 300 professors) and can annually provide approximately one million euros in ‘seed funding’ to answer questions about what could be possible in the future. In practice, the FDF is reluctant to share its current or future operational problems/questions with outside civilian researchers, making it harder for the military to then receive military-specific answers or solutions.

Nonetheless, today the challenges explored are more focused than before but remain multi-disciplinary. For example, within the broader rubric of how urbanization impacts warfare, one issue is how to geolocate in buildings and underground structures when satellite positioning is unavailable. Ultimately, the questions addressed at this juncture are ‘known unknowns’ or ‘unknown unknowns’. From here the FDF research organisations² are charged with developing a demonstrator; the total annual FDF budget for R&D is about 50 million euros, out of which 9 to 10 million is reserved for procuring tech innovation, the rest is for innovating around existing technologies or developing new ‘use cases.’ If the demonstrator is judged a success and strategic planning (J5) deems it useful for the defence system as a whole, then further development is offloaded to the different services (Army, Navy, Air Force etc), which together with Logistics Command begin the procurement and iterative capability development process. This system works

² The Finnish Defence Research Agency is multidisciplinary and includes military, behavioral, social and natural sciences. The National Defence University and Centre for Military Medicine also conduct research, and the FDF Logistics Command and service branches contribute when relevant, particularly regarding capability development.

relatively well but due to the small sums involved it is beholden to larger global trends and developments.

Currently the central challenge is how to lead and fund innovation when it is not an outgrowth of purposeful defence planning or the above mechanism. For example, when an unexpected innovation from the field – either technical or use case – is identified, there is (after 2015-2018 cuts) no funding or obvious official ‘receptor’ that could take the innovation and integrate it into the overall capability development process. Previously some seven million euros was annually allocable to such ‘unexpected innovation’ (€30m over 4 years). There is a clear need to restore such funding to ensure that the FDF captures unexpected innovation and is able to distil and develop actual capability improvements from it. In addition to funding, to ensure that innovation is not only technical but conceptual, the FDF must ensure that it recruits, cultivates and promotes a broader spectrum of intellectual capacities and thinkers, who are ready to and able to challenge conceptual orthodoxy; alternatively, it can open up more of itself to engaged civilians (reservists), researchers or even the private sector.

Technological innovation is of course mainly done by universities and the private sector (where on average about 15% of revenues go into R&D, whereas the FDF uses less than 2% of its budget on R&D) but innovations in warfare by devising new ways to use and combine existing technologies occurs almost exclusively in the military domain. The above inflexibility related to unexpected innovations ‘from the field’ and lack of support structures for ‘mavericks’ within the FDF is particularly problematic for small countries that must rely on both technological and doctrinal innovation to support development of capabilities to retain a comparative advantage against a specified adversary.

Overall, the Finnish comprehensive security approach, that includes national service (conscripts and reservists), has a number of features that increase the potential for innovation. First, at the very senior levels across society (private sector, NGOs, public sector, politicians, academy), most leaders have participated in the National Defence Course, a three to four-week course on Finnish security, and their organisations’ roles in it. Among other benefits, this ensures at least a latent sense of how innovations in their fields of expertise could be used to improve national security. More specifically, due to national service, many individuals across a range of disciplines have a connection to the military. Thus, if called-upon, they can potentially translate their civilian experiences into

innovations for the military. The FDF is learning to better take advantage of Finland's reservists, using their civilian skills and expertise to identify potential innovations, both technical and process. An example is a project to identify how 'everyday tools' could be used to improve command and communications systems, with the goal of equipping masses of reserve units with more functional technology and capabilities than a 'traditional high-tech unit'. This activity is still limited but even now, the potential of such innovation from 'outside' the FDF is too often stifled by organisational culture and structure.

