Annex: *Defining the Belgian Defence Technological and Industrial Base: Outlining Inclusion Criteria Through Multiple Case Study Analyses*

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1. Multiple case study analyses

1.1 Country level analysis

1.1.1 Canada

Solomon and Penney (2020) refer to the 2016 review of the Canadian defence industry (Canadian Defence Aerospace and Marine Industry Survey – CDAMIS) which includes enterprises with sales in products and services connected to military platforms, training, in-service support and sub-systems.[1] Given that the CDAMIS is set up by the official statistics department of the government ('Statistics Canada'), the mapping and inclusion criteria of the CDAMIS can be seen as "*the* definition" of the Canadian defence industry.[2] The CDAMIS also remains in line with definitions used in previous studies on the Canadian Defence industrial base (e.g. Berkok 2010, Solomon 2009, Treddenick 1987).[3]

The inclusion criteria of CDAMIS (see below) result in a mapping that includes 664 enterprises, of which the vast majority are SMEs,[4] representing around 7.6 billion USD[5] in sales and directly employing 27,000 people.[6] The CDAMIS defines a 'defence firm' as *any* enterprise with any sales of defence goods and services that occurred in the year of the survey.[7]

Since there is no further boundary given for the broad term 'enterprise', even 'non-profit legal persons' (e.g. non-profit Research and Technology Organizations - RTOs) can fall under the CDAMIS definition, provided that sales of defence goods and services occurred. However, some of these RTOs may have been overlooked,[8] given that a sample list of businesses with enterprises (2,019 enterprises in 2016) thought of as potentially engaging in the manufacturing and delivery of defence-related products and services was identified to send the questionnaire to.[9] This was done through a "targeted

[1] Solomon B. and Penney C.E. (2020), CH21: Canada, in K. Hartley and J. Belin (Eds.), *The economics of the global defence industry* (1st ed.), Routledge, p445.
[2] Solomon and Penney (2020), p445
[3] Solomon and Penney (2020), p445
[4] While only 32 out of the 664 firms in the CDAMIS are noted as having more than 500 employees, these 32 enterprises together account for 75% of industry R&D and represent around 60% of defence industry sales, export and employment. More than 500 firms out of the 664 have less than 100 employees. (CH21: Canada in The economics of the global defence industry by Belin et al. p445-446)
[5] 2018 constant dollars
[6] Solomon and Penney (2020), p445
[7] Solomon and Penney (2020), p459; For detailed delimitations of 'defence goods and services', see: ISED - Innovation, Science and Economic Development Canada (2022). State of Canada's Defence Industry Report for Spring 2022 concerning the 2020 survey, pp33-41, https://ised-isde.canada.ca/site/aerospace-defence/sites/default/files/attachments/StateCanadaDefence2022Report.pdf
[8] While a summary report of the 2016 survey is available, as the details of the 2016 CDAMIS survey results are not publicly available, this cannot be investigated here in more detail.
[9] Statistics Canada (2018). *Canadian Defence Aerospace and Marine Industries Survey* (CDAMIS). https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=333412

approach based on prioritized firms", which was outlined together with industry.[10] Therefore, the 2016 survey may not include all applicable enterprises.

The inclusion criteria to be considered part of the Canadian DTIB mapping therefore rest on the definition of what are considered 'sales of defence goods and services'. In this regard, the 2016 survey outlines 21 defence goods & services sales categories, but does not provide further details on products and services within these categories or those that are to be excluded from consideration.[11] However, the definition of these 'defence categories' can be found in the summary results of the expanded follow-up surveys conducted in 2018 and 2020, which outline 24 'defence categories' (See the overview in ***Table 1.1.1.1***.[12]

Category of Defence goods and services
Ammunition and Other Munitions
Missiles and Rockets
Firearms and Other Weapons
Military Systems Deployed in Space, Space Launch Vehicles, Land based Systems for the Operation, Command and Control of Space Launch Vehicles or Systems Deployed in Space, and Related Components
Primarily Airborne Electro Optical, Radar, Sonar and Other Sensor / Information Collection Systems; Fire Control, Warning and Co untermeasures Systems, and Related Components
Primarily Land based Ground Vehicle Borne, Man Portable or Non Platform Specific Electro Optical, Radar, Sonar and Other Sensor/ Information Collection Systems; Fire Control, Warning and Countermeasures Systems, and Related Components
Primarily Airborne Communications and Navigation Systems; and Other Information Systems (Including Processing and Dissemination), Software, Electronics and Components
Primarily Land based, Ground Vehicle Borne, Man Portable or Non Platform Specific Communications and Navigation Systems; and Other Information Systems (Including Processing and Dissemination), Software, Electronics and Components
Naval Ship Borne Mission Systems and Components
Naval Ship's Structural Elements, Platform Systems, Parts & Components (Excluding Shipborne Naval Mission Systems)
Naval Vessel Architecture, Engineering, Certification and Related Professional Services
New Naval Vessels Constructed by Shipyards, and Naval Conversions
Naval Ship Maintenance, Repair and Overhaul
Combat Vehicles and Components

[10] Innovation, Science and Economic Development (2018), *State of Canada's Defence Indusrty 2018 report for 2016 survey*, p3. https://www.mynorthmyhome.ca/wp-content/uploads/2018/05/State_of_Canadas_Defence_Industry-2018_Report.pdf

[11] Ibid, p16

[12] Innovation, Science and Economic Development (2020), *Statistical Overview of Canada's Defence Industry in 2018*, pp29-35, https://www.defenceandsecurity.ca/UserFiles/Uploads/publications/reports/files/document-32.pdf ; Innovation, Science and Economic Development Canada (2022), State of Canada's Defence Industry Report for Spring 2022 concerning the 2020 survey, pp33-41, https://ised-isde.canada.ca/site/aerospace-defence/sites/default/files/attachments/StateCanadaDefence2022Report.pdf (The 2020 'defence categories' list adds 'Naval Vessel Architecture, Engineering, Certification and Related Professional Services' as a new category and splits 'Firearms, ammunition, missiles, rockets, and other munitions and weapons' into 3 separate categories.)

Combat Vehicles Maintenance, Repair and Overhaul
Aircraft Fabrication, Structures and Components
Military Aircraft Maintenance, Repair and Overhaul Services
Unmanned Aerial Systems and Vehicles and Components
Simulation Systems for Aircraft
Simulation Systems for Naval Vessels
Simulation Systems for Land Vehicles or Other Applications
Military Training Services
Military Personal Protective Equipment, Load Carriage Systems and Operational Clothing
All Other Defence (Specify)

Table 1.1.1.1: 'Defence Goods and Services Categories' (Canada). Source: Innovation, Science and Economic Development Canada (2022), State of Canada's Defence Industry Report for Spring 2022 concerning the 2020 survey, pp33-41.

An enterprise is therefore considered part of the Canadian Defence Industry when it has any sales of defence goods and services within these 'defence categories' that occurred in the year of the survey. Considering any enterprise established under Canadian law (i.e. registered as a Canadian enterprise) falls within this scope, there is no exclusion of foreign owned companies. These are also considered part of the Canadian DTIB in so far as the above inclusion criteria are applicable. Hence, the definition can be summarized as: *Any enterprise established under Canadian law is considered part of the Canadian Defence Industry when it has any sales of defence goods and services within the 'defence categories' outlined in the CDAMIS.*

1.1.2 Germany

Germany currently has no known official mapping analysis of the German DTIB. According to Brzoska (2020), there is no official data or official definition of the boundaries of the defence industry, nor is the defence industry included as a broad category in industry statistics or the national account.[13] The available mapping and data on the German defence industry is provided by consultants, independent research institutes, industry associations and academic researchers (Schubert and Knippel 2012 [14]; VDI

[13] Brzoska, M. (2020), Ch9: Germany, in K. Hartley and J. Belin (Eds.), *The economics of the global defence industry* (1st ed.), Routledge, p197

[14] Schubert, S. and J. Knippel (2012), *Quantifizierung der volkswirtschaftlichen Bedeutung der Sicherheits- und Verteidigungsindustrie für den deutschen Wirtschaftsstandort*, Berlin: Bundesverbands der Sicherheits- und Verteidigungsindustrie e.V., Berlin. http://ruestungsexport-info.de/fileadmin/media/Dokumente/R%C3%BCstung Gesellschaft/R%C3%BCstungsexporteure R%C3%BCstungsindustrie/BDSV-R%C3%BCstungsindustrie Wirtschaftsleistung-November2012.pdf

TZ 2015 [15]; Weingarten et al. 2015 [16]; Ostwald and Legler 2015 [17]), who all employ different criteria and boundaries of what the industry entails and are driven by the data available at the time to the respective authors. Furthermore, the official data that is available on procurement and export of defence goods and services contain inconsistent definitions on the categorizations of the goods and services.[18]

The broadest known mapping (Ostwald and Legler 2015), employs the term *'German Defence and Security Industry'* for its mapping and includes more SMEs than other definitions.[19] This is the case as the definition employed by Ostwald and Legler sets the boundaries for inclusion into the German Defence and Security Industry mapping according to broader product-related delimitations, which enables the inclusion of a wider net of SMEs.[20] The product-related delimitations are split between the 'core area' and the 'extended area' of the industry.[21] 'Core Area' includes all goods the state employs for sovereign security tasks, especially goods that enable the use of force such as defence weapon systems, military grade guns, but also police weapons.[22] The 'Extended Area' consists of goods used for preventative and mission management, such as goods for surveillance, reconnaissance and alerting, operational readiness and mobility, protection and mitigation.[23] More specifically, the group of defence and security industry goods and products are divided in 7 product groups, 1 for the 'Core Area' and 6 for the 'Extended Area' (see: ***Table 1.1.2.1***). Some defence and security goods are not

[15] VDI Technologiezentrum – VDI TZ (2015*), Analyse der strukturellen Lage der Verteidigungsindustrie in Deutschland*, Düsseldorf: Bundesministeriums für Wirtschaft und Energie, www.bmwi.de/Redaktion/DE/Downloads/S-T/sicherheit-verteidigungsstrategie-studie.pdf?__blob=publicationFile&v=4

[16] Weingarten et al. (2015), *Perspektiven der wehrtechnischen Industrie in Deutschland*, Frankfurt: Hans Böckler Stiftung

[17] Ostwald, D. A. and B. Legler (2015), *Der ökonomische Fussabdruck der deutschen Sicherheits und Verteidigungsindustrie*, Berlin: Bundesverband der deutschen Sicherheits- und Verteidigungsindustrie – BDSV, www.bdsv.eu/files/downloads/publikationen/2015-11-BDSV_WifOR-Studie.pdf

[18] Ibid, p197

[19] Ibid, p203; Ostwald and Legler build on the 2012 WifOR study, done by Schubert and Knippel on the economic significance of the German Security and Defence Industry (SVI), in order to update the key industry figures for 2014 and measure these for the first time on the basis of ESA 2010.

[20] Ostwald and Legler (2015), p23-25; The different source of demand for these goods and services are differentiated between demand from the public sector for sovereign security tasks (German armed forces, authorities or organizations with security tasks) and demand from the private sector (e.g. operators of critical infrastructure) for non-sovereign safety tasks. Given this differentiation of demand is not further expanded upon or used in the figures, we do not further expand on this here.

[21] Ostwald, D. A. and B. Legler (2015), *Der ökonomische Fussabdruck der deutschen Sicherheitsund Verteidigungsindustrie*, Berlin: Bundesverband der deutschen Sicherheits- und Verteidigungsindustrie, p7, www.bdsv.eu/files/downloads/publikationen/2015-11-BDSV_WifOR-Studie.pdf

[22] Ibid, p8

[23] Ibid, p8

included within the product-related boundaries of the analysis due to unreliable and insufficient data.[24]

Group of Goods/products	Explanation of included goods/products
Core Area (goods for interdiction and effect)	
G1 Weapons systems, weapons and ammunition	° Mobile weapon systems (e.g. tanks, combat aircraft, warships, mobile air defense systems) ° Stationary weapon systems (e.g. artillery, stationary air defense systems) ° Weapons for equipping forces (e.g. handguns, light weapons) ° Ammunition, cartridges, projectiles
Extended Area (goods for prevention and operational management)	
G2 Operational readiness	° Goods for analysis and consulting (e.g. analysis software) ° Goods for modeling and simulation (e.g. simulation software and platforms) ° Installation, maintenance, repair (e.g. industrial product-related services)
G3 Operational mobility	° Land, water and air vehicles (e.g. emergency vehicles, coast guard boats, rescue helicopters)
G4 Monitoring, reconnaissance and alerting	° Goods for video surveillance ° Goods for intrusion detection as well as fire alarm systems ° Goods for large-scale surveillance, (e.g. surveillance of the EU external borders, maritime surveillance, airspace surveillance) ° Goods for identification and access control, (e.g. Card systems, biometric systems, vehicle and ship tracking) ° Goods for checking people and their belongings ° Goods for monitoring goods and merchandise, (e.g. RFID) ° Goods for CBRN detection (e.g. Geiger counters) Equipment and systems for reconnaissance support (e.g. TCT, data mining, devices for topographic reconnaissance)
G5 Protection	° Critical infrastructure protection goods ° Body protection goods (e.g. for protection against bullets and shrapnel, protection against fire, heat and pressure, contamination protection) ° Goods for network and information protection (e.g. IT security, cryptography)

[24] E.g. fire ships, fire-fighting ships, non-technology-driven mechanical security goods, private security services, surveillance services, private security weapons, goods for forensic science, traction vehicles for security-focused use.

	° Goods for vehicle protection, for example also vehicle armoring
G6 Command, Control, Communication	° Communication technologies (e.g. communications technology, navigation technology) ° Goods for coordination and management (e.g. IT-supported mission coordination, control center technology)
G7 Mitigation	° Fire, flood and explosion fighting (e.g. fire extinguishers, large pumps, disrupters) ° Decontamination (e.g. high-pressure cleaners) ° Mobile and emergency power generation (e.g. power generators)

Table 1.1.2.1: Defence and Security Industry definition. Goods groups of the core area and the extended area of the industry. Source: Ostwald and Legler (2015), p37.

