COVID-19 AND SUPPLY CHAIN ISSUES: THE CASE OF THE ESTONIAN DEFENCE INDUSTRY

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Abstract. This article focuses on the impact of the COVID-19 crisis on the Estonian defence industry. It is an exploratory research paper that attempts to sketch out some more salient features of a complex of problems that is deep and wide in nature, the reasons and effects of which are only gradually starting to become clearer. The paper focuses on the Estonian case but, as it tries to place its findings in the wider context of global and regional changes, it also tries to generalise the impact of these crises upon the defence industry of a small state.

The paper relies mainly on theoretical literature on global value chains. Also important is the topic of regional resilience as understood from an evolutionary economic perspective.

Keywords: COVID-19 crisis, Estonian defence industry, small states, supply chains, SMEs

1. Introduction

This article focuses on the impact of the COVID-19 crisis on the Estonian defence industry. It is an exploratory research paper that attempts to sketch out some more salient features of a complex of problems that is deep and wide in nature, the reasons and effects of which are only gradually starting to become clearer. The paper focuses on the Estonian case but, as it tries to place its findings in the wider context of global and regional changes, it also tries to generalise the impact of these crises upon the defence industry of a small state.

The paper relies mainly on theoretical literature about global value chains. Also important is the topic of regional resilience as understood from an evolutionary economic perspective.

The case study of Estonia draws empirically on two complementary methods. First, a survey was conducted among the members of the Estonian Defence and Aerospace Industry Association (EDAIA) in May 2020, at the time when the public was experiencing the problems and restrictions that

accompanied the first wave of COVID-19. Second, interviews were conducted with members of the EDAIA in late June and early July 2022.

The second chapter outlines the theoretical background, the third the immediate experience from other states and companies, the fourth presents the results of the survey and the survey and interviews conducted with members of the EDAIA, and the fifth discusses the results and places them in the wider context of global and regional experience.

2. Globalisation, crises and small states

Decades ago, the core elements of any given industry value chain tended to agglomerate or 'cluster' closely to one another geographically[1]. Trade liberalisation and the advancement of ICTs has since made international communications and logistics, management of remote business units, and the relocation (offshoring) of individual elements of value chains inherently easier[2]. With greater specialisation and a massive increase in the trade of manufactured intermediate goods[3], a successful economic development has also become increasingly dependent on imported technologies and, subsequently, emerging production capabilities along with more global and more complex industry and market dynamics. Thus, industrial specialisation that used to be driven by agglomeration economies is increasingly being analysed in a broader international setting, like global value chains (GVCs).[4]

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[1] **Porter, M. E**. 1990. The Competitive Advantage of Nations. London: Macmillan; **Marshall, A**. 1920. Principles of Economics. London: MacMillan.

[2] **Gereffi, G., Korzeniewicz, K**. 1994. Commodity Chains and Global Capitalism. Praeger Publishers; **Ernst, D.; Kim, L**. 2002. Global production networks, knowledge diffusion, and local capability formation. – Research Policy, Vol. 31, pp. 1417–1429; **Berger, S**. 2005. How We Compete: What Companies around the World Are Doing to Make it in Today's Global Economy. New York: Doubleday.

[3] **Cattaneo, O.; Gereffi, G.; Staritz C**. (eds.) 2010. Global Value Chains in a Postcrisis World: A Development Perspective. Washington, DC: The World Bank.

[4] **Ponte, S.; Gereffi, G.; Raj-Reichert, G**. (eds.) 2019. Handbook on Global Value Chains, Cheltenham, UK: Edward Elgar Publishing. https://doi.org/10.4337/9781788113779; **Gereffi, G.; Fernandez-Stark, K**. 2016. Global Value Chains Analysis: A Primer. https://www.researchgate.net/publication/305719326_Global_Value_Chain_Analysis_A_Primer_2nd_Edition; **Coe, N. M., Dicken, P.; Hess, M**. 2008. Global Production Networks: Realizing the Potential. – Journal of Economic Geography, Vol. 8(3), pp. 271–295, here p. 277.

