



# Annex B: Denmark

Annex to report: Vision on defence related skills for Europe today and tomorrow

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*Defence-related skills:*

*Building evidence on skills shortages, gaps and mismatches and defining the sector's strategy on skills*

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# Table of contents

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Preface .....	Error! Bookmark not defined.
Figures .....	4
Tables .....	5
<b>Annex B. Denmark .....</b>	<b>6</b>
B.1. Background .....	7
B.2. Overview of skills gaps and shortages .....	8
B.3. National and regional policies and programmes .....	9
B.4. Overview of industry defence related skills policies and programmes .....	12
B.5. SWOT analysis of national and industry programmes .....	13

## Figures

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Figure B.1 Executive summary - Denmark.....	6
Figure B.2 SWOT analysis of national and industry programmes.....	14


## Tables

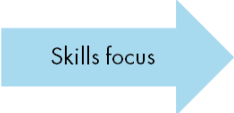

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Table B.1 Selected leading Danish defence companies.....	8
Table B.2 National and regional policies relating to defence industrial skills.....	10
Table B.3 Obligatory industrial cooperation project examples.....	11
Table B.4 European defence capability programme - example .....	12
Table B.5 Examples of defence industry skills programmes .....	13

## Annex B. Denmark

Figure B.1 Executive summary - Denmark

<b>Denmark</b>	
<b>DITB size</b>	Turnover €400M per annum; approximately 3,000 employees, mainly comprised of SMEs
<b>Domain focus</b>	Aerospace and complex weapons - advanced subsystems & software in communication & radar technology
<b>Defence capabilities</b>	Manufactures subcomponents and parts of weapon systems; in 2017 purchased 27 F-35 fighter jets
<b>Exports</b>	Approximately 80% of the defence industry's production is exported
<b>Selected companies</b>	Terma, Scandinavian Avionics, Systematic, Gomspace, Hydrema
<b>Identified skills gaps and challenges</b>	<ul style="list-style-type: none"> <li>• Marketing and sales competences specifically related to the defence market</li> <li>• Administrative skills and capacity to manage export licenses and other procedures of defence equipment</li> <li>• Production planning, management and organisational skills for building manufacturing capacity &amp; quality</li> <li>• STEM skills in areas such as advanced manufacturing, electronics, and software</li> <li>• Manufacturing automation technologies and skills needed to achieve certification in production</li> </ul>

Skills supply landscape		Identified top-down initiatives		Identified bottom-up initiatives		Investment in R&D?
National skills strategy	Includes defence skills?	Education programmes	Other top down initiatives	Industry-led initiatives	Collaborative initiatives	
✓	✓	2	-	1	6	✓
 Skills focus		Systems engineering & design		Management; avionics	Systems engineering & design, unmanned systems engineering, mechanical engineering, production engineering, certification	No specific skills focus or programmes identified
 Examples		Defend Arktis (Aalborg University), Haderslev Municipality, Aeronautical Center of Excellence, and Technical Education Copenhagen (TEC)		Mercantec and Scandinavian Avionics	Innovation Network Production, Drone Countermeasures Project	Research highlighted that private companies invest in internal R&D

Source: Danish Technology Institute and RAND Europe

## B.1. Background

Denmark has historically had a long tradition of neutrality which has influenced Denmark's political stance in NATO and the European security landscape. Exercising an opt-out from EU defence cooperation mechanisms (including EDA membership) has meant that Denmark has refrained from participating in CSDP operations and cooperation on the development, acquisition and pooling and sharing of European military capabilities. Denmark's security policy has however gradually changed since the end of the Cold War towards a more 'activist security policy' involving military engagements in conflicts abroad. As a result, Danish security policy and defence strategy are undergoing significant changes with the government increasing investments in defence capabilities. In 2018, the Danish defence budget has been marked at just over €3 billion, measuring 1.21% of BNP and placing Denmark under the NATO 2% guideline. However, for the period 2018-2023, the new defence inter-party budgetary agreement is set to increase the Danish defence budget by about 20 per cent by the end of that period from today's benchmark.