These groups of goods delimitating the boundaries of what is included in the analysis as part of the German Defence and Security Industry, is based on 2008 classification of economic activities of the Federal Statistical Office, which subdivides the areas of the national account (based on EU NACE rev. 2).[25] Every economic unit[26], i.e. any entity engaged in an economic activity, (referred to as 'undertaking') is assigned in this classification system to the economic activity that represents the largest proportion of the value added of the undertaking ('main activity').[27] The official classification enables the identification of undertakings that are part of the Defence and Security Industry, through matching the classification of economic activities to the group of goods as outlined above.[28]

[25] Ostwald and Legler (2015), p12. ; DuStatis (2008), Klassifikation der Wirtschaftsweige 2008, Statistisches Bundesambt Wiesbaden, https://www.destatis.de/static/DE/dokumente/klassifikation-wz-2008-3100100089004.pdf

[26] The use of the term 'economic unit' comes from the 2008 classification being based on the nomenclature set out in the ESA 2010 (European Systems of Accounts 2010) and is not based on legal status, but rather on the presence of any economic activity. For instance, ESA 2010 'economic units' can also be government units and non-profit institutions (see: National Bank of Belgium. ESA list of Economic Units). https://www.nbb.be/en/statistics/securities-holding-shs/declarations-onegate/list-economic-units-making-economic-sectors). This aligns well with the concept of 'undertaking' employed in EU competition law, where the term *covers "any entity engaged in an economic activity, regardless of its legal status and the way in which it is financed* (see: judgment of 10 January 2006, Cassa di Risparmio di Firenze and Others, C-222/04, EU:C:2006:8, paragraph 107*), in which the public or private status of the entity engaged in the activity in question has no bearing on the question as to whether or not that entity is an 'undertaking'"*(see: Judgement of 27 May 2017, Congregacion de Escuelas Pias Provincia Betania, C-74/16, EU:C:2017:496, paragraph 41-42. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:62016CJ0074&from=EN). While Ostwald and Legler (2015) refer to the 'economic units' as 'undertakings' ("Unternehmen"), it is not specified if they do so from German law or from the EU concept of an 'undertaking'.

[27] Ostwald and Legler (2015), p12.

[28] Ostwald and Legler (2015), p12; This is done by identifying the economic sectors/activities in the national statistics seen as belonging to the 'cross-sectoral' Defence and Security Industry and then to identify the undertakings according to the classification of their economic activities.

The product-related delimitations for the '*German Defence and Security Industry*' are further delineated within a 'delimitation matrix' according to the sources of demand (see: ***Figure 1.1.2.2*** below). This depiction more clearly illustrates the cross-sectoral nature of the industry. Aside from the government demand for security-related products to ensure its sovereign security responsibilities, the matrix also indicates the demand from the private sector to secure critical infrastructure (e.g. transport such as train stations, railroads, airports, etc.).[29] Hence, the matrix clearly indicates the role of certain private sector actors in contributing to ensuring the national security of Germany and the needs of these actors for security-related products towards this end. Despite the illustration of the matrix, no differentiation is provided concerning the values or specific products demanded by each category of demand. Thus, it remains a conceptual depiction, rather than one providing practical insight.

Delimitation according to the German Defence and Security Industry Matrix			**Demand-side delimitation**		
			By public services/institutions		By the private sector
			Bundeswehr	Security services	Operators of critical infrastructure and sensitive systems or installations
			Sovereign security tasks		Non-sovereign security tasks
			Military security*	Civil security	Civil security
Product-related delimitations (supply-side)	Core Area of the Defence and Security Industry	goods for interdiction and effect	**e.g.** heavy equipment, tanks, warships, military aircrafts, weapons systems	**e.g.** personal equipment, weapons and ammunition for (non-defence) task forces	
	Extended Area of the Defence and Security Industry	goods for prevention and operational management	**e.g.** goods for operational readiness, surveillance/reconnaissance, protection, guidance/control/communication and damage mitigation/harm reduction		
			Expansion to include the area of IT security: Within the scope of this delimiation the IT security industry were integrated and the definition of the sector was expanded to include it.		

*Military security here refers to broad notion of security generated by military means. (It does not refer here to the narrow selection of goods required by the 'Military Security Unit' of the Bundeswehr.)

Figure 1.1.2.2: delimitation according to the German Defence and Security Matrix. Source: Translated from German from Ostwald and Legler (2015), p7.

No distinction is made between German-owned or foreign-owned enterprises. Therefore, *any undertaking in Germany classified with its main economic activity (i.e. activity that represents the largest proportion of the value added of the enterprise) linked to the 'group of defence and security industry goods' (see: **Table 1.1.2.1**), and providing these to certain customers (Bundeswehr, Security Services, Operators of critical infrastructure and sensitive systems or installations), is considered part of the German Defence and Security Industry* in the analysis of Ostwald and Legler. While no explicit definition is provided by the authors themselves, this can be derived from the outlined delimitations as constituting their definition of the *'German Defence and Security Industry'*. This definition results in

[29] Ostwald and Legler (2015), p9.

a mapping representing an estimated 25.3 billion EUR in Defence and Security Industry sales, 12.2 billion EUR Direct Gross Value added and 135k in direct employment (in 2014).[30] However, it is important to note that due to the reliance on the 2008 classification system of economic activities, the figures of undertakings with relevant economic activities are not accounted for when it is not their main economic activity (as only the 'main economic activity' is used for the classification), thereby undercounting the direct economic impact of the Defence and Security Industry. On the other hand, the figures derived from undertakings with their 'main economic activity' considered belonging to the Defence and Security Industry includes the figures from their non-Defence and Security-related economic activities, thereby overcounting the direct economic impact. Furthermore, despite stating that the official classification makes it possible to identify the undertakings belonging to the cross-sectoral Defence and Security Industry on the basis of their classification in the economic activities[31], the number of undertakings included in the mapping is not provided by the authors.[32] It is not indicated whether this is due to the statistics only being available to the authors on an aggregate level, meaning the amount of undertakings itself cannot be derived from it (i.e. in this case the authors would be able to derive sales and other financial data from the economic activity code as an aggregate, but not what undertakings are part of it), or whether this information was known and purposefully omitted.

[30] Ostwald and Legler (2015), p2. ; Also see: Brzoska (2020), p196. ; For other insights (e.g. innovation and R&D) Ostwald and Legler (2015) employed a survey sent to 35 members of the German Security and Defense Industry Association (BDSV), which counted 221 members in 2022. The insights of this survey on R&D and innovation are taken by the authors as representative for the entire Defence and Security Industry.

[31] Ostwald and Legler, p12

[32] Given that the development of the Defence and Security Industry 'definition' was done in close cooperation with the BDSV(see: Ostwald and Legler 2015, p6), all BDSV members are likely to be included within the delimitations. However, given the delimitations are based on economic activities found in the national statistics, the applicable undertakings are not limited to the members of the BDSV.

1.1.3 Sweden

For Sweden, a recent parliamentary inquiry titled *'What Constitutes the Defense Market and a Defence Product'* (2022) clearly outlines the definition and delimitations of the defence market. The inquiry states that it employs the term 'defence market', as opposed to 'defence armaments' or 'defence equipment market', since this term covers both goods and services.[33] The 'defence market' itself is defined by the inquiry as the market for goods and services that are of a 'defence-specific nature' or 'goods and services that are subjected to specific requirements such as security of supply'.[34] Together these are also referred to simply as 'defence products'. A 'Swedish Defence Company' is considered any Swedish-based company that is active in the market of 'defence products', i.e. the 'defence market'.[35] There is no distinction for the mapping of the Swedish 'defence market' whether a company is foreign-owned or Swedish-owned; any legal entity or sole proprietorship registered in Sweden and operating under the inclusion criteria outlined above, falls within the definition of the 'Swedish defence market'.[36]

What is encompassed within the term 'defence products', is further clarified within the classification framework for defence products.[37] The classification framework for defence goods and services is split into the armaments (KM)[38] or dual-use items (PDA)[39] control systems, which are respectively based on the 'Inventory of Munitions (ML list) found in the appendix to the Regulation (1992:1303) on war-equipment' and on the dynamic 'EU Dual-Use regulations' (2021/821).[40] ***Table 1.1.3.1*** provides an overview of the ML list and ***Table 1.1.3.2*** of the categories of the EU Dual-Use regulation. Each company is responsible for having their products classified correctly and to know whether any of their products fall under the particular control systems.[41] However, companies requiring aid to correctly classify their products and services can contact the responsible authority 'Inspectorate for Strategic Products' (ISP) for support.[42]

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[33] Statens Offentliga Utredningar (2022), *Materielförsörjningsstrategi: För vår gemensamma säkerhet*, Elanders Sverige AB, Stockholm, p117, https://www.regeringen.se/49f07e/contentassets/c4e9c8e487314030b8a4d5830b3e274c/sou-2022_24_webb.pdf#page=117

[34] Ibid, p117.

[35] Ibid, p118.

[36] Ibid, p118.

[37] Forsvarsexport (2022), Product classification, https://forsvarsexport.se/produkter/klassificering/

[38] Swedish Inspectorate for Strategic Products - ISP (2022), Classification of munitions and technical assistance, https://isp.se/krigsmateriel/klassificering-av-krigsmateriel-och-tekniskt-bistand/

[39] Swedish Inspectorate for Strategic Products - ISP (2022), PDA: Classification of Product and Technology, https://isp.se/pda/klassificering-av-produkt-och-teknik/

[40] Forsvarsexport (2022), Product classification, https://forsvarsexport.se/produkter/klassificering/

[41] Ibid

[42] Forsvarsexport (2022), Product classification, https://forsvarsexport.se/produkter/klassificering/

Munitions List	
ML1 – Smooth-bore weapons with a caliber of less than 20 mm	ML12 – High-speed kinetic energy weapon
ML2 – Smooth-bore weapons with a caliber of at least 20 mm	ML13 – Armored or protective equipment
ML3 – Ammunition and tempering devices	ML14 – "Specialized equipment for military training" or for simulating military scenarios
ML4 – Bombs, torpedoes, rockets, missiles, other explosive devices and charges	ML15 – Imaging or countermeasure equipment
ML5 – Fire conduction, and related monitoring and warning equipment	ML16 – Wrought irons, castings and other unprocessed products specially designed for equipment
ML6 – Ground vehicles and component	ML17 – Other equipment
ML7 – Chemical agents	ML18 – Equipment and components for the 'production' of products
ML8 – Energetic materials	ML19 – Directed energy weapon systems (DEW systems)
ML9 – Warships (surface ships or underwater vehicles)	ML20 – Cryogenic and "superconducting" equipment
ML10 – "Aircraft"	ML21 – "Software"
ML11 – Electronic Equipment	ML22 – "Technology"

Table 1.1.3.1: Inventory of Munitions (ML list): There is a yearly update of products in these categories in the 'EU Common Military List' . Source: Common Military List of the European Union adopted by the Council on 26 February 2018.

Broad categories of the EU Dual-Use Regulation	
Category 0 - Nuclear materials, plant and equipment	Category 5 - Telecommunications and "information security"
Category 1 - Special materials and related equipment	Category 6 - Sensors and lasers
Category 2 - Material processing	Category 7 - Navigation and avionics
Category 3 - Electronics	Category 8 - Marine
Category 4 - Computers	Category 9 - Space and propulsion

Table 1.1.3.2: Categories of the Dual-Use Regulation (2021/821). Source: Regulation (EU) 2021/821 of the European Parliament and of the Council of 20 May 2021 setting up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items.

Based on the Swedish Defence Material Administration (FMV - Försvarets materielverk) supplier register (containing companies that have delivered at any time since 2008 to the armed forces), there are 2,780 'defence companies' (companies active in the market of 'defence products', i.e. the 'defence market') in Sweden.[43] In 2019, these companies employed 371,500 employees and had a combined

[43] As the inquiry refers to these companies under 'defence companies', it is considered that these fall under the delimitations of the concepts 'Swedish defence market' and 'defence products' mentioned in the inquiry. ; Statens Offentliga Utredningar (2022), Materielförsörjningsstrategi: För vår gemensamma säkerhet, Elanders Sverige AB, Stockholm, p122.

turnover of around 123.9 billion EUR (SEK 1.3 trillion).[44] [45] However, most of this represents civilian market sales of non-defence products. As these figures are based on all economic activities of the included companies in the delimitation, only a portion of turnover will be derived from economic activities related to the 'Swedish Defence Market'. No specific figures are provided as to the average proportion of 'Defence market' activities per 'defence company' for Sweden. Hence, this has to be done on best estimates. From other country studies (with wide mapping criteria), one can derive an average of 5%-15% as the proportion of 'Defence market' related turnover. However, as these studies employ other delimitations (wider or more narrow), either the average proportion of 'Defence market' turnover will be lower or higher in the total turnover. Hence, it is important to represent the figures in a range first and consider from context which figure in the range seems most accurate to be presented as the estimate. Likewise, we apply the same logic in order to better estimate the employees linked to the 'Swedish Defence market'. According to this, the 'Swedish Defence market' ranges between 6.2-18.6 billion EUR in 'Defence market' turnover and 18-55k employees. Considering the wider mapping inclusion criteria of the 'Swedish Defence Market' compared to those of its peers, a slightly lower-range 8% estimate as the average proportion of the 'defence market' turnover across all the 2,780 'defence companies' seems most adequate for the estimate. Hence, the 'Swedish Defence Market' is estimated to have a turnover of around 9.9 billion EUR and to consist of about 29.7k employees.