GVCs account for almost 50% of global trade, largely driven by the manufacturing sector, but GVCs have also expanded rapidly in services (Figure 1)[5].

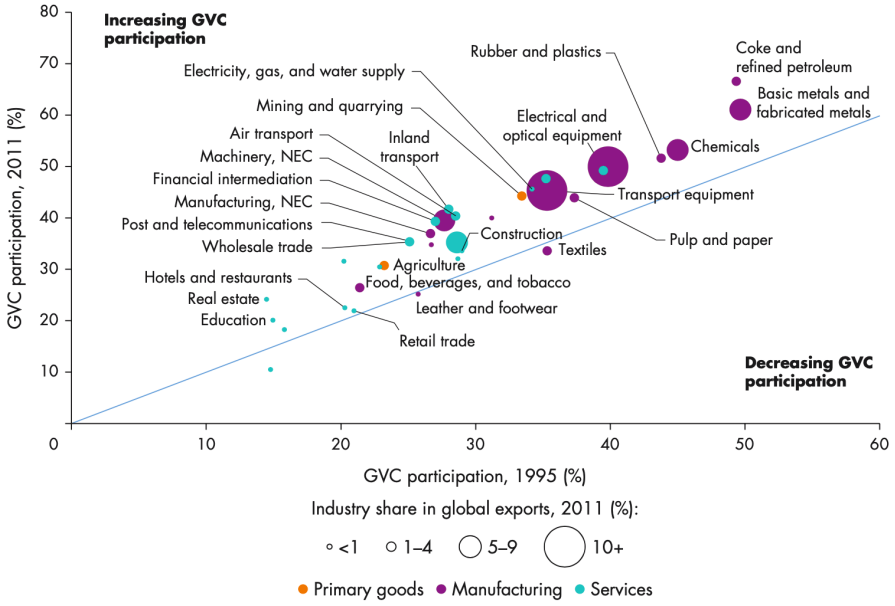

Figure 1. GVC participation by sector, 1995 and 2011[6]

The defence industry is particularly strongly organised around GVCs[7] and, as concluded by Hartley and Belin,

> */…/ future defence industry is likely to have an even smaller number of larger firms with larger R&D divisions. An increasing dependence on defence business might lead to arms firms merging with civil firms /…/.*[8]

The defence industry has an inner complexity and an amorphous form. This is why it defies any easy definition. It has been called a hybrid business. Even if many products are directly imputable to military needs in a narrow sense,

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[5] **World Bank** 2020. World Development Report 2020: Trading for Development in the Age of Global Value Chains. Washington. [**World Bank** 2020]

[6] **World Bank** 2020.

[7] See, e.g., **SIPRI** 2022. SIPRI Yearbook 2022. Armaments, Disarmament and International Security, Stockholm.

[8] **Hartley, K.; Belin, J.** 2020. The Economics of the Global Defence Industry. London, UK: Routledge, p. 599.

a growing number of them are dual- or even multi-use[9]. Also, ownership varies from complete state-ownership to partial or complete shareholder ownership[10]. Due to an increasing amount of dual-use goods and services that the industry produces, instead of and in parallel with "the defence industry", the heterogeneous group of companies is named "the defence-related industry", "the defence and security-related industry" or "defence-related companies".[11] Thus, a clear line of demarcation between defence and non-defence products and services is hard to draw, and this is made even more complex with the emerging hybrid threats.

Thus, the defence industry holds a peculiar status. The pattern of ownership indicates that states still keep this sector under tighter control than is ordinarily the case with other sectors. Also, the domestic markets of defence equipment and services are more heavily regulated, entailing *inter alia* that domestic and especially international investments are monitored in detail. Likewise, states usually keep an eye on defence exports and often regulate them more strictly than other goods. In short, the defence industry involves an unusually close cooperation between the state and defence industry companies which, setting high requirements for both, includes limited users, an exceptional export regime and market environment, and a heightened risk of industrial espionage and security requirements.[12]

In this article we do not intend to delve into the idiosyncratic features of the defence industry, as comparative information is also largely missing. The defence industry with its peculiar characteristics has not yet been under scrutiny as far as the influence of the COVID-19 pandemic is concerned. Therefore, we will look at the defence industry in terms of its general characteristics, applying wider economic analysis to it.