Denmark is currently the only EU MS with an opt-out from European cooperation within defence. Although Denmark does not channel activity through CSDP and EDA, the country contributes to European defence through other frameworks. Denmark is drawing closer towards European defence cooperation,<sup>1</sup> having signed up to the European Intervention Initiative (EII) on 25 June 2018.<sup>2</sup> In addition, Denmark participates in ad hoc and multilateral European defence initiatives, such as the Joint Expeditionary Force (JEF) with the UK; NORDEFECO with Nordic partners; and a member of the Northern Group with the UK, Scandinavian and Baltic nations.

Denmark acquires much of its defence equipment from European and North American suppliers, while at the same time seeking to promote and preserve sovereign industrial competences in areas of strategic importance to the protection of Danish security interests. In order to sustain the country's indigenous skills base, national policies aim to ensure that foreign suppliers cooperate with local defence companies in Denmark to transfer (at least elements of) their knowledge, skills, and technologies. The overall aim of the industrial defence strategy is to work for a competitive and innovative international market for defence equipment, while at the same time ensuring the development of Danish industrial competences and skills in defence.

### B.1.1. Key industry players

The Danish defence industry includes about 440 companies, dominated by SMEs who are manufacturers of parts and components as part of local or global supply chains. Approximately 60 per cent of the companies employ fewer than 50 people, and only 5 per cent of the companies have more than 500 employees. The few systems integrators (primes) within Denmark provide compound, advanced products,

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<sup>1</sup> Euractiv. 2018. 'Denmark wants to cooperate "as much as possible" on European defence.' As of 28 September 2018: <https://www.euractiv.com/section/defence-and-security/news/denmark-wants-to-cooperate-as-much-as-possible-on-european-defence/>

<sup>2</sup> Forsvarsministeriet (2018). 'Ny aftale for forsvaret 2018-2023 (New agreement for Danish Defence 2018-2023).' As of 28 September 2018: <http://www.finn.dk/nyheder/Pages/ny-aftale-for-forsvaret-2018-2023.aspx>

and operate with project management and quality assurance at a high and complex level. Table B.1 below details the few examples of these mid-tier players.

**Table B.1 Selected leading Danish defence companies**

<b>Company</b>	<b>Focus area(s)</b>	<b>Number of employees</b>
Terma	Operates in the aerospace, defence, and security sectors. Specialists in major engineering areas such as systems engineering, electronics engineering, software engineering, mechanical engineering, and mechatronics design.	1,400
Scandinavian Avionics	Provides complete turn-key avionics solutions for civil and military aircraft, helicopters and UAS. Including sales, maintenance (MRO), certification (STC), design & engineering, installation, product development, production, training, and consultancy services.	170+
Systematic	Develops software products for the military, intelligence and national security, healthcare, financial, public and private sectors	1,000+
Gomspace	Provides nanosatellites platforms including advanced functionality such as inter-satellite linking, station keeping & agile pointing. Delivers thousands of subsystems to customers in more than 50 countries.	200
Hydrema	Develops, manufactures and markets high technology earth-moving equipment and mine clearing vehicles.	400
Odense Maritime Technology (OMT)	Development and delivery of maritime design and production engineering solutions. Odense Maritime Technology (OMT) was established in 2010 with Valcon A/S as a spin-off from Odense Steel Shipyard (OSS).	100-249

Source: Danish Technology Institute and RAND Europe

Most Danish defence companies, however, are subcontractors or component suppliers to original equipment manufacturers (OEMs) and systems integrators. Furthermore, in many companies, defence-related supplies account for only a very small part of the company's business given their civil-dominated and dual use focus.<sup>3</sup>

## B.2. Overview of skills gaps and shortages

The main challenge for many Danish defence industry companies is insufficient size or international experience to enter the global defence market. Thus, the main skills gaps and challenges identified for local SMEs include:

<sup>3</sup> Oxford Research (2009). 'Mapping and analysis of the Danish defence and security industry.' As of 28 September 2018: <https://erhvervsstyrelsen.dk/sites/default/files/kortlaegning-og-analyse-af-den-danske-forsvars-og-sikkerhedsindustri.pdf>



- **Marketing and sales competences** that enable Danish companies to operate in the defence market, including contacts and networking with governmental institutions and business associations at home and in potential export markets;
- **Administrative skills** and the capacity to **manage export licenses** and other bureaucratic procedures relating to the sale of defence equipment;
- **Production planning, management and organisation skills** for building up manufacturing capacity and ensuring product quality;
- **STEM skills in areas such as advanced manufacturing, electronics, and software.** There is a general shortage of engineers in Denmark, affecting not only defence, but also other sectors more broadly. A shortage of approximately 10,000 STEM-candidates has been estimated by 2025.<sup>4</sup>
- **Automation of manufacturing** (i.e. process design, data management), **quality management** (of both process and product) and **military certification and testing** (which places heavy demands on both SQEP and test facilities, unique to defence). Many SME manufacturers need skilled automation technicians to manage production equipment to achieve a high quality level and certification.

Companies within Denmark's defence industry (including SMEs and large companies) are also experiencing challenges in recruiting for STEM-focused roles quickly enough to meet company needs. This is particularly notable for roles requiring skills such as **electrical and control design, electrical engineering; materials engineering,** and **software design and engineering.**<sup>5</sup> It is also anticipated that over the next five years, industry will find it increasingly challenging to access **design engineering** skills.

## B.3. National and regional policies and programmes

### B.3.1. Overview of national and regional policies

At the national level, the main tools for ensuring Danish defence skills and capabilities are:

1. Danish defence industrial strategy;
2. Obligatory Industrial Cooperation for foreign suppliers of new defence equipment; and
3. Cooperation and dialogue between the Danish defence and the industry.

The Danish defence industrial strategy (July 2014) identifies Denmark's defence capabilities and skills areas of strategic importance. Meanwhile, the industrial cooperation for foreign suppliers (which may be mandated by the Danish Business Authority) is an important tool for developing and maintaining skills in Danish companies in these strategic areas. The Open for Business Strategy (March 2015)<sup>6</sup> focuses on improving marketing competences among Danish defence companies and updating their technological

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<sup>4</sup> Hoimark, Julie. 2017. 'Mindre mangel på ingeniører og it-uddannede end forventet.' Science Report DK. As of 28 September 2018: <https://sciencereport.dk/samfund/mindre-mangel-paa-ingenioerer-it-uddannede-forventet/>

<sup>5</sup> RAND Europe survey analysis

<sup>6</sup> Forsvarsministeriet. 2015. 'Open for Business – strategi til støtte for fremme af dansk erhverv.' 23 March. As of 28 September 2018: <http://www.fmn.dk/videnom/Pages/Open-for-Business-strategi-til-stoette-for-fremme-af-dansk-erhverv.aspx>

insight into defence products and upcoming procurements. These tools are elaborated upon further in Table B.2.

**Table B.2 National and regional policies relating to defence industrial skills**

<b>Strategy</b>	<b>Description</b>	<b>Priority skills/technology areas</b>
<b>Defence industrial strategy<sup>7</sup></b>	The defence industrial strategy defines future security interests of Denmark and defines defence capabilities and competences of strategic importance to Denmark.	Skills developed are limited to defence equipment, mainly focusing on: <ul style="list-style-type: none"> <li>• Advanced software, including cyber</li> <li>• Communication and command control systems</li> <li>• Monitoring and radar technology</li> </ul>
<b>Obligatory industrial cooperation for foreign suppliers<sup>9</sup></b>	Obligation on foreign suppliers (as a result of procurement of defence equipment) to cooperate with companies in Denmark to ensure the maintenance and development of the necessary industrial competences and capabilities in the defence area.	<ul style="list-style-type: none"> <li>• Operative protection of persons and military capabilities</li> <li>• Parts of the maritime/land area critical to military operations</li> <li>• Advanced material technology and treatment<sup>8</sup></li> </ul>
<b>“Open for business Strategy”<sup>10</sup></b> <b>Cooperation and dialogue between the Danish Defence and the national defence industry</b>	The Danish Defence Acquisition and Logistics Organisation have the legal authority to support the national defence industry with access to military expertise, new products and solutions. The Open for business Strategy defines key areas of action for supporting the Danish DTIB	<p>Marketing competences and contacts in the defence market</p> <p>Technological insight into upcoming future defence procurements</p> <p>Skills relevant for participation in tender procedures</p> <p>Certifications and organisational skills as regards transparency and quality management</p>