Only a small portion of the aforementioned combined turnover 123.9 billion EUR (turnover from all economic activities) is represented by sales to the Swedish armed forces - 1.5 billion EUR (or SEK 16.6 billion) - and most of the supply to the Swedish armed forces comes from the members of the Swedish Defence Industry trade association ('Säkerhets- och försvarsföretagens' - SOFF).[46] The association itself employs a wide definition for potential members, by being open to any Swedish-based company that conduct activities in the field of 'Societal Security' and 'Defence'.[47] This is also reflected in the members, given that of the approximately 150 members of SOFF, about 100 are SMEs.[48] 'Societal security' refers to the ability of a society to continue essential societal functions and safeguard lives, health and core needs of the citizens during times of duress, while 'Defence' refers to being active in providing goods and services to military authorities.[49] Concerning the later, SOFF indicates in its 2021

[44] Statens Offentliga Utredningar (2022), Materielförsörjningsstrategi: För vår gemensamma säkerhet, Elanders Sverige AB, Stockholm, p122.
[45] To achieve the amount of EUR in 'current euros' for 2019, the conversion of SEK to EUR is done based on the exchange rate of 31Dec2019 (17:00 UTC). SEKEUR (31Dec2019) = 0.09535182278867305
[46] Statens Offentliga Utredningar (2022), *Materielförsörjningsstrategi: För vår gemensamma säkerhet*, Elanders Sverige AB, Stockholm, pp122-123
[47] Säkerhets- och försvarsföretagen – SOFF (n.d.), *Our Organization*, https://soff.se/om-soff/var-organisation/
[48] Ibid.
[49] Ibid.

overview that it employs the same definitions for 'defence products' as defined in the 2022 inquiry and outlined by 'classification framework for defence products' discussed above.[50] Every year SOFF provides an overview of industry statistics based on data from their members in order to reflect the state of the 'Swedish Defence and Security Industry'. According to SOFF, the industry had a combined turnover in 2019 of 4.02 billion EUR (SEK 42 billion) for sales in 'defence' and 'societal security' products, of which 64% represented exports and 36% domestic sales.[51] The 100 SMEs[52] members of SOFF represented around 11% of the total turnover in 2019 with 429 million EUR (SEK 4.5 billion).[53]

The 2022 inquiry claims that around half of the turnover of the SOFF members was derived from goods and services that do not fall under the authorization requirements of the export legislation for war materials or dual-use regulations.[54] These sales would not be included as turnover from 'defence goods' under the definition of the 2022 inquiry. On the other hand, the SOFF does not include all Swedish companies that have sales of 'defence products'. Hence, there is a mismatch between the concept of the 'Swedish Defence Market' defined by the 2022 inquiry and the 'Swedish Defence and Security Industry' employed by the SOFF.

So far, prior studies by independent researchers on the Swedish DTIB (Lundmark 2019[55]; Olson et al. 2022[56]) have referred to the SOFF industry statistics for their description of the Swedish Defence market. However, these studies were published or commenced before the Swedish inquiry concluded and officially outlined the employed definitions. Future studies may employ the broader inclusion criteria for the mapping of the wider Swedish DTIB.

[50] Säkerhets- och försvarsföretagen – SOFF (n.d.), *Industry Statistics 2021: Historical growth in the defence market,* https://soff.se/2022/06/27/branschstatistik-2021-historisk-tillvaxt-pa-forsvarsmarknaden/

[51] Säkerhets- och försvarsföretagen – SOFF (n.d.), *Industry Statistics 2019,* https://soff.se/2020/06/16/branschstatistik-2019/

[52] Ibid: *"Smaller companies (SMEs) are, according to the EU definition, companies with fewer than 250 employees in the group and an annual turnover of less than €50 million."*

[53] Statens Offentliga Utredningar (2022), p123.

[54] Statens Offentliga Utredningar (2022), p123.

[55] Lundmark, M. (2019) The Swedish defence industry, in K. Hartley and J. Belin (Eds.), *The economics of the global defence industry* (1st ed.), Routledge.

[56] Olson, P. et al. (Oct 2022), *Defence industrial Outlook: A global outlook with a special focus on the EDF*, Swedish Defence Research Agency - FOI.

1.1.4 The Netherlands

For The Netherlands (NL), a recent mapping analysis of the NL Defence and Security-related Technological Industrial Base (hereafter simply referred to as NL DTIB), done by Berenschot consulting at the behest of the Ministry of Economic Affairs and Climate, outlines the definition and inclusion criteria of the NL DTIB. It considers *any Dutch undertaking ("companies, these companies their subcontractors/suppliers, any knowledge institutions and provider of services) that is active in terms of design, development, production or maintenance of 'defence materials'* (for the Marines, Land component or aerospace) *or 'security products', including cyber* (targeting the societal security market - e.g. for EUROPOL, the intelligence services, police, military police and other public security organizations) *part of the NL DTIB.*[57]

It is explicitly stated and clear from the industry analysis based on the mapping, that the term 'Dutch undertaking' includes any undertaking (any 'companies' as well as 'knowledge institutes', 'subcontractors' and relevant service providers) registered in the Netherlands that is active in 'defence materials' or 'security products' described in the definition above.[58] Hence, it does not exclude between Dutch-owned and foreign-owned undertakings for the inclusion into the mapping of the NL DTIB.

The estimations of undertakings within the market were based on prior research, publicly available publications of the Ministry of Defence, publicly available awarded defence procurement contracts (via TED and Tenderned), and on inputs from the defence and security related industry associations.[59] Thus, rather than delimitation according to clear product categorizations, the DTIB mapping is based on supply of products to defence or security actors. Hence, products to defence actors are defined as 'defence materials', while products to security actors are defined as 'security products'. Therefore, the NL inclusion criteria seems to put more emphasis on to whom (i.e. which Defence and Security actor) the products were delivered, rather than on the classification of the products themselves in order to build the DTIB mapping. These defence and security actors (e.g. Dutch Defence, Security services) their feedback then add undertakings to the DTIB mapping list. Only the sectors deemed relevant for defence and security were selected, resulting in the exclusion of construction companies, facility service providers and some other sectors (not outlined in the report) from the scope.[60] This

[57] Schotel, H., Oh, L., Coppola, V., & van Noortwijk A. (May 2022), *Nederlandse defensie- en veiligheid gerelateerde technologische industriële basis*, Berenschot en Ministerie van Economische Zaken en Klimaat, p14, https://www.berenschot.nl/media/ykmgbsh1/rapport-nederlandse-defensie-en-veiligheid-gerelateerde-technologische-industri%C3%ABle-basis.pdf
[58] Ibid
[59] NIDV, FME, NAG and VNO NCW ; Schotel H. et al (May 2022), p14.
[60] Ibid, p14

'top-down' approach, employing the inputs from higher authorities, is the opposite of the bottom-up classification approach as used by some studies for other countries (e.g. Ostwald and Legler for Germany).

These mapping criteria result in a mapped market size for the Defence and Security related Technological Industrial Base of 932 undertakings based in the Netherlands.[61] 88% of these are considered SMEs, which, in line with the EU-employed definition, refers to undertakings with less than 250 employees.[62] However, the 932 undertakings includes those that do little business with the defence and security actors, given that on average the defence and security related turnover of these undertakings accounted for 10,6% in 2021 (4.7 billion EUR).[63] Furthermore, while the 932 undertakings have a total of 150k FTE under employment, only 20k FTEs are estimated to be linked to the defence and security related activities.[64]

1.1.5 Conclusion: country cases

There is a clear similarity between the cases concerning the inclusion of foreign owned/controlled entities **(GQ2)** and research entities **(GQ5)**; all of the cases enable the inclusion of these within their delimitations. Also, while the cases employ different terms for the included entities (enterprise, undertaking, company), these all refer to any separate legal entity registered within the country fitting the delimitation criteria **(GQ7)**. Hence, while the terms employed differ they do not elicit a difference in practice between the analyzed cases; this despite the legal differences between the terms. As shown **in the summary table below (*Table 1.1.5.1*)**, other than these similarities, no generalizations can be found in the other criteria **(GQ10)**.

Firstly, there is little generalizability concerning the inclusion criteria in order to categorize an entity as part of the DTIB **(GQ1)**. While Canada, Germany and Sweden employ product-delimitations, they each use their own set of criteria. That is, they do not employ common or standardized criteria of which goods and services would enable an entity to be included in the mapping. Furthermore, the Netherlands rather employs customer-delimitations (i.e. rather than delimitations according to clear product categorizations, the inclusion of entities in the mapping is based on the supply to Defence and Security actors).

[61] Ibid, p14
[62] Ibid, p16
[63] Ibid, p15
[64] Ibid, p19.

Secondly, none of the cases employ the same term for the mapping: 'Defence Industry' (Canada), 'Defence and Security Industry' (Germany), 'Defence market' (Sweden), 'Defence and Security-related Technological and Industrial Base' (The Netherlands) **(GQ4)**. While the mappings for the Netherlands, Sweden and Germany can be seen as attempting to gauge the size of their DTIB, the mapping for the 'Canadian Defence Industry' is instead more limited, as it only includes a narrow category of Defence goods and services in order to considered in its mapping.

Thirdly, there is no generalizability concerning the methodology employed to source the data and information required for the development of a list of entities fitting the mapping delimitations **(GQ3)**. Sweden and the Netherlands derive this top-down, while Germany derives the size of the 'German Defence and Security Industry' bottom-up by analyzing classification of economic activities. Canada derives an initial list from the top-down and then employs a survey to further narrow down the list to only those entities that fit their outlined product-delimitations.

Given the cases employed different delimitations and methodologies, it is challenging to sufficiently compare the size of the cases with each other **(GQ6)**. For instance, the size of the 'Swedish Defence Market' cannot adequately be compared to the size of the 'Canadian Defence Industry' as these are based on alternative product-delimitations. In order to adequately compare these, comparisons would need to occur on a common basis by employing the same criteria. Despite this, general comparative insights on the size can be derived when taking into account the respective delimitations. The inclusion criteria for Sweden are far more expansive than those of Canada. Given similar criteria as employed for Sweden, the size for Canada is expected to be larger than for Sweden in absolute terms. However, this is not expected to be the case in relative terms. The relative figures in ***Table 1.1.5.2*** give some insight in this regard.[65] We see that the 'Swedish Defence Market' turnover in relative terms (*'sales per capita', 'sales/GDP', 'sales/Def. Expenditure'*) is significantly higher than the turnover of the other cases. These insights and the remaining uncertainty thereof again highlight the necessity for different cases to employ similar delimitations.

While turnover and employment figures are provided for all of the cases **(GQ8 – GQ9)**, the figures for Sweden concerned those related to all economic activities of the included companies. The turnover and direct employment related to the 'Swedish Defence Market' had to be calculated based on assumptions derived from other studies/cases.

[65] As the objective of our research in this article is to compare the definitions and their delimitations (rather than compare the metrics of the different cases in-depth), we limit the insights to these 3 relative metrics.

Country	Delimitations of definition/ mapping criteria	Foreign-owned incl.	Methodology employed[66]	*'Term'* employed	Research entities incl.[67]	Size	$/EUR Sales[68] [69]	Employment
Canada	Product-delimited	Yes	Top-down: Gov. development of draft list of 2,019 enterprises in cooperation with known industry (2016) Bottom-up: Survey to draft list to identify enterprises according to product delimitations (applied to 664 of these)	*'Canadian Defence Industry'*	Yes	664 'enterprises' (2016)	7.6 billion USD (for 2016) (in 2018 constant dollars) *= 6.6 billion EUR (in 2021 constantEUR)*	27k (direct) (2016)
Germany (Ostwald and Legler 2015)	Product (and customer-) delimited	Yes	Bottom-up: Data-driven based on linking the group of defence goods to classification of economic activities	*'German Defence and Security Industry'*	Yes	Not indicated [70] 'undertaking'	25.3 billion EUR (2014 currentEUR) *= 23.2 billion EUR (in 2021 constantEUR)*	135k (direct) (in 2014)
Sweden	Product-delimited	Yes	Top-down: Based on Swedish Defence Material Administration (FMV - Försvarets materielverk) supplier register	*'Swedish Defence Market'*	Not specified [71]	2,780 'defence companies'	9.9 billion EUR[72] (2019 currentEUR) *= 9.6 billion EUR (in 2021 constantEUR)*	29.7 k (direct)[73]
The Netherlands	Customer-delimited	Yes	Top-down: inclusion of undertakings based on input from defence and security actors (e.g. Dutch Defence, Security services)	*'NL Defence and Security-related Technological and Industrial Base'*	Yes	932 'undertakings	4.7 billion EUR (2021 currentEUR) *= 4.7 billion EUR (in 2021 constantEUR)*	20k FTEs (direct)[74]

Table 1.1.5.1: Summary table – Country cases. Source: Own composition based on the analysis of the coutry cases.

[66] Top-down = decision on which entities are to be included is based on feedback from the government and/or industry organizations. Bottom-up = employing data (e.g. national statistics) or surveys to derive whether an entity is included within the delimitations.
[67] Universities and other Research and Technology Organizations (RTOs).
[68] Sales for the <'term' employed> (column 5): *'Canadian Defence Industry', 'German Defence and Security Industry', 'Swedish defence market', 'NL DTIB'*.
[69] In 2021 Constant EUR: conversion to constant EUR is based on calculation of the researchers.
[70] Analysis was done for the BDSV association which has about 200 members (now: 221 member companies). Given the delimitations employed in the study, the size is likely to be larger than this membership count.
[71] While it is not specified whether these are included, the delimitations of the definition allow it.
[72] = Combined turnover of 123.9 billion EUR (SEK 1.3 trillion) in 2019 for all economic activities of the included companies * 8% (estimated proportion 'defence market' in combined turnover)
[73] = 371,500 employees for all economic activities of the included companies * 8% (estimated proportion 'defence market' in total employees)
[74] Estimated to be linked to defence and security related economic activities.

Relative figures per country case[75]	Canada (2016)	Germany (2014)	Sweden (2019)	The Netherlands (2021)
EUR sales (for year of case study in 2021 constant EUR)	6.6 billion	23.2 billion	9.6 billion	4.7 billion
Population[76] (for year of case study)	36.1 million	80.9 million	10.2 million	17.5 million
GDP (for year of case study in 2021 constant EUR)[77]	1,271 billion	2,692 billion	460 billion	855 billion
Def. expenditure (for year of case study in 2021 constant EUR)[78]	14.8 billion	30.9 billion	5 billion	11.6 billion
Sales/population size (EUR per capita)	183	286	934	268
Sales/GDP	0.52%	0.86%	2.09%	0.55%
Sales/Def. expenditure	45%	75%	191%	40%

Table 1.1.5.2: *Relative figures – Country cases.* Source: Own composition based on the analysis of the country cases.