However, the increasing connectivity of supply chains, the number of actors involved, and economic and political instability found in certain countries have all considerably raised the risks in the world economy and, similary, in GVCs. These risks are triggered by a manifold of developments,

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[9] **Surry, E**. 2006. Transparency in the Arms Industry. – SIPRI Policy Paper, No. 12. https://www.sipri.org/sites/default/files/files/PP/SIPRIPP12.pdf (accessed 17 Nov 2021).

[10] Ibid.

[11] **Berrebi, C.; Klor, E. F**. 2010. The Impact of Terrorism on the Defence Industry. – Economica, Vol. 77, pp. 518–543.

[12] **Kaitseministeerium** 2021. Eesti kaitsetööstuspoliitika „Koostöös loodud kaitsevõime", p. 1. https://www.kaitseministeerium.ee/sites/default/files/sisulehed/Files/kaitsetoostuspoliitika_2021.pdf.

such as the increasing digitalisation of industries and connectivity of value chains, as well as political instability and aggressive actions by some powers and multinational enterprises.

As a result of the COVID-19 pandemic, it is being increasingly questioned if we might be returning to the previous globalisation wave. Or, rather, a more regionally-based world economy offering a better balance between national and international interests, efficiency and resilience in global supply chains, and between growth, inclusiveness, and equity impacts.[13]

In any case, triggered by recent (economic) crises, researchers have shown an increasing interest in the topic of regional resilience (from the evolutionary economic perspective) in understanding not only the ability of a region to accommodate shocks but in understanding the long-term ability of regions to develop new growth paths.[14] Gereffi et al. highlight that resilience is not a one-dimensional concept but has different meanings at the levels of the firm (operational efficiency), the global value chain (appropriate governance), and the nation-state (national security and economic development)[15].

In conclusion, the world economy has gone through rapid globalisation and the emergence of global value chains, and this has helped the defence industries of numerous small states to prosper. Furthermore,

> *Arms production around the world was largely resilient to the economic downturn caused by the Covid-19 pandemic: while the global economy contracted by 3.1 per cent in 2020, the aggregated arms sales of the Top 100 increased*.[16]

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[13] See, e.g., **Enderwick, P.; Buckley, P**. 2020. Rising regionalization: will the post-COVID–19 world see a retreat from globalization? – Transnational Corporations, Vol. 27(2), pp. 99–112. https://unctad.org/system/files/official-document/diaeia2020d2a5_en.pdf; **Buckley, P.; Hashai, N**. 2020. Scepticism Towards Globalisation and the Emergence of a New Global System. – **Global Strategy Journal**, Vol. 10(1), pp. 94–122; **Farrell, H.; Newman, A. L**. 2020. Chained to Globalization: Why It's Too Late to Decouple. – Foreign Affairs, Vol. 99(1), pp. 70–80.

[14] See, e.g., **Boschma, R**. 2015. Towards an Evolutionary Perspective on Regional Resilience. – Regional Studies, Vol 49(5), pp. 733–751, https://doi.org/10.1080/00343404.2014.959481; See also **Reinert, E. S**. 2007. How rich countries got rich and why poor countries stay poor. London: Constable.

[15] **Gereffi, G.; Pananond, P.; Pedersen, T**. 2022. Resilience Decoded: The Role of Firms, Global Value Chains, and the State in COVID-19 Medical Supplies. California Management Review. https://doi.org/10.1177/00081256211069420.

[16] **SIPRI** 2012. SIPRI Yearbook 2022. Armaments, Disarmament and International Security, Stockholm, p. 11.

However, more empirical evidence is needed on the general behaviour of defence industries in smaller states, the challenges faced and the policy options, a gap the current article is addressing.