Source: Danish Technology Institute and RAND Europe

### B.3.2. Overview of national and regional programmes

Industrial cooperation with foreign suppliers is generally regarded as a flexible and useful tool for developing skills at company level, as each obligatory cooperation project must be related to the actual equipment order and the core competence fields that are needed by the Danish company to help fulfil the order. Many Danish SMEs in the defence industry strive to obtain orders and references that will enable them to enter the defence market, and for these SMEs industrial cooperation with international suppliers

<sup>7</sup> Erhvervsstyrelsen. 2014. ‘Denmark’s Defence Industrial Strategy.’ 1 July. As of 28 September 2018: <https://erhvervsstyrelsen.dk/sites/default/files/media/den-nationale-forsvarsindustrielle-strategi.pdf>

<sup>8</sup> Erhvervsstyrelsen. 2014. ‘Denmark’s Defence Industrial Strategy.’ 1 July. As of 28 September 2018: <https://erhvervsstyrelsen.dk/sites/default/files/media/den-nationale-forsvarsindustrielle-strategi.pdf>

<sup>9</sup> Erhvervsstyrelsen. 2014. ‘Denmark’s Defence Industrial Strategy.’ 1 July. As of 28 September 2018: <https://erhvervsstyrelsen.dk/sites/default/files/media/den-nationale-forsvarsindustrielle-strategi.pdf>

<sup>10</sup> Forsvarsministeriet. 2015. ‘Open for Business – strategi til støtte for fremme af dansk erhverv.’ 23 March. As of 28 September 2018: <http://www.fmn.dk/viden/Pages/Open-for-Business-strategi-til-stoette-for-fremme-af-dansk-erhverv.aspx>

can be a valuable mechanism to achieve that. It is important to emphasise that industrial cooperation is mandated in cases where the Danish Ministry of Defence regards the particular procurement as necessary for safeguarding Denmark's essential security interests and the Danish Business Authority deems that the obligation will not distort civil market competition. Selected examples of current cooperation projects within Denmark are reflected in Table B.3 below.

**Table B.3 Obligatory industrial cooperation project examples**

<b>Cooperation projects (examples)</b>	<b>Professionals involved</b>	<b>Domain</b>	<b>Skills focus</b>
Hydrema has entered into an agreement with Swiss General Dynamics European Land Systems - Mowag (GDELS MOWAG) regarding the final assembly of the order for Piranha 5 for the Danish defence <sup>11</sup>	Management Manufacturing engineers Machinists Industrial operators	Land	Industrial electrical engineering, computer science, mechanical engineering, production engineering
Mikkelsen Electronic has entered into an agreement with GDELS <sup>12</sup>	Production Management Manufacturing engineers Machinists Industrial operators	Land	Complex cable technology for armoured vehicles, production engineering, industrial engineering, testing procedures for quality control
Lockheed Martin and MyDefence Communication have signed an agreement to pair unmanned system with KNOX Counter-UAS system <sup>13</sup>	Production Management Manufacturing engineers Machinists Industrial operators	Air	Expertise on rapid response aerial surveillance capabilities, integration and sustainment of advanced technology systems, Industrial electrical engineering

Source: Danish Technology Institute and RAND Europe

In addition to leveraging national defence procurement to promote cooperation with foreign firms, Denmark also engages in European collaboration opportunities. For example, Denmark takes part in the Drone Countermeasures Project with France and Switzerland (see Table B.4).