While the FDF has myriad examples of innovation from internal sources, it is less capable of accepting it from the outside, because of organisational cultural and structural forces. For example, if reservists identify a way to use commercial off the shelf technology in new ways, it is too often forced into the 'moulds' of the existing organisation, rather than considering changes in the architecture of the organisation to take advantage of the innovation itself. Unsurprisingly, the results of forcing an innovative approach into existing forms does not result in step-change innovation. At worst, it results in the organisation as a whole discounting the usefulness of the innovative concept as a whole, because it does not provide a step-change in capabilities when used in a 'classical' way.

While the military tend to be responsible for doctrinal/use innovation, the role of defence industry, universities and research institutions such as VTT³ is critical in the development of technology-based innovation and process improvements/innovations.⁴ Finnish defence industry is composed of a few larger companies, such as Patria, Millog and Insta, and many companies of at most a few dozen employees that are focused on developing highly advanced niche solutions. As such, even the largest Finnish companies recognize the need to build networks / ecosystems, to deliver more complex capabilities and expand beyond the small Finnish defence market. In terms of interesting technologies, each Finnish defence company has its own, often specific focus, some with a strictly military clientele but others developing dual-use technologies (such as Varjo Technologies VR/AR goggles). What almost all of them share is an assumption that the product must function in extreme operating conditions, with 'Everything is arctic, exportable and interoperable'

³ VTT is a government owned technology research institute with 2000 employees and an annual turnover of around 150 million euros, with half of its revenue coming from foreign sources.

⁴ Most recently, a research group at Tampere University won the EDA Defence innovation prize for its work on using "Full-Duplex Radio Technology for Enhanced Defence Capabilities Against Drone Swarms."

being a frequently heard catch phrase. Some of these companies have been acquired by larger international firms, thus automatically placing them within larger networks. For instance, the Finnish rifle manufacturer SAKO has been acquired by the Italian holding group Beretta in 2000. Identically, Safran Electronics and Defence (France) has taken over Robonic (the Finnish premier manufacturer of UAS launchers worldwide) in 2007. In other cases, larger international companies have established R&D centres or innovation hubs in Finland, taking advantage of existing skills or ecosystems. For example, SAAB established an R&D center focused on the development of electronic warfare suites, as well as the use of microwaves and associated software solutions. The center was recently expanded to cover the Finnish Navy's new combat management system, the SAAB 9LV, ensuring the Finnish Navy has the necessary competence to service and develop the system for itself, and potentially for other navies.

The Finnish Defence Forces has identified three key themes on which its research efforts will be focused in the next few years: (1) Emerging technologies, with a focus on situational awareness (sensors and the processing of the data produced by them) and unmanned systems (including autonomy and aspects of AI); (2) Operating environment, with a geographic focus on development of military capabilities near Finland and a conceptual focus on four core environments, land, sea, air and electromagnetic, but increasingly also on space, cyber and information environments; and, (3) the design of the Finnish defence system, its future development and use, with priority themes being 'producing effects/impacts' (*joint fires*), protection and C4ISR⁵.

The benefits of the 2014 reorganisation of the FDF research architecture is likely to show even more benefits as the above topics are explored in the coming years. The Finnish Defence Research Agency (FDRA) was created to enable a holistic approach to research, so that the same organisation is responsible for research on people (physical and psychological), technology and warfare (doctrine etc.). This means that if, for example, the effectiveness of infantry units needs to be increased, the increased performance can be sought by combining improvements in equipment, tactics, leadership, doctrines and individual physiology and psychology. For example, a change in how individual soldiers and leaders are trained in urban warfare can through testing be seen to provide better

⁵ <https://puolustusvoimat.fi/en/web/tutkimus/r-d-focus-areas>. Accessed 13.12.2020

combat capabilities/results than multi-million investments in bleeding edge situational awareness technologies.