3. The impact of the COVID crisis on the global and European defence industry

For the global defence industry, the main problem that the COVID-19 crisis has brought to the surface can be seen in the diminished returns of the sector. Factors that have contributed to this include reduced governmental investments in the sector, serious difficulties that particularly the SMEs (small medium enterprises) have experienced, thereby harming the value chains of the sector, and supply chain problems including the unavailability or shortage of some strategic inputs for the sector. Although in Europe, returns did not diminish in the first year of the crisis, problems with supply chains remain. The COVID-19 crisis has thus made it hard to maintain the efficiency and productivity of the sector and caused issues in multiple domains, one of which has particularly impacted companies' ability to keep key competencies intact. In the following pages we will address these problems as they appear globally, but also in Europe, in general and in some detail.

The clearest impact of COVID-19 on the global defence industry appears to be a significant fall in returns. A global analysis shows that aerospace and defence were among those sectors that suffered most, witnessing a negative cumulative abnormal return of 33.29%[17]. In Europe, states have retained their defence investment levels, although they have simultaneously cut spending in EU programmes[18]. Also, the level of investments into R&D of

[17] **Szczygielski, J. J.; Charteris, A.; Bwanya, P. R.; Brzeszczyński, J**. 2021. The impact and role of COVID-19 uncertainty: A global industry analysis. – International Review of Financial Analysis, Vol. 80(2022), 101837. https://doi.org/10.1016/j.irfa.2021.101837.

[18] Notably, the European Defence Fund (EDF) was originally meant to receive EUR 13.4 bn for the next EU Multiannual Financial Network for 2021 (in current EUR prices). This was cut to EUR 8 bn in May 2020, amounting to about 45% of the development projects of the defence industries of the EU Member States. For context, in years 2008 and after, a total of around EUR 24 bn was cut. See **Meyer, C. O.; Bricknell, M.; Pacheco Pardo, R.; Jones, B**. 2021. How the COVID-19 crisis has affected security and defence-related aspects of the EU. Brussels: European Parliament. https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/653623/EXPO_IDA(2021)653623_EN.pdf.

the defence sector has been severely reduced[19]. At the same time, considering the immediate effects of the crisis in the EU in mid-2020, companies with a larger share of civilian revenue were impacted more seriously compared to companies with an exclusively military-derived revenue[20].

Looking at the government expense dynamic during the COVID crisis in the EU, it is interesting to see that the majority of European Union member states planned to increase their defence spending in 2021.[21] Zooming into the European land and naval industry, for example, one can see that their combined turnover went up even by 6.4%, from €68bn in 2019 to €72.3bn in 2020. Military exports increased by 14%, reaching as high as €45.6bn in 2020.[22] This demonstrates that the reasons for the problems in the sector, at least among the EU member states, should be sought elsewhere.

As Béraud-Sudreau argues, one of the problems in the EU is that member states may still prefer to prioritise their local industry over off-the-shelf imports, even more so than they do today[23]. This means that risk in export markets is tougher. This comes in a context where arms' export to some controversial extra-EU customers is coming increasingly under the spotlight. This will likely further exacerbate intra-EU competition[24]. For the time being, however, as Béraud-Sudreau contends, given the challenges in many economic sectors, defence still appears to be a "safe harbour", a "stable oasis in

[19] Levels of R&D investments into pharmaceuticals, biotech, computers and electronics have, in comparison, seen a significant rise. See **Paunov, C.; Keenan, M**. 2021. COVID-19: A pivot point for science, technology and innovation? – OECD Science, Technology and Innovation Outlook. https://www.oecd-ilibrary.org/sites/75f79015-en/1/3/1/index.html?itemId=/content/publication/75f79015-en&_csp_=408df1625a0e57eb10b6e65749223cd8&itemIGO=oecd&itemContentType=book.