<sup>11</sup> Hydrema. 2017. 'Hydrema receives order for final assembly of Piranha 5 to the Danish Defense.' 16 November. As of 28 September 2018: <https://www.hydrema.dk/virksomhed/nyheder/hydrema-faar-ordre-paa-slutmontage-af-piranha-5-til-det-danske-forsvar>

<sup>12</sup> Hydrema. 2017. 'Hydrema receives order for final assembly of Piranha 5 to the Danish Defense.' 16 November. As of 28 September 2018: <https://www.hydrema.dk/virksomhed/nyheder/hydrema-faar-ordre-paa-slutmontage-af-piranha-5-til-det-danske-forsvar>

<sup>13</sup> My Defence. n.d. 'Lockheed Martin and MyDefence Communication Sign Agreement to Pair Unmanned System with KNOX Counter-UAS System.' As of 28 September 2018: <https://mydefence.dk/2017/08/lockheed-martin-and-mydefence-communication-sign-agreement-to-pair-unmanned-system-with-knox-counter-uas-system/>

**Table B.4 European defence capability programme - example**

<b>Programme</b>	<b>Professionals involved</b>	<b>Domain</b>	<b>Skills focus</b>
The Drone Countermeasures Project, funded by the EU's Regional Fund	Management Manufacturing engineers Machinists Industrial operators	Air	Dual use: jamming technology for protection of critical infrastructure

Source: Danish Technology Institute and RAND Europe

### B.3.3. Industry-led policies and programmes

Traditionally, the national policy of obligatory industrial cooperation has been the main tool used to ensure market involvement and, subsequently, the retention of skills and capabilities for the Danish defence industry. To strengthen the access of Danish companies to the defence market it became recognised that it would be important to strengthen SMEs at the regional level. Over the last decade, the Danish regions have initiated clusters, innovation networks and cooperation projects between universities and companies in the defence industry to facilitate skills development and knowledge transfer.

## B.4. Overview of industry defence related skills policies and programmes

Due to the SME-dominated Danish defence sector, there is no emphasis on company-led defence related skill policies and programmes outside of the typical internal workforce development, such as mentoring schemes and on-the-job training within companies. Instead, most skills programmes at company level are initiated and partly funded by the government, the Danish MOD, the Regions, and by sector associations namely the Danish Defence and Aerospace Industry (FAD) and Centre for Defence, Space & Security in Denmark (CenSec). Defence companies are represented in steering groups of clusters and innovation networks, with skills programmes organised in cooperation with universities and colleges. The two sector associations promote different aspects of cross-DTIB cooperation. FAD acts as a point of contact for foreign defence equipment suppliers who seek to do business with Danish defence and aerospace companies. CenSec is the prime Danish industrial cluster for SMEs, acting as a liaison between the MOD and the companies. It has 120 members, consisting of companies specialising in advanced manufacturing, electronic and software development, as well as a number of universities and other education establishments in the field. Skills developed through clusters and innovation networks are typically not specifically aimed at defence, but may rather have wider dual use applications. Some examples of skill programmes at regional level are included in

Table B.5.