[75] Conversion to 2021 constant EUR (for sales, GDP, and defence expenditure) is based on calculations of the researchers. See: ***Annex 4*** for the excel file with calculations.
[76] The World Bank (2023), Population (2014-2021), https://databank.worldbank.org/reports.aspx?source=2&series=SP.POP.TOTL&country=CAN,DEU,SWE,NLD#
[77] The World Bank (2023), GDP in current USD (2014-2021), https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.MKTP.CD&country=CAN,DEU,SWE,NLD#
[78] The World Bank (2023), Defence Expenditure in current USD (2014-2021), https://databank.worldbank.org/reports.aspx?source=2&series=MS.MIL.XPND.CD&country=CAN,DEU,SWE,NLD

1.2 Prior BE studies/mapping/databases

1.2.1 Groupe de Recherche et d'Information sur la Paix et la sécurité (GRIP) database

The GRIP[79] database seeks to map out the Belgian 'armaments sector' and defines this sector as *"Belgian companies whose activity is partly linked to the production of goods and services for military purposes"*.[80] However, GRIP admits it is difficult to set the delimitation on the perimeter of what constitutes this sector since it cannot be derived from the current national statistics, nor from the NACE-BEL classification system of activities. NACE-BEL is the Belgian version of the statistical nomenclature used in the European union for classification of economic activities (NACE Rev. 2) and is the framework of reference for the production and dissemination of statistics related to economic activities in Belgium. The NACE-BEL only contains a limited number of codes (e.g. 20510 for 'Explosive products manufacturing' and 25400 for 'weapons and ammunition manufacturing') from which production in military goods can be derived. Furthermore, for the production of dual-use and dual-product goods, there is no way to differentiate between military and civil market economic activities according to the NACE-Bel classification system. Most enterprises also do not make the proportion of military versus civil economic activities publicly available. Furthermore, as the NACE-BEL indicates only the main economic activity of a given enterprise, many enterprises which are active in the field of defence or security, but which have another main economic activity would be excluded from the mapping if relying on the NACE-BEL categorizations.

As a result of these limitations mentioned by GRIP, the inclusion of companies into the mapping of the GRIP-defined 'armaments sector' relies on a set of qualitative criteria of which at least one must be met:

(1) The company is a member of the 'Belgian Security and Defence Industry' (BSDI), which is the "Security and Defence" business group of AGORIA, a Belgian multisectoral business organization for technology-inspired companies;

(2) The company has been present at one or more trade fairs of a military nature. Eurosatory or Milipol in Paris and IDEX in Abu Dhabi are presented as examples, but they indicate the list is not exhaustive and do not specify further examples. While they do not specify what is meant by

[79] The 'Groupe de Recherche et d'Information sur la Paix et de la sécurité' is an independent research center, recognized as a continuing education organisation by the Wallonia-Brussels Federation (Belgium), focusing on broad security issues and with specific *"expertise in arms and disarmament issues (production, regulation and transfer control, non-proliferation), conflict prevention and management (particularly on the African continent) and European integration in the field of defence and security."* - see: GRIP (2023), About GRIP, https://www.grip.org/a-propos/)

[80] GRIP (n.d.), GRIP base de donnees, https://production.grip.org/la-base-de-donnees

'military nature', from the provided examples one can derive that they refer to fairs with a clear military focus, i.e. on armaments and other defence-specific capabilities;

(3) The company explicitly refers to military or security products or services on the website of the company;

(4) The company has submitted applications for export licences to the competent export authorities (e.g. The 'Arms Licensing Management Directorate' of the Walloon Region or their equivalents in Flanders and Brussels);[81]

Furthermore, any company for which the production of goods and services for military purposes is only an insignificant activity, companies that target the civil market for priming systems and explosives, gunsmiths, intermediaries and brokers, are excluded from consideration for the GRIP database.[82] These exclusions result in only companies being included that "have an activity of production of goods or services specifically related to the development, manufacture, deployment or maintenance of weapons systems", for which the export of these goods is usually subjected to the export licenses framework.[83]

While GRIP does not explicitly state how it understands the concept of 'Belgian company', a look on the companies contained in the database indicates that it does not distinct there is no distinction made between foreign-owned and Belgian-owned companies for inclusion in the mapping of the sector.

These delimitations of the definition of the 'armaments sector' lead to a database size of 89 enterprises, directly employing 4897 employees for the production of goods and services for military purposes and representing 580 million EUR of gross value added. Hence, it is clear that the GRIP-employed 'armaments sector' definition and the employed inclusion criteria constitute a more narrow definition than what the wider Belgian DTIB actually entails. Furthermore, GRIP also admits that the database does not provide an exhaustive list of all the companies that constitute the 'armaments sector' as defined by GRIP. The GRIP database categorizes these 89 companies according to 5 (GRIP-defined) sectors of activity, as shown in ***Table 1.2.1.1*** below.

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[81] La Direction de la Gestion des Licences d'Armes (n.d.), *Arms Licenses*, https://economie.wallonie.be/Licences_armes/Accueil.html

[82] GRIP (n.d.), GRIP base de donnees, https://production.grip.org/la-base-de-donnees

[83] Ibid. ; The Special Act of 12 August 2003 regionalised most of the competence for arms control (export, import, transit). See: Bijzondere wet van 12 augustus 2003 betreffende de wijziging van de bijzondere wet van 8 augustus 1980 tot hervorming der instellingen, Belgisch Staatsblad, 20 augustus 2003, p. 41496, https://www.ejustice.just.fgov.be/mopdf/2003/08/20_3.pdf#Page2. For instance, in the Walloon Region, the applicable legal framework is established by the Decree of 21 June 2012 on the import, export, transit and transfer of civilian weapons and defence-related products.

Sector of activity	# of companies
Weapons, ammunitions and explosives • FL (1): *Red star forwarding & logistics* • WL (8): *Browning international, CK Technology, FN Herstal, ~~Forges De Zeebrugge (Thales Belgium S.A.)~~*, La Manufacture Du Haut Rhin Benelux (formerly: MR Equipment Benelux), Mecar, New Lachaussee, Pb Clermont* **duplicate so excluded*	9
Aeronautics, electronics and space • FL (18): A*.e. Petsche Belgium, Advionics, Alcatel-Lucent Bell (Nokia Bell), Asco Industries, Celestia Antwerp, Elcos, Esterline Belgium (Scioteq), Ignition!, Luciad, Nexans Harnesses, Nijkerk Computer Solutions, Optronic Instruments And Products, Sabca Limburg, Sabena Aerospace Engineering, Septentrio, St Engineering Idirect (Europe) Cy (formerly: Newtec Cy), Unmanned (Sol. One), Xenics* • WL (18): *Agusta Aerospace Services (Leonardo Belgium), Alx Systems, Ami Metals Europe, Belgian Advanced Technology Systems (BATS), ECA Robotics Belgium, Flying-Cam, Hexcel Composites, Infrared Research & Development, Msc Software Belgium, Patria Belgium Engine Center (Formerly: Belgium Engine Center And Pratt & Whitney Belgium Engine Center), Quality Spi Network, Shur-Lok International, Societe Nationale De Construction Aerospatiale (Sonaca), Technical Airborne Components Industries, Techspace Aero (Safran Aero Boosters), Teledyne ICM, Thales Alenia Space, Thales Belgium* • BXL (5): *Akka Technologies, Ilias Solutions, Sabca Brussels, Sky-Hero, Umicore*	41
Mechanical, vehicle and naval • FL (12): *Anglo Belgian Corporation, Bodywork Moeyersons (Moeyersons), Clemaco Contracting Nv, Dotocean, Droneport, Flanders Ship Repair, FTS Belgium, Melotte, Prodata Systems, Roosen Fijnconstructie (Roosen Laser & Welding), Teksam Company, Varec* • WL (17): *Britte-Mustad, Capaul, Carat Duchatelet, CMI Defence (John Cockerill Defense), Doncaster Settas (European Company For Titanium And Special Alloys Technologies), Duma Engineering Group, Eloy & Becker Sprl, Etabisselents Emile Vanhulen (Vanhulen High Precision Springs), Grimonprez Transmission Gears, Jd'c Innovation, Mecaspring, Mockel, Mustad Belgium, NLMK Clabecq, Precision Foundry Precimetal (Castingpar), Sabiex International (Oip Land Systems), Simtech*	29
Textiles and miscellaneous equipment • FL (4): *Concordia Textiles, Seyntex, Sioen, Summit Engineering* • WL (4): *Daudé Fabrication, Federal Coating, Feronyl, Top Duty Gear By Cia* • BXL (2): *Info Global BVBA, Pitagone*	10
Services and logistics	0

Table 1.2.1.1: Companies categorized according to sector of activity. Source: Own composition based on the GRIP database available at https://production.grip.org/la-base-de-donnees.

For the aforementioned summary figures (gross value added, direct employment) presented on the GRIP website, it is not specified for which year they are. Rather these are presented as the average

figures across the years. Furthermore, while the sum of the gross value added figures derived from the production of goods and services for military purposes is provided, the sum or the turnover thereof for all the enterprises is not. Hence, in order to derive these insights, manual input of available data and calculations have to be done (see: ***Annex 4*** for more info). While the turnover of (most of) the enterprises are provided on the publicly available version of GRIP their database on their website, not all figures are complete (i.e. gaps for certain enterprises or gaps for more recent years) and they are only viewable per company separately. As there are gaps in the data and there is no aggregate overview, we instead source the turnover figures from the Belfirst database using the enterprise names listed by GRIP.[84] After filling in data gaps[85] remaining from the Belfirst data, the total combined turnover of all the enterprises listed by GRIP amounts to about 10 billion EUR for 2021 for all economic activities.[86] Employing the given estimations by GRIP per enterprise on the proportion of turnover derived from the production of goods and services for military purposes, we can further calculate the turnover derived from the 'armaments sector' activities. Wherever gaps are present in the GRIP database concerning the proportion, these are inferred from the existing data and similarity to the other enterprises.[87] Thereafter, we calculated the turnover derived from the 'armaments sector' for each enterprises[88] in order to subsequently retrieve the sum of the 'armaments sector' turnover. This combined total turnover derived from the economic activities of the 'armaments sector' amounts to an estimated 1.8 billion EUR. Hence, the combined 'armaments sector' turnover represent a proportion of 18.27 % within the total combined turnover of all the economic activities of these enterprises.[89] Of course, as these calculations are based on imperfect data, where data had to partially be filled in (based on data inference practices to derive best estimates), this figure is limited to estimating the size of the 'armaments sector', rather than providing a completely accurate figure.

[84] Certain enterprise names listed by GRIP were outdated and not directly findable by the Belfirst system. After updating these to their current names (through desk research), the Belfirst database could retrieve these enterprises (see the Annex 4 for more info).

[85] Turnover data was missing for 30 of the Small Enterprises (< 50 employees). By taking the average turnover per small enterprise from the enterprises for which data was available, a combined turnover for these 30 enterprises was calculated (30 * 13,870,376 = 416,111,280). By adding these missing estimates to the sum of the available turnover figures, an estimated combined total turnover can be obtained (416,111,280 + 9,693,213,848 = 10,109,325,128).

[86] While this is the estimate for 2021, based for the majority on 2021 figures, turnover of other years (2018, 2019, 2020, 2022) was employed when other turnover data was not available.

[87] For the purposes here, the inference method employed is based on the employment size of the enterprises. Where gaps remain for the SMEs, the average proportion of turnover derived from the 'armaments sector' economic activities for SMEs is taken to fill in the gaps for other SMEs. There were no gaps for larger enterprises. For larger datasets more detailed inference calculations can provide more exact estimations (e.g. based on size of the enterprise as well as their sector or main economic activity). For the smaller dataset here, the inference via employment size remains the sole option, yet it suffices for its purpose.

[88] 'armaments sector' turnover for each enterprises = % of turnover derived from the 'armaments sector' * turnover derived from all economic activities

[89] Proportion 'Armaments sector' turnover within total turnover = 18.27% = 1,847,376,216 / 10,109,325,128

1.2.2 Flemish Peace Institute ('Vlaams VredesInstituut')

In *'The Defense-related industry in Flanders'*, Cops and Viaene (2022) aim to identify Flemish-based companies that are involved in the development, production, maintenance or export of defence-related goods and technologies.[90] They define the term 'defence-related companies' as *companies that develop, manufacture or customize products that are employed for military purposes*.

While an initial idea was to base the analysis on export licensing data, the delimitation of the industry cannot only be based on the data of licensed export data of defence-related goods due to several reasons.[91] Firstly, there are companies which are directly involved in projects with the Belgian Military through the maintenance of material or through being involved in the procurement programs of new military material, mainly via compensation arrangements. As these activities are not subject to export or transfer licenses, these companies could be overlooked if relying on export and transfer licenses data for the identification of companies. Secondly, not all defence-related goods and technologies require approved export or transfer licenses and can therefore be exported according to normal market mechanisms. Thirdly, the authorized authority for approving export licenses is the regional government where the company has their corporate headquarters for their Belgian activities. Hence, companies with production facilities in Flanders, but with their corporate headquarter in Wallonia (or Brussels) would be overlooked for the mapping of the Flemish-based defence-related industry when only relying on export licenses. Finally, certain companies and research institutions that are involved with consortia focusing on targeted R&D of military goods will only in the future apply for export licenses once these projects near completion.[92]

As a result of these limitations, the delimitation of the Flemish 'defence-related industry' explicitly includes companies that have not applied for export licenses, as they do not export their goods, but which do supply the Belgian military or other Belgian defence companies with defence-related products, as described in the Belgian export licensing regime.[93] Similar to Sweden (see: ***Section 1.1.3***), the term 'Defence-related products' refers to all products (goods, services and technologies) contained in the EU Common Military List (see: ***Table 1.1.3.1*** for categories).[94]

[90] Cops, D. and Viaene, E. (2022), De defensiegerelateerde industrie in Vlaanderen: doorlichting van een sector op scherp, *Vlaams vredesinstituut*, p31. https://vlaamsvredesinstituut.eu/wp-content/uploads/2022/06/web-20220621-VVI-Rapport-Defensie-industrie.pdf
[91] Cops and Viaene (2022), p32
[92] Cops and Viaene (2022), p32
[93] Dienst Controle Strategische Goederen – dCSG (n.d.), *Controle strategische goederen: militaire goederen*, https://www.fdfa.be/nl/vrede-en-veiligheid/controle-strategische-goederen/militaire-goederen
[94] Ibid

For the identification of the Flemish-based defence-related companies, the authors rely on the following sources:

(1) The company has a membership of 'Belgian Security and Defence Industry' (BSDI) association of AGORIA.

(2) The company is mentioned in the fact sheets of the European Commission concerning financed projects through the Preparatory Action on Defence Research (PADR) and the European Industrial Development Program (EDIDP).