[20] E.g. BAE Systems saw a growth of 4.8% of its revenue in half a year's results in 2020; Patria +6.9% Hensoldt +9.5%. See **Béraud-Sudreau, L**. 2021. COVID-19 as An Opportunity for European Armament Cooperation. Paris: Institut de Recherche Stratégique de l'Ecole Militaire. [**Béraud-Sudreau** 2021] https://www.irsem.fr/media/5-publications/notes-de-recherche-research-papers/rp-irsem-111-b-raud-sudreau.pdf.

[21] Ibid.

[22] Combined European investment in defence R&D amounts to roughly €10.5bn, mainly from national governments as key customers. Despite a general increase in defence spending, investments in defence R&D remains low in percentage of the over - all defence budget. See **Aero-Space and Defence Industries Association of Europe** 2021. Facts and Figures 2021. https://www.asd-europe.org/sites/default/files/atoms/files/ASD_Facts%26Figures_2021_.pdf.

[23] Even if some of the largest spenders chose not to decrease their military expenditure, they may still prefer to prioritise their local industry over off-the-shelf imports, even more so than they do today. See **Béraud-Sudreau** 2021.

[24] Ibid.

the current chaos". But this thinking is rather short term. Indeed, the defence industry sector traditionally takes the hit in economic crises with a delay compared to the rest of the economy. This was also the case after the 2008 financial crisis. It is a "consensus" in the sector that a true crisis will arrive in mid- to long term[25].

Nevertheless, there exist more serious supply chain-related problems for the European defence industry. As the same study by Béraud-Sudreau asserts, the COVID-19 crisis has influenced the supply chain of the European defence industry in two ways: by showing dependencies on non-domestic or non-European suppliers and by jeopardising the survival of SMEs that are critical for the defence industry. More specifically, even though some of them are losing revenue, the largest defence companies are probably too big to fail. Still, the defence industry relies on complex supply chains where many smaller companies are involved and are often active in both the military and civilian domains. Those companies have been severely impacted in some sectors, and this is where the short-term impact is the harshest on the European defence sector. Delays in production have led to delays and reduced number of deliveries, which means less money since the number of payments has been reduced, leading, in turn, to cash flow problems[26]. The vulnerability of SMEs globally and reliance on the global supply chain have also been the case in the UK's commercial aerospace, making companies look to local suppliers. Generalising upon that, the UK MOD noted that the international trend appears to be a movement towards increasingly local supply chains, accompanied by a risk of protectionism, motivated by security, surety of supply and economic stimulus[27]. The added challenge for the A&D industry is that the technical, safety and security aspects of their work mean that supply chains are often specialised and require suppliers to be pre-qualified. This process can be both

[25] Ibid. See also **AeroSpace and Defence Industries Association of Europe** 2021. COVID-19. https://www.asd-europe.org/covid-19-updates-resources. It argues that while defence and security have not faced the same immediate market meltdown as civil aviation, it may well suffer from the severe pressure on public budgets that follows the pandemic.

[26] **Béraud-Sudreau** 2021. For supply chain problems in the US, see **Losey, S**. 2021. No Company is Immune: Supply Chain woes weigh on defence firms. Defence News, November 23. https://www.defensenews.com/air/2021/11/23/no-company-is-immune-supply-chain-woes-weigh-on-defense-firms/. [**Losey** 2021] For similar problems in Australia, see **Parliament of Australia** 2020. Effects of COVID-19 on Australia. https://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Foreign_Affairs_Defence_and_Trade/FADTandglobalpandemic/Report/section?id=committees%2Freportjnt%2F024552%2F73973.

[27] **UK Parliament** 2021. The impact of COVID-19 on the Defence Supply Chain., 14 February 2021. London: UK Parliament. https://publications.parliament.uk/pa/cm5801/cmselect/cmdfence/699/69907.htm#footnote-023.

costly and time consuming, creating barriers in terms of both sourcing new suppliers and exiting existing relationships[28].

As the vice president of AIA John Luddy told the US-based Defence News web portal, since end-use producers rely on components that SMEs in aerospace and defence produce, "such as bolts, wiring, hoses and electronics," the losses the latter suffered in terms of employees, revenue and products had serious effects throughout the rest of the industry. In turn, ML Mackey, chair of the small business division for the National Defence Industrial Association, argued that those SMEs tend to be "niche" companies that specialise in only a single or few components. Those parts can still be critical for the military to keep planes, weapon systems and other equipment operational[29].