The central insight of the Finnish defence innovation system is that it is most important to build the foundation for innovation. This foundation is a network of actors (such as systems integrators) and multidisciplinary expert individuals (“crazy scientists”) who understand the fundamental nature of the problems at hand and can produce innovations during crises; crises allow for faster innovation as problems come into relief, resources (money and people) are less restricted and it is possible to ‘cut corners’ that would not be possible during normal times. The ultimate role of the FDF is small here, as it generally does not possess the technical know-how. Thus, in the future it will become even more important to clearly identify (1) which skills are necessary to have within the FDF (such as doctrine development), (2) which must be held within Finnish research institutions or firms (such as skills necessary to develop electromagnetic spectrum technologies), (3) which are ok to exist within broader partner networks, and (4) which can always be accessed through direct commercial purchases. This structure supports the fundamental approach to Finnish procurement, where individual systems are not procured, but rather capabilities that fit into and improve the defence system as a whole.

A FINNISH PROCUREMENT SYSTEM DESIGNED TO MATCH FINLAND'S DEFENCE NEEDS WITH LIMITED MEANS

Finland reorganized its defence procurement system between 2012 and 2015, so that the central actor is the Finnish Defence Forces Logistics Command. Since procurement is for a capability, acquiring the materiel or services is only one early part of procurement, and Logistics Command owns the materiel and is responsible for the entire life cycle, from procurement to end-of use. This ensures the FDF has a more holistic view of when capabilities will reach the end of their useful life (vis a vis threat), and enables a replacement process to begin in time. Because of the system of systems nature of Finnish defence, this capability life-cycle management is of significant importance so that critical capability gaps do not open up. This approach also means that Logistics Command annually uses approximately half the entire defence budget of €4.87Bn (2021). This sum is an increase of 54% over the previous year, due to early stage of new fighter jet

procurement, the process itself which serves as an example of defence procurement innovation (see box below).

Finland procures capabilities in a mixture of ways, but three main categories are identifiable. Two are based on long-term planning and capability development processes. First, high-end cutting-edge (not bleeding edge) capabilities that should provide a qualitative edge against an adversary over a period of time; long-range Air-to-ground strike is an example of this. Second, capabilities that are 'good enough' yet procurable in large enough volumes to be useful to the fully mobilized field army of 280 000 soldiers. The third category of procurements benefits from the long-term capability development plans but is at heart opportunistic. The purchase of nearly all Dutch Leopard 2A6 main battle tanks in the 2010s or massive purchases from the DDR and Russia at the end of the cold war are two examples of this strategy of opportunism. This opportunistic approach enables Finland to field a large number of adequately armed units, increase performance (moving from existing Leopard 2A4s to 2A6s), while saving money to invest in high-end capabilities. Such opportunistic acquisitions may entail a certain degree of innovation for at least two reasons. First, second-hand off-the-shelf capabilities may offer room for technological and operational improvements. It has been the case, for instance, with ammo-based air defence which have modernized rather than replaced by new equipment. Second, buying and 'militarizing' commercial off-the-shelf items with high technological added value may be the best way to ensure that the FDF have high-tech equipment for a reasonable cost. For instance, the FDF recently announced it would buy 3000 COTS tablets, for use by front line tactical units, to enable them to access the digital 'situational awareness' system, which is of Finnish origin.

As the procurement lead, Logistics Command must also ensure that materiel is serviced and modernized in peace and during war. Increasingly service, development and modernization of capabilities is done by strategic partners, of which the FDF has between five and twenty (depending on definition), in addition to which it does daily business with another few hundred companies. The most well-known strategic partner is Millog (a joint venture between Patria, Insta and the Finnish government), which is responsible for an increasing amount of depot level maintenance and modernization across the FDF. Depending on the type of company, each has different requirements for readiness; in extremis they are required to change their production/servicing to ensure that the FDF

gets what it needs. The tight integration between the FDF and strategic partners reaches down to individuals, who in some cases would be integrated into the FDF order of battle in times of war.

A benefit of this integration is that incremental innovation is easier, as the companies understand the FDFs actual needs. For example, the FDF may explain or the company may have identified a problem, then the two together evaluate whether a technical or process solution is appropriate. More broadly, because the Finnish defence industry generally understands the goals, approaches and doctrines of the FDF, it is possible to focus on developing concepts around many incremental innovations together with the FDF, rather than simply develop new products or services and then seek to sell them.