(3) The company is mentioned in Belgian or international news reports as being a participant of an industrial participation mechanism for new procurement of Belgian Defence.

(4) The company is mentioned in prior studies concerning the Flemish defence-related industry.[95]

The term 'Flemish' refers to any company that has production facilities in the Flemish Region where they *"develop, manufacture or customize products that are employed for military purposes"* ('defence-related goods'). Hence, companies that are foreign-owned are included in the mapping of the 'Flemish Defence-related Industry'. The term 'company' employed by the report actually refers to any entity with activities taking place on Flemish soil (e.g. production facility, factory), rather than to the legal concept of a company (in Dutch: 'vennootschap') itself as a whole according to the location of their Belgian corporate headquarter. While the report mentions universities (UGent, VUB), expertise centers (MCM lab) and research organizations (OCAS, VLIZ, IMEC), these are not included under the definition of the 'Flemish Defence-related Industry'. Hence, not all possible relevant entities are taken into account.

These delimitations of the 'Flemish Defence-related Industry' resulted in the identification of 33 companies, with a total revenue of more than 3.254 billion EUR and employing around 5000 employees for defence-related and civil activities[96]. At least 1052 of these employees are directly connected to the production for defence-related goods. However, presenting the correct revenue and employment figures is complicated by the fact that these are not available for all of the companies. This is especially the case concerning specific defence-related information ('Defence-related proportion of revenue', 'Defence-related revenue', 'Defence-related direct employment'), for which the data is not available for many of the companies. Nevertheless, the available data can still be employed to derive key observations. For most of these companies, the defence-related revenue only

[95] The report does not explicitly refer to which prior studies were employed as a source. Feedback from the authors and the bibliography clarified that they drew on prior studies done by the 'Flemish Peace Institute' itself *(e.g. Duquet, N. (2011) 'Van Vlaamse makelij')*.

[96] No data is provided for Sioen Balistics.

accounts for 5-15% of total revenue[97], but given that there are a few outliers that rely almost exclusively on defence-related revenue, the combined average per company is 44%.[98] Taking the 5-15% range as a conservative estimate, this results in an estimated 'Defence-related revenue' within a range of 162-488 million EUR for the identified 'Flemish Defence-related Industry' for 2020. A closer look at the data provided by the study allows us to derive further assumptions for more accurate estimation calculations.[99] Given that for most of the companies for which data is available the defence-related revenue accounts for 5-15% of the total revenue, we can employ this as an assumption to fill in the remaining blanks for companies for which the proportion is not given. Then we can calculate the estimated defence-related turnover per company. Summing up all of these, we come to an estimated combined defence-related turnover of around 442 million EUR. The same method can be employed for the direct employment related to defence-related economic activities. Here, we calculate an estimated direct defence-related employment of about 1230 persons.

As shown in ***Table 1.2.2.1.***, 10 companies have less than 50 employees and 16 have between 50-250 employees. Hence, more than 3 quarters of the companies identified are SMEs in terms of employees.[100] Only 6 of the companies can therefore be considered mid to large companies.

Company size	# of companies
Less than 50 employees: Varec, Treality, Sol.one, DotOcean, Moeyersons, Epic Blue, Flanders Ship Repair, Ateliers Vlassenroot, Antwerp Space, Xenics	10
Between 50 and 250 employees: Clemaco Contracting & Trading, Advionics, OIP sensor Systems, Theissen training systems, Hexagon Geospatial, SABCA Limburg, BMT Aerospace, Dupont, Veldeman, Septentrio, Concordia Textiles, Seyntex, Safran Aircraft engines, ECA Robotics Belgium, FN Zutendaal	16
More than 250 employees: ScioTeq, ASCO Industries, Anglo Belgian Corporation, DAF Trucks Belgium, ST Engineering, Mol Cy	6
Not categorized: *Sioen Ballistics*	1

Table 1.2.2.1: Companies listed according to company size. Source: Own composition derived from Cops, D. and Viaene, E. (2022).

[97] Cops and Viaene (2022), p50
[98] Own calculations based on the available data. (see: Cops and Viaene (2022), p33-35)
[99] See: Cops and Viaene (2022), p33-35
[100] Note: when a company has less than 250 employees, but has turnover exceeding 50 million EUR, it is not considered an SME within the EU-employed definition.

Given that the mapping of the industry is not only based on licensed export data of defence-related goods, but on a wider set of criteria, it includes a broader range of goods and technologies. The authors categorize the companies based on this wider range of products according to three broad categories, as shown in ***Table 1.2.2.2***.

Product category	# of companies
High-tech parts for diverse military application: ScioTeq, Advionics, OIP sensor systems, Hexagon Geospatial, Treality, DotOcean, Dupont, Epic Blue	8
Specific parts for military vehicles, aircrafts or vessels: Clemaco Contracting &Trading, ASCO Industries, Varec, SABCA Limburg, BMT Aerospace, Moeyersons, Anglo Belgian Corporation, DAF Trucks Belgium, Flanders Ship Repair, Ateliers Vlassenroot, Mol Cy, Safran Aircraft engines, ECA Robotics Belgium	13
Finished products in niche domains: Theissen training systems, Veldeman, Concordia Textiles, Seyntex, Sioen Ballistics	5
Not categorized: Sol.one, Melotte, ST Engineering, Septentrio, Antwerp Space, Xenics, FN Zutendaal	7

Table 1.2.2.2: Categorization of companies according to products categories. Source: Own composition derived from Cops, D. and Viaene, E. (2022).

1.2.3 De Beurme, Quentin (2021)

In *"R&D Processes and Open innovation in the Public Sector: Practices and Challenges for the Belgian Defence Industry",* Quentin De Beurme analyzes private and public companies and associations connected to the operations of Belgian Defence via general procurement activities, in order to derive insights on open innovation processes of Belgian Defence. [101]

According to a list of companies provided by the procurement office of Belgian Defence, 1,314 companies are associated with the procurement activities of the Belgian military. However, this figure encompasses all companies connected to any procurement type for defence and includes foreign companies. Hence, companies with activities that were not considered by the author to be conducive to *potential cooperative partnerships with Belgian Defence concerning research, development or innovation practices were excluded from consideration*. These exclusion criteria can be considered as the delimitation of the mapping employed by the study. From the remaining companies, 829 of these are located in Belgium, 352 in other countries of the EU and 75 outside of the EU.[102] In total the companies located in Belgium are estimated to employ around 219,245 employees[103] [104] [105] and have a total combined turnover of almost 184 billion EUR.[106] The estimated proportion of defence-related revenue or employees is not indicated. Given the context of the study, the wide mapping criteria, and the lack of a full list of the names of the 829 companies included in the mapping; it is not possible to correctly derive assumptions on the average % rate of the proportion of turnover derived from economic activities related to the 'defence industry', in order to better gauge its size within the combined turnover for all economic activities of these companies. Hence, we do not estimate the proportion of 'defence industry' turnover.

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[101] De Beurme, Q. (2021), R&D Processes and Open Innovation in the Public Sector: Practices and Challenges for the Belgian Defence Industry, [Master thesis for the Master of Science in Business Engineering, Gent University], p79.

[102] QDB presents and provides a sector analysis for both the Belgian and Luxembourg companies combined. In the description here, the Luxembourg companies are instead added to 'companies in other countries of the EU' (352 companies in other countries of the EU, 344 companies located in other countries of the EU + 8 companies located in Luxembourg).

[103] De Beurme (2021), p91.

[104] The calculation is based on the average employees per company for companies located in Belgium and Luxembourg. Given that the 8 Luxembourg companies were excluded for the calculation of the total amount of employees in order to derive the amount only for Belgium, yet the average is based on companies from Belgium and Luxembourg, there is a slight deviation from what the correct number should be. Calculation = average of 295 employees per BE & LU company * 829 BE companies = around 244,555 employees for BE companies. See Annex 4 for the data employed in the calculations.

[105] De Beurme (2021), p91. Employee figures are only available for 740 of the 829 BE companies.

[106] De Beurme (2021), p94. Calculation = mean of 221,682,900 EUR per company for BE and LU companies * 829 BE companies = 183,775,124,100 EUR = "almost 184 billion EUR". Given that the employed average turnover is based on both BE and LU companies, there is a deviation from the actual estimated total combined turnover.

The term 'Belgian company' refers to any company with a Belgian VAT-number matching the delimitation above. While the majority of these companies are listed as corporate offices, the term 'company' includes research institutes and pension funds as well.[107] The broad range of included companies further becomes clear in the sector-based categorization of these companies, which is based on the first-level classification of the NACE-BEL 2008 code (instead of, for instance, according to categories of defence-related products or technologies). As shown in ***Table 1.2.3.1*** below, the majority of these companies are categorized under the broad categorization of 'Wholesale and retail trade; repair of motor vehicles and motorcycles'. The author further narrows this down to the key sub-sectors within this category according to the fourth-level categorization of sectors of the NACE-BEL 2008 classification system. Other sector categories were not narrowed down into sub-sectors and there is no deeper analysis to the product level. Given this omission (due to scope), the author advises that Belgian Defence itself or other researchers further analyze the activities of companies in the most reoccurring NACE-BEL 2008 sectors to derive more detailed insights on the activities connected to Belgian Defence.[108]

[107] De Beurme (2021), p85.
[108] De Beurme (2021), p86

First-Level Character	Corresponding NACE Sector	# of companies
A	Agriculture, forestry and fishing	7
B	Mining and quarrying	≤4
C	Manufacturing	138
D	Electricity, gas, steam and air conditioning supply	≤4
E	Water supply; sewerage; waste management and remediation activities	10
F	Construction	74
G	Wholesale and retail trade; repair of motor vehicles and motorcycles • Wholesale of pharmaceutical goods (79) • Wholesale of other machinery and equipment (42) • Sale of cars and light motor vehicles (40) • Wholesale of machine tools (22) • Non-specialized wholesale trade (14) • Wholesale of other household goods (14) • Maintenance and repair of motor vehicles (14) • Wholesale of other office mmachinery and equipment (11) • Retail sale of medical and orthopedic good in specialized stores (11) • Wholesale of chemical products (10) • Wholesale of electrical household appliances (10) • Other sub-categories (90)	357
H	Transportation and storage	17
I	Accommodation and food service activities	≤4
J	Information and communication	70
K	Financial and insurance activities	7
L	Real estate activities	≤4
M	Professional, scientific and technical activities	65
N	Administrative and support service activities	51
O	Public administration and defence; compulsory social security	≤4
P	Education	≤4
Q	Human health and social work activities	13
R	Arts, entertainment and recreation	≤4
S	Other service activities	≤4
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	≤4
U	Activities of extra territorial organisations and bodies	≤4

Table 1.2.3.1: Belgian (and Luxembourgian) companies categorized according to the first-level of the NACE-BEL 2008 classification system. Source: Own composition based on De Beurme, Q. (2021), pp.86-88.

1.2.4 ACOS STRAT-NAD

In 'Mapping of the Belgium Defence and Security Industry' (2022), ACOS STRAT-NAD presents the outcome of a draft database, which was developed by ACOS STRAT-NAD in cooperation with input from the Belgian Federal Public Service Economy. Although no definition itself outlines the delimitation of the 'Defence and Security Industry' in the obtained document, the employed data sources clearly set the inclusion criteria and boundaries for the current mapping. To identify the Belgian enterprises that encompass the 'Belgian Defence and Security Industry', the following criteria and sources were employed:[109]

(1) Belgian enterprises that were awarded 'defence and security' procurement contracts.

(2) Belgian enterprises of which ACOS STRAT-ICM/NAD knows that they are involved with the EDF (or the EDIDP, one of the two EDF precursor programs) or EDA projects.

(3) Belgian enterprises already listed in the GRIP database of the Belgian 'armaments industry'.

(4) Belgian enterprises that are a member of business associations connected to the defence and security sector. The following professional associations were employed as sources: Agoria Defence and Security[110], Skywin[111], GRIP[112], BSDI[113], FLAG[114], EWA[115], Pôle MECATECH Defence and Security[116], Agoria Belgospace[117], BAG[118]. **Table 1.2.4.3** expands on the membership count of these associations and their coverage of the industry.

(5) Belgian enterprises connected to the defence and security sector that reached out to ACOS Strat-ICM/NAD, the RHID or FPS Economy.

(6) Belgian enterprises that FPS Economy identified in their databases as active in the field of defence and security.

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[109] ACOS Strat-NAD, B. (2022), *Mapping of the Belgium Defence and Security Industry* [PowerPoint slides], Belgian Defence Strategy Department ACOS-STRAT, p3.
[110] Agoria Defence and Security, https://www.agoria.be/en/services/business-clusters/safety-security-defence/introduction
[111] Skywin, https://www.skywin.be/fr#no-back
[112] Groupe de recherche et d'information sur la paix et la sécurité - GRIP, https://www.grip.org/
[113] Belgian Security and Defence Industry - BSDI, https://www.bsdi.be/
[114] Flemish Aerospace Group - FLAG, http://flag.be/
[115] Entreprises Wallonnes de l'Aeronautique - EWA, https://ewa.be/
[116] Pôle MECATECH Defence and Security, https://www.polemecatech.be/en/
[117] Agoria Belgospace, https://www.agoria.be/en/themes/businessgroups/aerospace-manned-unmanned/belgospace/introduction
[118] Brussels Aerospace and defence Group - BAG, http://www.bag.brussels/

The term 'Belgian enterprise' refers to any enterprise located in Belgium, i.e. the enterprise has a registered office in Belgium. While data on ownership is collected for the industry analysis, foreign-owned Belgium enterprises are included for the mapping of the 'Belgian Defence and Security Industry'. The term 'enterprise', as employed in the study, also includes academia and R&T organizations.

These criteria result in a mapping size of the Belgian 'Defence and Security Industry' of 638 enterprises[119] with an estimated total operating revenue of around 15 billion EUR per year and employing 63,800 employees.[120] Important to note is that these revenue and employment figures are not only linked to defence and security-related economic activities, but encompasses both defence and civil economic activities. Furthermore, universities and certain multisectoral companies with limited defence and security-related economic activities were excluded from these figures to provide a more correct picture of the current state of play of the industry.[121] Employing (a preliminary) range of 5-15% defence-related revenue within the total revenue of these enterprises, this results in a range of 750 million to 2.25 billion EUR 'Defence-related revenue' for the Belgian 'Defence and Security Industry'. Employing the same range, the directly related employment amounts to an estimated 3190 to 9570 persons. Out of the 638 enterprises, 552 (86,5%) are SMEs. As opposed to the other Belgian mapping studies, a more detailed break-down of company size types and employed definitions is provided, as shown in ***Table 1.2.4.1***.