As for supply chain problems, as brought up by AIA, they can stem from a variety of issues, such as a lack of raw materials to make vital parts; bottlenecks when trying to transport finished items, like a shortage of shipping containers; backlogged ports without enough people to unload shipments; or a dearth of trucks available to drive items across the country. Financing challenges also dealt another blow to those small firms[30].

A study conducted among Finnish manufacturing companies, including one defence-related company, shows a similar range of problems connected to the supply chains that were identified globally and regionally. Common issues included decreased supplier capacities, increased vulnerability because of multiple supplier tiers, and a reliance on a few suppliers and decreased responsiveness because of a lack of visibility in the supply chain. Next to pointing to material flows that were disrupted during the COVID-19 pandemic, the analysis highlights the fact that some suppliers' capacities seem to have decreased, even in the long term[31]. The study also mapped the most common methods for addressing these vulnerabilities and disruptions,

[28] **Matthews, P.; Nicholson, J**. 2021. How to Reshape Aerospace and Defence Supply Chains for Resilience. 2 February 2021. London: Ernst & Young. https://www.ey.com/en_uk/aerospace-defense/how-to-reshape-aerospace-and-defence-supply-chains-for-resilience. To bring an example from the US, the average American aerospace company relies on roughly 200 first tier suppliers. See **US Department of Defence** 2022. Securing Defense-Critical Supply Chains: An action plan developed in response to President Biden's Executive Order 14017. February 2022. https://media.defense.gov/2022/Feb/24/2002944158/-1/-1/1/DOD-EO-14017-REPORT-SECURING-DEFENSE-CRITICAL-SUPPLY-CHAINS.PDF.

[29] See **Losey, S**. 2021.

[30] Ibid.

[31] **Rönkkö, P. B.; Majava, J.; Isopoussu, A.; Kaupplia, O**. 2021. An Ability to Survive Disruptions: Findings from Three Finnish Manufacturing Companies' Supply Challenges during the covid-19 Pandemic. – Managing Global Transition, Vol. 19(2), pp. 105–126. https://ltu.diva-portal.org/smash/get/diva2:1615619/FULLTEXT01.pdf. [**Rönkkö et al**. 2021]

including increasing inventory levels for critical components, transferring from single- to dual- or multi-sourcing, and the decentralisation of the supply chain to mitigate country-specific disruptions. Also, supplier collaboration was increased to share real-time information and identify common risks[32].

4. Results of the survey and interviews conducted with the members of EDAIA

An online survey in the ILIAS environment was carried out in May 2020 to study and predict the influence of the COVID crisis on the companies of the Estonian Defence and Aerospace Industry Association (EDAIA). The survey was conducted by the Estonian Military Academy, TalTech and the Estonian Ministry of Defence.

19 companies provided answers to the survey. As it was possible to skip questions, the number of answers for specific questions varied. It should also be taken into account that the survey was carried out just a few months after the start of the COVID pandemic, thus making the answers partly estimative. It should likewise be noticed that for many EDAIA members, the defence industry forms merely a (small) part of their turnover. Therefore, the answers provided might not exclusively be defence sector-specific but might also touch upon wider problems related to the COVID crisis.

First, the main results of the survey are presented. Most of the companies estimated that within the next year, there will be no major changes in supply chains. Still, they pointed out that the delivery times for input are expected to be longer. About half of the respondents said that a decrease in demand could already be felt, and some of the companies predicted that this trend will continue.

9 companies predicted that they will have enough working capital for the next three months, 3 companies for six months, 2 companies for 1 month, and 1 company for more than 6 months. 9 companies said that, at the moment, they do not need additional working capital.

Most of the companies predicted that they will be viable for at least the next three months, and for longer periods if cuts are made. Most of the companies did not consider changing their profile to be a reasonable option.