Security of supply is also a concern in Finland, where the concept includes resilience of the entire network/logistics chain and thus requires cooperation between the military and private sector. The military maintains stores of necessary materiel to 'get started' during a war, but the continued flow of goods and services is thereafter only expected to work through the use of networks and logistics chains developed during peace. Modern extended logistics chains also present questions for defence planners. For example, since Finland cannot produce everything a modern artillery piece/system requires, is it relevant to keep some component production in Finland, or all in friendly (NATO) states and simply maintain a capability to service existing artillery?

Innovation in the procurement process: The HX-projet (fighter replacement)

When the Finnish defence forces procured its current fighter fleet, it already knew that it would be replacing them in the 2025-2030 timeframe. The planes have been utilized and upgraded (three MLUs) with a view to this. The process to replace the jets – the Hx project – formally started in 2015, with an evaluation of broad options for replacing the capabilities. The conclusion was that a manned multi-role fighter was the only solution that could deliver the needed capabilities. This also became the initial mantra of the project, that it was about replacing existing capabilities so that relative performance against potential adversaries was maintained, not just buying a new jet. Due to operational reasons the number of jets must remain about the same as the current force of some sixty fighters. In truth, whichever option is chosen, it will deliver new capabilities. However, due to FDF culture, and for broader political reasons, even step-change innovations/new capabilities are usually presented as merely sustaining or replacing and modernizing to keep up. The now existing long-range strike capability or cyber and electronic warfare aspects of the various Hx-candidates serve as examples of this.

Recognizing the complexity of procuring new fighters so that they would fit into the defence system and seeking to ensure they are operationally relevant even in the 2060s, the FDF and Defence Ministry developed an innovative competition-procurement process. Based on the kinds of capabilities the FDF knew it wanted at the time, the initial request for information was sent in 2018, for a 'full-package'. This has been followed by multiple iterative rounds of discussions to fine tune packages. These also were meant to ensure that the competitors would ultimately produce final bids that would pass the go/no go gates, which involve security of supply, industrial participation (to ensure an ability to service in country), and life-cycle costs. Only the military capability portion of the evaluation is ranked; security and defence policy implications are considered separately.

During the process the FDF not only visited each of the bidders to receive information, but hosted the HX Challenge, to verify information given by competitors, to enable more accurate simulations. An example of transparency is that while any of the competitors could ask for clarification from the FDF, both the question and the answers were distributed to the other competitors. Though challenging, the process has been described as transparent, competitive and the most technically demanding fighter procurement process the bidders have been involved in.

By the time the revised request for quotations was sent in late 2019, bid structure was changed so that as opposed to delivering 64 jets, the driver of the package was that it could not exceed the cost ceiling set by the Finnish government at ten billion euros, of which the bidders can use a little more than nine billion (the remainder is used for project related upgrade costs). The request for final and binding offers was delayed due to the global corona pandemic, but it was sent in January 2021, and the final decision is still expected in 2021. When the FDF receives the final offers in April 2021, it will run a range of simulations and games, from relatively simple air-to-air combat scenarios to the full 'kitchen sink' defence of Finland. The latter emphasizes that the winner will be the package best optimised to fit within Finland's defence system, which could also be the technically most advanced fighter.

Ultimately, Finland's procurement process is based on strategic future estimates and long-term capability development plans and relatively stable budget outlooks, irrespective of the political makeup of the coalition government in power. Of note is that because the futures estimates are done together with other security actors, such as the Finnish foreign and interior ministries, they are all preparing for 'the same future' and can thus in theory cooperate more smoothly; of course, it increases the pressure on getting the futures analysis right, as a serious mistake would impact all of Finnish security.

The political culture does not usually insert itself into defence procurement, with the exception of large projects, and even then, the evaluation of alternatives is insulated from political interference. The lack of a large domestic defence industry gives the FDF greater flexibility in choosing different suppliers, while also limiting the benefits accrued by size.