Size type	# of companies
Large enterprise: *more than 3000 employees*	6 (1%)
Mid-Cap: *between 250 and 3000 employees*	80 (12.5%)
SME: *less than 250 employees and turnover not exceeding 50 million EUR*	552 (86.5%)

[119] ACOS Strat-NAD (2022), p9.

[120] ACOS Strat-NAD (2022), p14.

[121] Universities and the following companies were excluded from the figures: Engie Fabricom, Exxon, IBM, Proximus, Q8, Sodexo, Solvay, Total, Umicore. These enterprises were excluded since while their defence and security-related economic activities represent only a small portion of their revenue, these enterprises are among the larger companies in the dataset. As there is no info in the dataset on what proportion of revenue is derived from defence and security-related economic activities as compared to other commercial economic activities, the revenue from all economic activities per enterprise is employed for the figures. If these were included in the figures they would skew the data too much, so these were excluded by ACOS STRAT-NAD. For better insights the proportion of revenue from defence and security-related economic activities of the enterprises would need to be obtained, so that the actual defence and security-related revenue figures can be presented. However, these proportions are not statistically gathered nor are they commonly reported by the enterprises themselves.

• 136 (21%) medium enterprises: *SME that does not fit the criteria to be considered a small enterprise.* • 165 (26%) small enterprises: *SME with less than 50 employees and turnover between 2 million EUR and 10 million EUR.* • 251 (39%) Micro-enterprises: *small enterprise with less than 10 employees and with turnover up until 2 million EUR.*	

Table 1.2.4.1: Number of companies per size type and employed definitions. Source: Own composition based on ACOS Strat-NAD (2022).

For the categorization of the subsectors and the specialty of the enterprises within the 'Defence and Security Industry', they employ self-set categories indicating the economic activity of the enterprise relevant for defence, rather than the NACE-BEL or the categorizations used in the export licensing framework. Given the data and categorization limitations of both the NACE-BEL and the export licenses (respectively indicated above in ***Section 1.2.3*** and ***Section 1.2.2***), these self-set categorization make sense and are a more targeted method to link the enterprises their 'Defence and Security Industry' related activities to the interests of Belgian Defence. However, these self-set categorization will have limited comparability to categories employed in (future) mapping studies of other (EU) countries. Important to note is that within the categorization of the wider 'Defence and Security Industry', 'Defence and Security' itself is provided as a subsector. This may cause some confusion as the term 'Defence and Security Industry' as it is employed in the study in reality more accurately refers to the wider DTIB, whereas the categorization of the subsector 'Defence and Security' refers to companies for which their economic activities are related to armaments and weapons systems (e.g. FN Herstal, John Cockerill Defence, Thales Belgium, etc). In other words, a good portion of their turnover is derived from defence-related activities and they find themselves at the core of the Belgian 'Defence and Security Industry'. Instead of referring to 'Defence and Security', it would be preferable to refer to this as 'armaments and weapons systems sector', as this better expresses the product typology and avoids confusion. ***Table 1.2.4.2*** below shows the range of different subsectors included within the 'Defence and Security Industry'.

Sub-sectors of the D&S industry	# of companies	% distribution
Mechanics	80	13%
Digital	70	11%
Consulting	57	9%
Electronics	34	5%
Aeronautics	31	5%
Automotive	29	5%
Defence & security (core)	29	5%
Research	22	3%
Logistics	21	3%
Simulation and training	21	3%
Test and medical equipment	21	3%
Drones	20	3%
Space	19	3%
Sensors	17	3%
Chemicals	16	3%
Naval	16	3%
Coatings	15	2%
Textile	14	2%
Communication	14	2%
Composite materials	13	2%
Security	12	2%
Legal	11	2%
Safety	10	2%
Tooling	9	1%
Environment	9	1%
Heavy industry	9	1%
Tertiary	7	1%
Additive	6	1%
HVAC	5	1%
Infrastructure	1	0%
Grand Total	638	100%

Table 1.2.4.2: Companies allocated according to sub-sectors of the Belgian Defence and Security Industry.
Source: Own composition based on ACOS Strat-NAD (2022).

The expansiveness of the mapping is further emphasized by the proportion of enterprises without a membership in any of the listed Belgian Defence and Security related professional associations. As shown in ***Table 1.2.4.3*** below, about 44% (278) of the enterprises are not a member of any of these associations. Given there are clear advantages to joining (at least one of) these associations, this implies most of these 278 enterprises do not consider Defence and Security as core to their economic

activities. Furthermore, none of the associations have a membership count resulting in more than 38% coverage of the enterprises included in the mapping.[122]

Professional associations	# of enterprises	% of national coverage	% of regional coverage
Agoria D&S	237	37,15%	
SKYWIN (regional - Wallonia)	130	20,38%	57,02%
GRIP	81	12,70%	
BSDI	75	11,76%	
FLAG (regional - Flanders)	64	10,03%	20,32%
EWA (regional - Wallonia)	53	8,31%	23,25%
Pôle MECATECH D&S (regional - Wallonia)	24	3,76%	10,53%
Agoria Belgospace	15	2,35%	
BAG (regional - Brussels)	7	1,10%	7,69%
Enterprises with no membership of professional associations related to the field of defence and security	**278**	**43,57%**	

Table 1.2.4.3: Membership count of Defence and Security-related associations and their coverage of the industry. Source: Own composition based on ACOS Strat-NAD (2022).

[122] ACOS Strat-NAD (2022), p17.

1.2.5 Conclusions from Belgian mapping studies

Similar to the country cases discussed above, all the prior cases for Belgium include foreign owned/controlled entities in their mapping **(GQ2)**. As shown in the summary table below **(*Table 1.2.5.1*)**, some more "imperfect" generalizability can be derived as well from other observations.

Firstly, the cases employ different terms for the included entities (enterprise and company). For three of the cases, one can derive that these refer to legal entities with a corporate office registered in Belgium (i.e. with a company registration number as registered in the Belgian 'Crossroad Bank of Enterprises') fitting the inclusion criteria of the study **(GQ7)**. However, the 'Flemish Peace Institute' employs the term company to also refer to specific production facilities located in Flanders of companies that have their corporate office (and company registration number) in either Brussels or Wallonia. For these, rather than refer to companies, they in reality refer to the branch (in Dutch: 'vestiging'). Hence, while some generalizability can be derived here from the case studies, it is not absolute. Three of the cases enable the inclusion of research entities in their mapping **(GQ5).**

Secondly, three of the cases employ a bottom-up method to source necessary information required to develop a list of entities fitting the qualitative inclusion criteria **(GQ3)**. *De Beurme* is the only case that derives the initial list completely from the top-down. While *GRIP* and *FPI* mention product-delimitations to categorize an entity as being part of the mapping, in practice this is based as well only on these qualitative inclusion criteria. Thus, the product-delimitation is mentioned in the definition of the mapping, but not practically employed. Hence, three of the cases (*GRIP, FPI, ACOS STRAT-NAD*) rely on a mix of qualitative inclusion criteria with bottom-up sourcing (i.e. includes desk research of multiple other sources including analysis of websites and newspaper articles) to derive whether an entity is included within the delimitations **(GQ1)**.

Nevertheless, each study regards a different scope. This is also reflected in the different use of terms for the mapping: e.g. 'Belgian Armaments Sector' (GRIP) versus 'Belgian Defence and Security Industry' (ACOS STRAT-NAD) **(GQ4).** Therefore, they are not comparable to each other **(GQ6, GQ8, GQ9, GQ10)**, but can be employed to build upon. To illustrate, the GRIP mapping of the 'Belgian Armaments Sector' partially represents the core enterprises of the BE-DTIB, but remains limited in its scope to this core subset of the DTIB. The ACOS STRAT-NAD mapping includes the enterprises of the GRIP mapping, as well as a wider set of enterprises considered part of the BE-DTIB according to the qualitative inclusion criteria.

Not every mapping provides summary turnover figures (GRIP) and those that do refer to the turnover from all economic activities, rather than from defence (and security)-related economic activities.

Hence, these had to be calculated based on derived assumptions on the defence (and security)-related turnover within the total turnover from all economic activities **(GQ8)**.

In terms of information, the ACOS STRAT-NAD case study is the most expansive. Aside from the content indicated in the case study analysis above, other key data was collected as well. The ACOS STRAT-NAD analysis also collected data on: Value of assets; Ultimate owner, their country and percentage of assets; company info such as the enterprise number and certain administrative info; etc. The data and information collected by the different mapping analyses, which were discussed in the case studies, were employed to illustrate the outcomes of the employed definition and inclusion criteria in the different cases. Other content that the mapping analyses collected, which was not directly needed towards analyzing the definition and criteria, can drawn upon as insights to source the required content necessary to enable an analysis of the BE-DTIB. However, this not fall under the current scope of this article.

Table 1.2.5.1: Summary Table – Belgian mapping studies. Source: Own composition based on the analyses of the case studies.

Study	Delimitations of definition/ mapping criteria	Foreign-owned incl.	Methodology employed[123]	*'Term'* employed	Research entities incl.[124]	Size	EUR *Italic = own calculations*[125]	Employment *Italic = o.c*
GRIP	Product-delimited* *in theory, in practice based on qualitative inclusion criteria	Yes	Bottom-up: Qualitative inclusion criteria	*'Belgian Armaments sector'*	No	89 'enterprises'	580 million EUR GVA (avg/year) (production of goods and services for military purposes) [126] *1.8 billion EUR 'armaments sector' turnover (2021)*	4,897 (direct) (for the production of goods and services for military purposes)
FPI	Product-delimited* *in theory, in practice based on qualitative inclusion criteria	Yes	Bottom-up: Qualitative inclusion criteria	*'Flemish Defence-related industry'*	Yes* *included as a criteria for mapping but no research centers included in the actual list	33 'companies' (really: entity)	3.2 billion EUR (for all economic activities) *442 million EUR (defence-related revenue) (2020)*	5,000 (for all economic activities) *1,052 (for defence-related economic activities)*
De Beurme Q.	Customer-delimited*	Yes	Top-down: *procurement list from Belgian Defence of all companies providing goods and services to it	*'Belgian Defence Industry'*	Yes	829 'companies'	Turnover of 184 billion EUR (for all economic activities)[127]	219k employees (for all economic activities)
ACOS STRAT-NAD	Based on qualitative inclusion criteria	Yes	Bottom-up: Qualitative inclusion criteria	'Belgian Defence and Security Industry'	Yes	638 'enterprises'	Revenue of 15 billion EUR per year (for all economic activities) *750 million to 2.25 billion EUR (Estimated defence-related revenue)*	63k (for all economic activities) *3k to 9k (for defence-related economic activities)*

[123] Top-down = decision on which entities are to be included is based on procurement list of government and/or industry organizations. Bottom-up = employing data (e.g. national statistics), surveys or qualitative inclusion criteria with bottom-up sourcing (i.e. desk research including analysis of websites and newspaper articles) to derive whether an entity is included within the delimitations. A methodology is considered bottom-up overall when it employs some 'top-down' sources as components (e.g. procurement list received from Belgian Defence) and if they include multiple other qualitative inclusion criteria requiring bottom-up sourcing.

[124] Universities and other Research and Technology Organizations (RTOs). Can they be included in the employed delimitations and are they?

[125] Own calculation based on the definition of the study and its inclusion criteria in order to better estimate the revenue derived from the defence and security market.

[126] Summary figures presented on the GRIP website. It is not specified for which year, but it is presented rather as an average figure across the years.

[127] Given the context of the study, the wide mapping criteria, and the lack of a full list of the names of the 829 companies included in the mapping; it is not possible to correctly derive assumptions on the average % rate of the proportion of turnover derived from economic activities related to the 'defence industry', in order to better gauge its size within the combined turnover for all economic activities of these companies. Hence, we do not estimate the proportion of 'defence industry' turnover.

1.3 Non-country cases

1.3.1 SIPRI - Stockholm International Peace Research Institute

'Arms sales' defined by SIPRI refers to the sale of 'military goods and services' (including non-academic R&D services[128]) that are offered to foreign and domestic military customers (domestic procurement and export).[129] These 'military customers' are delimited to the components of the armed forces (army, navy, air force, paramilitary, special forces), the ministry of defence itself, as well as any agency responsible for military intelligence, reconnaissance and surveillance.[130] Hence, the 'arm sales market' can be considered as the market for 'military goods and services' to 'military customers'.

'Military goods and services' are defined as such when they have a specific military purpose in their design.[131] Any technologies that are closely linked to this are also considered under this term. Hence, only military-specific equipment and related components thereof are included under the term 'military goods' (e.g. military uniforms, boots are excluded, as they are considered general-purpose goods, i.e. they are inherently not military-specific) and only military-targeted services directly related to the armed forces their military operations (e.g. external armed security services in conflict zones; and facility management, training, intelligence and logistics services) are considered under the term 'military services'.[132] Hence, dual-use goods and services are only considered as 'Military goods and services' when these are directly targeted at 'military customers'.[133] 'Arms companies' can hence be defined as public and private companies, excluding any manufacturing or maintenance unit of the armed services itself, offering 'military goods and services', i.e. 'arms sales'.[134] In practice, however, it is difficult to derive the true value of 'arm sales', as no standardized definition exists that is employed across companies for their reporting.[135] Some companies report the proportion of sales considered by the company to be defence-related within their total sales, while in other cases the sales of the 'defence division(s)' of the company are employed to derive figures, even though these may also include sales to civilian customers.[136] Furthermore, given that arm sales have to be estimated (via procurement data; company information on their goods and services; figures given by company

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[128] SIPRI (n.d.), *Sources and Methods*, https://www.sipri.org/databases/armsindustry/sources-and-methods#definitions

[129] Béraud-Sudreau L. et al (2020, December), Mapping the International Presence of the World's Largest Arms Companies, *SIPRI Insights on Peace and Security* (12), p26, https://sipri.org/sites/default/files/2020-12/sipriinsight2012_mapping_the_international_presence_of_the_worlds_largest_arms_companies.pdf

[130] Béraud-Sudreau L. et al (2020), p2.