[32] **Rönkkö et al**. 2021.

The majority of the companies used road transport for both input and output; they assumed that this will not significantly change. However, they predicted that logistics will take more time than it used to.

The companies did not point out any single governmental measure for helping them, i.e., the state preferring Estonian companies for orders and contracts, keeping the capacity of already existing contracts, revising the policy for public procurements, revising the laws on firearms, and assistance with strategic product transport.

All in all, in May 2020, the situation was considered quite stable but the companies perceived a noticeable economic uncertainty. The main problems brought up were a decrease in demand and slower supply changes. Generally, the companies made rather cautious estimations for the next year assuming that the problems already present will continue.

In order to understand the actual effects of the first two years of the COVID crisis, interviews were carried out amongst companies belonging to the EDAIA. The aim of these interviews was to obtain a provisional grasp of the situation, which is why we chose representatives of three companies with a defence profile but at different sizes and stages of development. All three companies provide mainly hardware solutions, including electronics. Company A has less than 10 employees and a yearly turnover of less than 100K €; company B has less than 100 employees and a yearly turnover of between 5 and 10M €; company C has less than 200 employees and a yearly turnover of between 10 and 20M €.

Focusing on the last two years, the companies were asked about the following topics: changes made due to the COVID-19 crisis, and support received from the government, the Ministry of Defence, EDAIA and other institutions. Within this framework, changes in the GVCs were observed.

The interviews were semi-structured. 17 questions covering the above-mentioned topics were sent in advance. The interviews were carried out orally (in person or via electronic means) in June 2022. If some questions were deemed unnecessary or had already been answered, they were skipped. The answers were analysed in the theoretical framework developed and compared to the experiences from other countries.

All the companies admitted that there was a noticeable decrease (up to 20%) in turnover at the beginning of the COVID period. This effect was less severe for company C due to long-term contracts and agreements. Demand diminished because of economic uncertainty; projects that were not critically necessary were frozen for at least a few months. Nevertheless, companies predicted that turnover for 2022 would be at a pre-crisis level or higher.

All the companies (especially A and B) point out that the biggest problem in their supply chains is the availability of electronic components (but also metals such as aluminium). From the beginning of the COVID crisis, the availability of components has decreased and prices increased dramatically (sometimes even more than 100 times) and there are no signs of the previous situation returning. Companies are looking for alternative providers for components, but since this problem is common for the entire sector, it takes some effort. It is especially so for smaller companies who have smaller funds and less manpower to deal with the challenges. Companies were forced to make more risky decisions, for example, buying components without a supplier warranty (from so-called brokers). Company C said that they have established a situation where they have multiple providers for nearly all critical components and have managed to mitigate risks. Companies A and B pointed out that an increase in prices caused a situation where they lack working capital. Company C with assumingly larger reserves did not mention such a problem.

Lack of components and long delivery time also influence several other aspects. For example, company B pointed out that while prior to the crisis, developing a new product took 2–3 months, now it takes around 6 months. It also happens that some components used for a particular device have to be changed during development and production. This sometimes requires additional coordination with clients and thus complicates the process even further.

All of the companies have close connections with other companies worldwide and in Estonia. However, the current position and the desired position in GVCs are different. Company A receives part of its turnover from outsourcing to another Estonian company. In addition, they are looking for possibilities to be the primary provider for the client (for example, via public procurements). To achieve this, they have international partners and representatives in different countries. Company B's turnover is mostly (85% and more) from outsourcing to 2–3 large companies that have a noticeable share on the international market. Company C's ambition is to be the top-level provider for large-scale clients (countries). Still, at the moment, they are also outsourcing their product for other companies.