That the focus of Finland's 'military problem' remains consistent, aids in stabilizing the procurement process, as sudden changes in focus or capability demands are rare. A continual challenge is finding a balance between technologically advanced capabilities and large enough volume, and keeping a focus on procurement of those capabilities that are thought to provide most comparative or marginal advantage, while seeking to make up shortfalls through innovation in doctrine or the use of existing capabilities.

EUROPEAN AND INTERNATIONAL COOPERATION IN PROCUREMENT AND INNOVATION: FROM EXCEPTION TO 'NEW NORMAL'?

Finland supports international cooperation, and as a small country is reliant on it. It is also in Finland's interest that militaries across Europe improve their capabilities. However, there is little expectation that cooperation will in the short-run strengthen Finland's defence. Overall, the Finnish Ministry of Defence is more bullish on the prospects of EU defence cooperation than the FDF, perhaps because of the broader potential security policy implications of deeper cooperation in capability development and procurement, and the relative newness of the processes involved. Potentially the need to 'semi-publicly' acknowledge specific challenges or areas of interest, which goes against

the general communications culture of the FDF plays a role, and will thus be dissipated as more experience is gained with these new instruments.

Finland currently participates in a number of cooperation projects both within NATO's frameworks as well as the EU's Permanent Structured Cooperation (PESCO). Within PESCO, Finland participates in various projects, including the Integrated Unmanned Ground System (UGS), European Secure Software defined Radio (ESSOR), Cyber Rapid Response Teams and Mutual Assistance in Cyber Security, Military Mobility, and Timely Warning and Interception with Space-based TheatER surveillance (TWISTER). However, PESCO is viewed as less relevant for innovation than the European Defence Fund (EDF), which is seen to have potential. However, the issue of who would prioritize projects and funding is a concern, because while the European Defence Agency (EDA) is seen as capable of defining European capability gaps and technology needs, and catalysing projects, the Commission's role in supporting industry (hoping it will result in innovation) is seen as potentially problematic in terms of innovation. There is some sense that the EDA itself should be given more money for directly funding the projects it identifies as important across the EU. The idea of an EU DARPA is viewed positively, if it means more R&D money for the European defence sector.

Overall, Finland sees many benefits to international defence cooperation. These include information exchange; sharing of costs related to procurement, R&D, support, and training; pooling of resources and results in projects that are too large for Finland itself to be able to fund (Artificial Intelligence, for example); and working on interoperability and regulation (for example regarding around UAVs and armed unmanned systems). Because of its relatively unique defence system, Finland usually does not usually expect cooperation to deliver immediate improvements to national defence capabilities. However, as cooperation is in principle seen as desirable, and it is possible to identify political and longer-term operational benefits, Finland is likely to continue engaging in defence cooperation on procurement and innovation. Most of such projects will, however, fall into one of four categories. First, those procurement or innovation attempts for which Finland alone is too small. Second, those that generate immediate concrete benefits in terms of savings or efficiency (ammunition). Third, projects which require relatively little input or commitment, but which have a high reward potential due to make up of other participants (for example US or Google in AI). Fourth, projects where Finland and Finnish

industry have a (temporary) competitive advantage and there is an interest in expanding the user or R&D financing base. An example of the last kind of project includes ones on arctic mobility and operations, where both Finnish industry and the FDF can contribute its expertise to others, in exchange for being on the receiving end of benefits in other projects, and ensuring that if Finland were to need assistance in a future conflict, more countries would be in a position to assist it. ■

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ARES GROUP

The Armament Industry European Research Group (Ares Group) was created in 2016 by The French Institute for International and Strategic Affairs (Iris), who coordinates the Group. The aim of the Ares Group, a high-level network of security and defence specialists across Europe, is to provide a forum to the European armament community, bringing together top defence industrial policy specialists, to encourage fresh strategic thinking in the field, develop innovative policy proposals and conduct studies for public and private actors.

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