[131] SIPRI (n.d.), *Sources and Methods*

[132] SIPRI (n.d.), *Sources and Methods*

[133] Béraud-Sudreau L. et al (2020), p2.

[134] SIPRI (n.d.), *SIPRI Arms Industry Database,* https://sipri.org/databases/armsindustry

[135] SIPRI (n.d.), *Sources and Methods*

[136] SIPRI (n.d.), *Sources and Methods*

representatives in reports or media) for some 'arms companies' that do not report defence-related sales figures, it is difficult to compare companies due to an absence of the same reporting basis.

While SIPRI maps only the largest 'arms companies', i.e. the 100 companies with the largest amount of 'arms sales' in a given year[137], they have also mapped the 'foreign entities' with economic activities in 'Military goods and services' which are majority-owned (50%+1) by the top 15 of these arms companies.[138] The term 'foreign entity' consists of majority-owned subsidiaries, branches and joint ventures, including those that are military research facilities, which are registered legally in another country than where the ultimate parent 'arms company' has their headquarter.[139] Given that the mapping only includes 'foreign entities' with economic activities in 'Military goods and Services', any entity without direct operational activity is not part of the mapping, i.e. holding and investment companies are excluded from the list.[140] This mapping approach leads to a list of 400 foreign entities that are majority-owned by the top 15 'arms companies'. No further breakdown of revenue or employees of the entities abroad is provided, as this information is not usually disclosed in a "systematic or comprehensive way".[141]

While the SIPRI database offers the most comprehensively and consistently updated data (country location; total sales and proportion of arms sales; yearly arms sales in constant and current prices; total employment; company profit)[142] on the top 100 'arms companies', it is, of course, limited in scope by design. While the SIPRI employed definitions can be employed to derive some insights, these will need to be expanded for our research as to encompass a mapping of the wider Technological and Industrial Base.

[137] Ibid.
[138] Béraud-Sudreau L. et al (2020).
[139] Béraud-Sudreau L. et al (2020), p3.
[140] Béraud-Sudreau L. et al (2020), p2.
[141] Béraud-Sudreau L. et al (2020), p3.
[142] Hartley. K and Belin J. (2020), The Global Defence Industry, in K. Hartley and J. Belin (Eds.), *The economics of the global defence industry* (1st ed.), Routledge, p1.

1.3.2 ASD – Aerospace, Security and Defence industries association of Europe

ASD is a transnational association representing the interests of the Aerospace, Security and Defence Industries across Europe for its members. It's direct members include 20 instrumental European-based defence companies[143] and 22 national associations from 18 countries (3-non EU), hence indirectly also representing the interest of all members part of these national associations. [144] ***Table 1.3.2.1*** below shows the (non-)membership of ASD based on location: EU countries with a national associations that are an ASD member (1), non-EU countries with a national association that is an ASD member (2), and EU countries with no ASD members (3).

ASD membership	ASD & EU (1)	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Poland, Portugal, Spain, Sweden, and The Netherlands.
	ASD & Not-EU (2)	Norway, Turkey, and the United Kingdom.
No ASD membership	Not-ASD & EU (3)	Croatia, Cyprus, Estonia, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Romania, Slovakia, and Slovenia.

Table 1.3.2.1: geographical location of ASD members. Source: Own composition based on ASD membership list for 2023 available at https://www.asd-europe.org/about-us/members.

Every year ASD issues a 'facts and figures' report on the aerospace and defence industry of Europe. Historically these were limited to the 18 countries where associations are located with ASD membership.[145] Hence, while these figures could be employed to indicate trends in the aerospace and defence sector of Europe, they had to be interpreted within the context of their (main) limitations: Firstly, the 9 EU-countries without ASD membership were excluded from the data, meaning the figures did not fully represent the industries in the EU. Secondly, the term 'European' employed by ASD includes both EU and non-EU countries.[146] Due to the inclusion of non-EU countries in the data, it is difficult to differentiate between EU and non-EU figures and trends.

Since 2022, the fact and figures report includes an estimation of the EU27 figures in order to compare it to the total turnover and employment figures of ASD membership. However, the provided EU-27 figures in the reports itself are on an aggregate level and lend no specific insight into the sub-

[143] Airbus, BAE Systems, Dassault Aviation, Diehl, Fincantieri, GKN Aerospace, Hensoldt, Indra, Kongsberg, Leonardo, Liebherr, MBDA Missile Systems, Naval Group, Navantia, Patria, Rheinmetall, Rolls-Royce, Saab, Safran, Thales.

[144] ASD (2023), ASD members, https://www.asd-europe.org/about-us/members.

[145] ASD (2022), Facts and Figures 2022 Report, p26

[146] Hence, the term 'European Defence sector' and 'EDTIB' employed by ASD contrasts with how the EU commonly employs it, i.e. to refer to a EU Defence Technological and Industrial Base. The term European defence technological and industrial base (EDTIB) as employed by ASD only refers to the European Defence sector and does not include the Civil aeronautics sector.

categories. More insights can be derived for the EU-27 countries after recalculating the provided figures in the report (see: ***Tables 1.3.2.4 and 1.3.2.5*** below).

ASD splits its figures between two main sectors: the European civil aeronautics sector and the European Defence sector.[147] The definition of the 'European defence sector' includes the following categories: military aeronautics, land, naval, and military space.[148] Interesting to note is that currently ASD does not include Cyber as a separate category within the defence sector. Every one of these sectors includes systems, platform and component: a small number of prime contractors provide 'systems'; tier-1 providers develop complete sub-systems; tier-2 suppliers develop special equipment or technologies for the levels above; and a wide span of tier-3 suppliers delivers or can deliver raw materials and basic components.[149] For a hierarchical representation of the supply chain, ASD employs the OEM-Tier3 pyramid structure model from Cauzic et al.

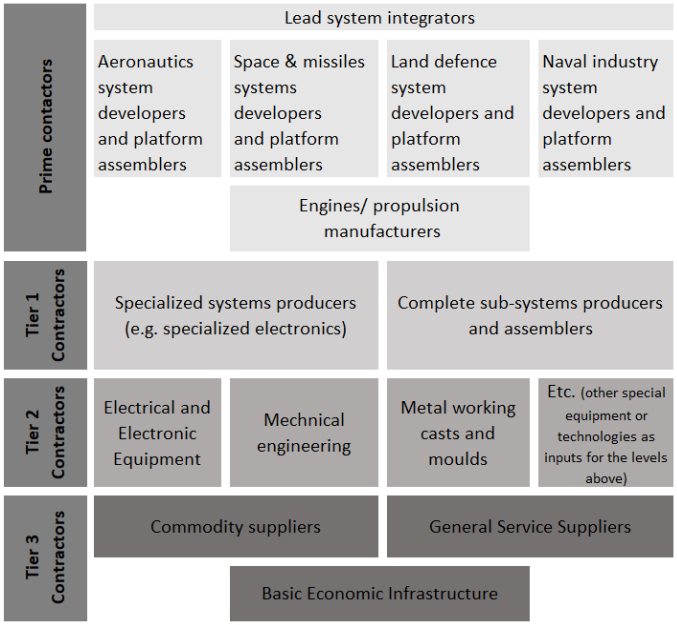

Figure 1.3.2.2: OEM to Tier 3 pyramid-structure model employed by ASD, based on Cauzic et al.[150] Source: ASD (2019), About Industry, https://www.asd-europe.org/about-industry

[147] While for the purposes of our research, the defence sector figures and the inclusion criteria thereof are more important than those of the civil sector, the trends in the civil sector are non-the-less important to track as the civil sector provides a technological, knowledge and industrial basis that positively seeps into the defence sector and has the potential to 'spin-in' into economic activities in the defence market or increase the proportion thereof in their turnover.

[148] ASD (2022), Facts and Figures 2022 Report, p26.

[149] ASD (2019), About Industry, http://web.archive.org/web/20220615000442/https://www.asd-europe.org/about-industry/

[150] Cauzic F., Colas H., Leridon N., Lourimi S., and Waelbroeck-Rocha E. (2009), A comprehensive analysis of emerging competences and skill needs for optimal *preparation and management of change in the EU defence industry – Final report*, Eurostrategies, p21, https://eda.europa.eu/docs/default-source/procurement/14-cps-op-030-q-a-nr1-annex-1-97-skills-report-vf-1.pdf

Hierarchical pyramid structure of the EDTIB[151]
Prime contractors / system integrators (aka: original equipment manufacturer (OEM))
Prime contractors in the EDTIB are producers of weapons systems and platforms, which are generally large companies at the centre of an ecosystem (often referred to as ''national champions"). Prime contractors are characterized by their focus on and specialization in defence production and their sourcing of other defence products from the tiers below which are needed within their systems. When prime contractors develop defence systems for several defence domains (e.g. systems for both LAND and NAVAL) they are referred to as 'Lead System Integrators' (LSI). Known examples of prime contractors in the EDTIB are: Saab (Sweden), Thyssenkrupp Marine Systems (Germany), Rheinmetall (Germany), Thales (France), Naval group (France), Finmeccanica (Italy), Fincantieri (Italy), Airbus (transEuropean, HQ in the Netherlands), Damen (The Netherlands), KNDS (the joint holding company for Nexter (France) and KMW (Germany)).
Tier 1 contractors:
Tier 1 contractors produce major components and sub-systems or focus on the production of specialized systems (e.g. engines, electronics). Often these tier 1 contractors are risk sharing partners with the prime contractors. Key examples of tier-1 companies in the EDTIB are: Safran Group (France), MTU (Germany), Indra (Spain).
Tier 2 contractors:
Tier 2 contractors supply services and produce components such as mechanical engineering, metallurgy products, specialized casts & moulds, electrical & electronic equipment and a host of other goods and services; often dual-use goods or services. Generally these contractors are SMEs or subsidiaries of the defence producers above (prime contractors and the tier 1 subcontractors). Given their economic activities are usually related to dual-use goods and services, these companies are not always considered as defence producers or as part of the defence sector.
Tier 3 contractors:
Tier 3 contractors are capacity contractors, commodity suppliers and general service suppliers, including providers of general economic infrastructure services (e.g. communication, external training, transport services and network, etc.). This level of the supply chain consists mostly out of SMEs and subsidiaries of the Prime contractors and Tier 1 subcontractors, which supply the levels above with dual-use products. Given that these companies usually produce non-defence goods aside from defence products and dual-use products, these companies are not always listed as part of the defence sector.

Table 1.3.2.3: Hierarchical pyramid structure of the EDTIB. Source: Own composition based on Cauzic et al. (2009), p21 ; Briani et al. (2013), p15.

[151] Table based on: Cauzic et al. (2009), p21 ; Briani V., Marrone A., Mölling C. and Valasek T. (2013) The development of a European Defence Technological Industrial Base, Directorate-General for External Policies of the Union & European Parliament's Subcommittee on Security and Defence, p15, https://www.europarl.europa.eu/thinktank/en/document/EXPO-SEDE_ET(2013)433838

While the definition of the 'European defence sector' above outlines general inclusion criteria, the data for ASD their 'facts and figures' itself are derived from the contributions of the national associations that are a member of ASD.[152] Some associations may include only members of their national association in the figures of their domestic defence sector that they share with ASD, while others national associations may also include non-members that they consider part of the sector. Hence, it is unclear what the specific inclusion criteria are, as different national associations can hold different criteria.

In total the 2021 turnover for the defence sector for countries with ASD-members amounted to 118.3 billion EUR and consisted of 467k employees.[153] [154] [155] The figures are derived from approximately 3,000 companies (direct company member and indirectly via the national associations)[156] of which around 2,000 (66%) to 2,500 (83%) are SMEs.[157]

Turnover 2021	Civil		Defence				
	Civil aeronautics	Civil space	Military Aeronautics	Land (def)	Naval (def)	Military space	Total
ASD & EU (1)	80.2	9.9	36.4	31.2	20.8	0.9	179.4
ASD & not-EU (2)	26.0	3.2	11.8	10.1	6.7	0.3	58.1
Not-ASD & EU (3)	1.7	0.2	0.8	0.7	0.5	0.0	3.9
TOTAL	107.9	13.3	49.0	42.0	28.0	1.2	241.4
	121.2		**120.2**				
ASD-members (1) + (2)	106.2	13.1	48.2	41.3	27.6	1.2	237.5
	119.2		**118.3**				
EU-27 (1) + (3)	81.9	10.1	37.2	31.9	21.3	0.9	183.3
	92.0		**91.3**				

Table 1.3.2.4: Civil and Defence turnover 2021. Source: Derived from our own recalculations based on the info provided in the ASD 2022 'Facts and Figures' Report. See Annex 4 for more info.

[152] ASD (2021), Facts and Figures 2021 Report, p12.
[153] ASD (2022), Facts and Figures 2022 Report, p19.
[154] ASD (2022), Facts and Figures 2022 Report, p5: In the 2022 report the turnover of a 'ASD member company' refers only to the turnover derived from countries where national associations have ASD membership.
[155] ASD (2020), 2020 Facts and Figures, p12: Given yearly changes in membership in ASD and within the national associations that are its member, year over year analysis are not done on the same basis and should be seen as a tool for checking trends rather than for accuracy.
[156] ASD (2022), Facts and Figures 2022 Report, p7.
[157] ASD (2022), Facts and Figures 2022 Report, p15.

Comparatively, the EU-27 had an estimated defence sector total turnover of 91.3 billion EUR (see: ***Table 1.3.2.4***) and about 354k[158] employees in 2021 (see: ***Table 1.3.2.5***). Defence sector turnover from the non-EU countries where ASD has national associations as members (Norway, Turkey, UK) was estimated at 28.9 billion EUR. This is comparatively equal to around 32% of the EU-27 turnover, hence indicating a comparative weakness of the EU-27.