**Table B.5 Examples of defence industry skills programmes**

<b>Programmes</b>	<b>Professionals involved</b>	<b>Domain</b>	<b>Skills focus</b>
Haderslev Municipality, Aeronautical Center of Excellence, and Technical Education Copenhagen (TEC)	Flight mechanics and technicians	Air	Maintenance of F-35, industrial electrical engineering, mechanical engineering, production engineering,
Mercantec in Viborg in cooperation with Scandinavian Avionics	Manufacturing engineers Machinists Industrial operators	Air	Automation technologies, industrial engineering, testing procedures for quality control
Innodrone.dk -a programme led by Innovation Network RoboCluster (universities, GTS institutes, innovation); funded by the Ministry of Higher Education & Science	Production Management Manufacturing engineers Manufacturing workers	Air	Dual use: drone technology, aerial surveillance and detection technologies, industrial electrical engineering
Defend ARKTIS is led by Aalborg University and funded as a North Jutland regional fund project, with ~15 defence companies	Production Management Manufacturing engineers Manufacturing workers	Land	Dual use: industrial engineering, testing procedures for quality control
Innovation Network for Production, with ~ 500 companies involved.	Production Management Manufacturing engineers Manufacturing workers	Air, Land, Naval	Skills relating to obtaining certification of quality in production to enter the defence equipment
The Space and Aerospace Cluster, consists of Aalborg University, Aarhus University, School of Business and Social Sciences, Alexandra Institute, Danish National Space Centre, FORCE Technology and DTI and ~20 companies	Business management Production Management Manufacturing engineers Manufacturing workers	Air, Space	Satellite technology, unmanned air systems  Market/sales competences, tender procedures and qualification criteria for participating in European Space Agency programmes.

Source: Danish Technology Institute and RAND Europe

## B.5. SWOT analysis of national and industry programmes

Denmark’s national and industry skills programmes are designed to address the identified skills gaps and shortages of the Danish defence industry, with national and industry programmes each playing complementary roles addressing these different gaps. For instance, the Open for Business Strategy facilitates cooperation and dialogue between the Danish MOD and the national defence industry, targeting skills gaps in marketing and sales. The Danish Defence Acquisition and Logistics Organisation plays an important role providing the companies with market contacts and insight into defence technologies and planned procurements. Industrial cooperation for foreign suppliers aims to build up

organisational, technological, and manufacturing skills in Danish defence companies through mandatory knowledge-sharing – though this is of course limited in terms of the breadth and depth of skills and technology. The industry cooperation is also important for transferring STEM skills in areas such as advanced manufacturing, electronics, automation technologies and software. Meanwhile, Danish universities and research institutions are increasingly involved in developing defence related skills programmes, particularly in the fields of electronics, space technology and advanced/automated manufacturing. A high-level SWOT analysis of national and industry programmes is depicted in Figure below.

Figure B.2 SWOT analysis of national and industry programmes

Internal factors	
<b>Strengths</b>	<b>Weaknesses</b>
<p>Clusters and innovation networks are flexible and useful tools for skills development in SMEs with the potential for entering the defence market.</p> <p>Industry cooperation with foreign defence equipment suppliers can be a flexible and useful tool for developing skills at company level, as it aims to bolster the core competence fields that are needed by the Danish company to help fulfil the order.</p>	<p>Some companies in innovation networks and clusters are competitors and may be reluctant to share knowhow with each other.</p> <p>Continued coordination between government authorities (e.g. the MOD and the Business Authority) is essential for effective mechanisms for industry cooperation, and its positive impact on skills sustainment can be limited by break-downs in this alignment.</p> <p>Areas addressed by industrial cooperation, and thus its benefit to skills, can be limited – as they must be restricted to essential security concerns of Denmark.</p>
External factors	
<b>Opportunities</b>	<b>Threats</b>
<p>The Danish Defence Industrial Strategy, developed in 2014, increases the focus on the Danish defence industry's areas of strength and makes the skills development aspect of industrial cooperation more strategically coherent. This provides a useful framework for action that can be built upon, capitalising on national strengths in order to develop a more targeted, strategic approach to skills development.</p>	<p>While the obligatory industrial cooperation arrangements can have a range of benefits, they are also politically sensitive as they must be compliant with EU legislation, which requires specific security-based justification for these arrangements given their potential contradiction of principles of supplier non-discrimination.</p> <p>As Denmark is not member of various European defence cooperation programmes, Danish companies may struggle to gain access to other international consortia, for example, those formed to deliver Permanent Structured Cooperation (PESCO) projects.</p>

Source: Danish Technology Institute and RAND Europe