Support to the EDAIA companies from the state and the government was generally considered reasonable. The COVID-specific measures (for example, wage subsidy) were described as having a rather low relevance but still being useful. Companies B and C pointed out that the most important state support is funding provided by Enterprise Estonia (EAS). It was also pointed out that

since the EAS took into account a drop in turnovers due to the COVID crisis, it could be considered an indirect support for dealing with COVID-related problems. Nevertheless, company C pointed out that EAS funding should take into account more seriously the research and development work done (for example, cooperation with universities). The research and development support provided by the Ministry of Defence was considered generally useful, especially by A. Because of its quite limited size (usually 20–100K € per company), it has a larger effect for small, starting companies. B and C said that they are looking more to the EAS for larger funding. Company C pointed out that, in their opinion, state support would be more efficient if it concentrated on 2–3 fields in the Estonian defence industry with the most perspective (considering state needs and export potential). Diplomatic and political support to the EDAIA companies was considered rather efficient. It was also mentioned that the EDAIA itself as an organisation helps to establish connections. Company C emphasised that, for them, support on a political and diplomatic level is most important since most major agreements influencing the defence policy and cooperation are made on a diplomatic level. One specific field where companies need state assistance is management of permission for strategic products. At the moment, this process is complicated and time-consuming.

Companies A and B pointed out that public procurements play an important role in the Estonian defence sector. They expect better means for supporting Estonian companies. Since procurements have to be open and international, one possibility for supporting Estonian companies is to require insourcing from Estonian companies in the procurement conditions, or to establish a means for maintaining facilities in Estonia. The ability to provide product support, maintenance and further development more effectively should be considered an important advantage that should also be favoured by the end user (the Estonian Defence Forces, for example).

To sum up, the companies have not made any major changes due to the COVID-19 crisis in the last two years. The main conclusion is that managing input (mainly electronic components) requires more attention and the companies have increased the prices of their products to handle higher input prices.

5. Discussion and conclusions

The case study of the Estonian defence industry shows that companies are already well integrated or are looking for strong integration into the GVCs and are heavily dependent on foreign markets. Typical challenges associated with economic development in small states were also evident, in particular regarding small home markets that limit possibilities for economies of scale and geographical agglomerations, and limited financial capabilities or human resources to invest in cutting-edge science, research, and development. However, Estonian defence companies have avoided over-specialisation and negative lock-in; new companies have been emerging around globally rapidly developing fields (such as cyberwarfare or unmanned vehicles).

While the defence industry market leaders have been impacted less by the recent crisis, the Estonian case also confirms that the impact has been more evident on SMEs which, by nature, have less market power, abilities to find alternative providers, etc. And, within the SME group of the Estonian defence industry, micro-companies have been especially strongly impacted, while medium-sized companies were influenced less.

Although the recent crises have resulted in some drawbacks in globalisation, this trend is generally expected to continue. Still, the Estonian case does illustrate the risks brought about by the increasing connectivity of supply chains, the number of actors involved, as well as economic and political instability found in certain countries leading to an increased focus on a more regionally-based (European) view on production inputs, sales, and co-operation.

Drawing on the Estonian case study, one can see how the defence industry competes with other sectors for input (components, etc.) but, due to the specific security and political restrictions, the choice is even more limited. Combined with an increasing demand, that phenomenon will likely end up with noticeably higher prices for the end user.

Another controversy reared its head: in modern technology development, all processes are optimised to be faster and more efficient. At the same time, bottlenecks in supply chains severely limit the speed of development.

Following the trends of the last decade, dealing with difficulties in hardware development might cause companies to prefer solutions that lead them towards more software-based solutions and upgrades wherever possible.

The recent COVID crisis has also called for a more active role for the state in increasing regional resilience. Maintaining human capital via wage subsidies has had a generally positive impact on the economic resilience of a

region, as well as on individual countries and companies. Due to a shortening of the life cycle of the defence industry products and services, companies need to innovate, which is why R&D grants remain important for long-term development. The role of public procurement was generally widely acknowledged, and at the time of the crisis—even if local defence markets are small, supplying to local defence forces serves as a mark of quality and opens doors in foreign markets.

The case study also supports the arguments raised in chapter 2 on the importance of democratic corporatism, i.e., having a comprehensive domestic decision-making framework built on consensus, which is to be used for building economic flexibility that allows companies to respond to fluctuations in the international economy now and in the future.

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