Employees 2021	Civil	Civ/Def	Defence		
	Civil aeronautcis	Civil & Mil space	Military Aeronautics	Land & Naval (def)	Total
ASD & EU (1)	249,184	34,282	120,023	200,611	604,100
ASD & not-EU (2)	113,516	15,618	54,677	91,389	275,200
Not-ASD & EU (3)	26,069	3,587	12,557	20,988	63,200
TOTAL	388,769	53,487	187,257	312,988	942,500
			500,244		
ASD-members (1) + (2)	362,700	49,900	174,700	292,000	879,300
			466,700		
EU-27 (1) + (3)	275,253	37,869	132,580	221,599	667,300
			354,178		

Table 1.3.2.5: Civil and Defence employees 2021. Source: Derived from our own recalculations based on the info provided in the ASD 2022 'Facts and Figures' Report. See Annex 4 for more info.

In summary, while the ASD 'facts and figures' provides a useful tool to track the trends in the 'defence-sector', they are restricted in scope due to the limitations discussed above. Given the aggregate overview, comparisons between counties are not possible with the (publicly available) reporting. Most importantly for our research, there is no detailed outline of the inclusion criteria and in practice this seems to be up to the national associations themselves, which all maintain different inclusion criteria for their membership and whether they include non-members considered part of the defence-industry in their reporting . As a result, the figures provided by each national associations are not on the same basis

[158] In actuality the ASD Defence sector employment figures are slightly higher as the number here excludes employees working in the military space sector. These were excluded as in the ASD report they do not differentiate between the employment figures of civil space and military space, but rather present them together.

1.3.3 Conclusion: Non-country cases

SIPRI employs product and customer delimitations to map the 'Arms sales market'. ASD looks at the 'European Defence Sector', which it equates with the term 'EDTIB', employing broad product categories and differentiates between civil and defence customers. However, it does not clearly delimitate the products or customers within these in detail. **(GQ1 & GQ4)**. SIPRI sources from the bottom-up (desk research to retrieve information from company reports or media). ASD relies on top-down information it receives from its direct members (transeuropean companies) and from the national defence business associations that are ASD members **(GQ3)**.

Both SIPRI and ASD refer to 'companies' **(QG7)**. Foreign-controlled companies are included in the mapping of both cases **(GQ2)**. For ASD, we know that there are members within the national associations that are foreign-controlled. This applies as well if we were to refer to 'foreign' here as consisting out of control by any non-EU or non-NATO actor. Thus, it considers these entities as well as part of the 'European Defence Sector'. SIPRI, aside from mapping the 100 largest 'arms sales companies', also maps the majority-owned (50%+1) foreign entities of the 15 largest of these.

While research entities are not included in the SIPRI mapping, they could be according to the criteria if these refer to non-academic R&D services that match the product and customer delimitations. ASD does not specify whether research entities are included. However, a quick look at the members of the national associations, of which these members become indirect ASD members, indicates they are **(GQ5)**.[159]

Given the differences in purpose, scope and method of their mappings, the cases cannot be compared to each other (GQ6) (GQ8) (GQ9) (GQ10).

Case	Delimitations	Foreign-controlled incl.	Methodology	'Term' employed	Research entities incl.	Size	$/EUR Sales[160]	Employment
SIPRI	Product & customer delimited	Yes	Bottom-up: Company and Media reports	Arms sales market	Yes	100 largest 'arms companies'	500.76 billlion EUR	n.a.
ASD	Product delimited (implicitly also customer delimited)	Yes	Top-down: Based on lists of the national associations that are ASD members.	European defence sector	Yes	approx. 3000 'companies'	118.3 billion EUR	467k employees

Table 1.3.3.1: Summary Table – non-country cases. Source: Own composition based on the analyses of the cases.

[159] E.g. See: AED cluster Portugal which includes research entities including universities. http://www.aedportugal.pt/en/members/#membersActive

[160] Sum of 'arms sales' expressed in 2021 constant USD (592.06 billion USD) converted to EUR based on average USDEUR rate for 2021 of 0.8458.

2. Sources for the initial mapping of the BE-DTIB

While it would be ideal if the data of the responsible export licensing authority of each of the regions could be employed for the mapping of at least the 'entities active in the defence market' portion of the BE-DTIB; as discussed by the Flemish Peace Institute, there are several limitations that make it impossible to rely only on export licenses data. Hence, the initial mapping of the BE-DTIB needs to rely on different sources and initial inclusion criteria. Desk research and questions on economic activities included in a survey sent to the mapped entities will be necessary to fill in the gaps.

For the sources to map the initial BE-DTIB list, we build on the Belgian case studies discussed above, especially deriving sources and inclusion criteria from the prior research done by ACOS STRAT-NAD. We outline the following sources:

(1) Defence and Security Procurement contracts

(2) EU, NATO, and Belgian Defence (R&D) programs[161]

(3) Already listed in the Group for Research and Information on Peace and Security (GRIP) database of the Belgian 'armaments industry'.

(4) D&S-focused or relevant business associations[162]

(5) 'Defence-related' or 'dual-use' products exports[163]

(6) Existing reports, e.g. reports from the Flemish Peace Institute.

(7) DG HOME list of EU security market

(8) EU Register of Certified Defence-related Enterprises - CERTIDER

(9) Defence-relevant NACE codes (limited)

(10) LinkedIn (legal entity self-identifies as defence or security related)

(11) Mentioned in newspaper articles or other open sources as having DTIB-relevant activities.

(12) Business days & events[164]

(13) Obtained via stakeholders (Federal Public Service Economy, The Belgian National Armaments Director office).

(14) Any legal entity participating in the impact survey shared on LinkedIn and the website of the Royal Higher Institute for Defence, which were not yet included via the above sources and indicated they have DTIB-relevant activities.

[161] e.g., the European Defence Fund (EDF) and its precursors programs – the European Defence Industrial Development programme (EDIDP), Preparatory Action for Defence Research (PADR) and Defence Pilot Projects (PP); European Defence Industry Reinforcement through common procurement act (EDIRPA); Act in Support of Amunition Production (ASAP); Defence Research Action (DEFRA); Royal Military Academy, Royal Higher Institute for Defence and other direct projects at Belgian Defence; Defence Innovation accelerator for the North Atlantic (DIANA).

[162] e.g.: BSDI; Skywin; FLAG; EWA; Pole Mecatech D&S; Belgospace; BAG.

[163] Via open source, as the regional export control services do not share this info publicly.

[164] e.g. Belgian Defence and Security association days; EUROSATORY; EURONAVAL.

3. Similarity table for selection of country case studies

Country	Def active forces size[165] (2019)	Def active forces as % of total laborforce (2019)[166]	All Def forces size (2023)[167]	DTIB size (employees)[168]	DTIB employees (% of labor force)[169]	Def expenditure as % of GDP[170] (2021)	Def ex. as % of Gov ex (2021) [171]	DTIB: Private[172] vs state-owned vs mixed	DTIB size (turnover)[173]	Turnover as % of GDP[174]	Similarity score	
Canada	72k	0.3%	94k	27-59.8k	0.11-0.25%	1.3	2.7	Private	6.73 B EUR	0.46	7	Similar
Germany	184k	0.4%	199k	90-120k	0.20-0.26%	1.3	2.5	Private	22 B EUR	0.67	6	Similar
Sweden	15k	0.3%	38k	30k	0.60%	1.3	2.4	Private	3.84 B EUR	0.80	8	Similar

[165] The World Bank, (2019), Armed forces personnel – active personnel. https://data.worldbank.org/indicator/MS.MIL.TOTL.P1?name_desc=false
[166] The World Bank (2019), Armed forces personnel – active personnel – as a % of the labor force, https://data.worldbank.org/indicator/MS.MIL.TOTL.TF.ZS
[167] Global Fire Power (2023), Countries Index, https://www.globalfirepower.com/countries.php
[168] Derived from Hartley and Belin (2020, p596), except the figures for the Netherlands and Belgium.
[169] All figures calculated on the 2019 labor force figures. Labor force figures were derived directly by dividing <Def active forces> by <Def active forces as % of labor force>.
[170] The World Bank, (2021), Military expenditure as a % of GDP, https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS
[171] The World Bank, (2021), Military expenditure as a % of general government expenditure, https://data.worldbank.org/indicator/MS.MIL.XPND.ZS
[172] "Private" refers here to 'private ownership', i.e. assets and/or shares are not owned by the state. Private ownership includes both privately-held companies and publicly-traded companies. The term 'private ownership' is hence not to be confused with the term 'privately-held company'.
[173] Figures derived from Hartley and Belin (2020), except the figures for the Netherlands and Belgium. Most of the figures from Hartley and Belin are in 2016 contant EUR values for 2017, but some figures are for 2016 or 2018. For our purpose here, any figures not from the same years still suffices to derive similarity or not, given that the purpose is to gauge the estimated size, these differences across the years have limited impact on the intended purpose. As turnover in the DTIB is commonly not quickly increased, the differences are likely to be small across these years in any case, as they occurred before a reemergence of overtly clear geopolitical tension (Cfr. 2022 Ukraine-Russia war).
[174] As DTIB figures are for 2017 (except for the Netherlands) calculated on 2017 GDP data from: The World Bank (2017), GDP (current USD), https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2017. GDP values are converted to EUR via average USDEUR exchange rate for 2017 (0.8865 EUR). Values for the Netherlands are calculated on 2021 GDP data as the DTIB figures are from 2021.

Netherlands	41k	0.4%	45k[175]	16-20k[176]	0.16-0.20%	1.4	2.9	Private	4.7 B EUR[177]	0.52	10	Similar
BELGIUM	26k	0.5%	33k	5k-10k[178]	0.10-0.19%	1.1	1.9	Mixed (MP)[179]	750M-2.25B EUR[180]	0.17-0.50		
USA	1.388 M	0.8%	1.832M	2.3-4.1 M	1.33-2.36%	3.5	8.3	Private	/	/	1	Dissimilar
UK	149k	0.4%	231k	260k	0.70%	2.2	4.7	Private	37 B EUR	1.56	2	Dissimilar
France	304k	1%	415k	200k	0.66%	1.9	3.2	Mixed (LSO)[181]	22.6 B EUR	0.98	0	Dissimilar
Italy	342k	1.3%	297k	50k	0.19%	1.5	2.6	Mixed (LSO)	14.8 B EUR	0.85	2	Dissimilar
Spain	199k	0.9%	215k	40k	0.18%	1.4	2.7	Private	5.9 B EUR	0.51	5	Neutral
Greece	147k	3.1%	385k	5.2k +	0.11%	3.9	6.5	Mixed (LSO)	800 M EUR	0.45	4	Dissimilar
Poland	189k	1%	152k	20k	0.11%	2.1	4.6	State-owned	+1.08 B EUR	0.23	4	Dissimilar
Norway	23k	0.8%	63k	6.7k	0.23%	1.8	3.6	Mixed (LSO)	1.74 B EUR	0.49	5	Neutral
Turkey	512k	1.5%	775k	44.7k	0.13%	2.1	6.3	Mixed (LSO)	5.76 B EUR	0.76	1	Dissimilar

[175] Does not include civilian personnel working at Defence. If these were included the figures would be closer to 68k. See: Ministerie van Defensie (2022), Aantallen personeel, https://www.defensie.nl/onderwerpen/overdefensie/het-verhaal-van-defensie/aantallen-personeel

[176] Berenschot (2022), p15-19.

[177] Berenschot (2022), p8: 2021 figures.

[178] See: prior BE case studies in ***Section 1.2.***

[179] Belgium has "split" characteristic for the notably defence-focussed companies between Flanders and Wallonia. While the market in Flanders (and Brussels) is made up of private ownership (privately-held and publicly traded companies), the Walloon region government has some state-ownership in defence-focussed companies. Despite this, the bulk of the ownership for the wider DTIB remains made-up of private ownership. Therefore, Belgium is listed as 'Mixed but **M**ostly **P**rivate' (MP).

[180] See: ACOS STRAT-NAD study in section 'prior BE studies'.

[181] Mixed: **L**eaning more towards **S**tate **O**wnership (LSO).

4. For Calculations see separately attached excel file

This excel file contains calculations and the related data as refered to throughout the article and the annex. The explanations for the calculations can be found directly within the footnotes of this annex. Each section containing our own calculations has a separate sheet in the excel file (Annex 4).

This file can also be accessed via: here

5. Reference list

For website references: all websites referenced were last checked/accessed on 02 September 2023 to control for any changes or deletions of referenced info. No changes to these website pages have been noted.

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6. List of Abbreviations

ACOS STRAT-ICM/NAD: Assistant Chief Of Staff Strategy - Integrated Capability Management /National Armaments Director

AGORIA: Belgian multisector company association

ASD: Aerospace, Security and Defence industries association of Europe

BAG: Brussels Aerospace & Defence Group

BE-DTIB: Belgian Defence Technological and Industrial Base

BSDI: Belgian Security and Defence Industry

CBE: The Belgian Crossroads Bank for Enterprises.

CDAMIS: Canadian Defence Aerospace and Marine Industry Survey

CERTIDER: Certified Defence-related Enterprise Register

CPV: Common Procurement Vocabulary

DIRS: Defence, Industry and Research Strategy

EDA: European Defence Agency

EDF: European Defence Fund

EDIDP: European Industrial Development Program

EDIRPA: European Defence Industry Reinforcement through common Procurement Act

FLAG: Flemish Aerospace Group

FPS Economy: Federal Public Service Economy

FTE: Full Time Equivalent

GRIP: Groupe de Recherche et d'Information sur la Paix et la sécurité

ILIAS: off-the-shelf software suite employed by Belgian Defence for IT and information management, e.g. for procurement.

IMEC: Interuniversity Microelectronics Centre

MCM lab: Mine Counter Measure lab

NACE: Nomenclature générale des Activités économiques dans les Communautés Européennes (statistical classifications system of economic activities in the EU)

NACE-BEL : The classifications system of economic activities for Belgium based on the EU NACE

NATO: North Atlantic Treaty Organization

OCAS: OnderzoeksCentrum voor de Aanwending van Staal (Metalurgy research center)

PADR: Preparatory Action on Defence Research

R&T(&D): Research & Technology (& Development)

RHID: Royal Higher Institute for Defence

RMA: Royal Military Academy

RTO: Research and Technology Organization

SEK : Swedish Krona

SIPRI: Stockholm International Peace Research Institute

SME: Small and Medium-sized enterprises

SOFF : Swedish Defence Industry trade association (‘Säkerhets- och försvarsföretagens’)

TED: Tender Electronic Daily (EU Tender information platform)

VLIZ: Vlaams Instituut van de Zee