Marshallian Clusters: Evidence from the Defence industry

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Abstract

Geographic agglomerations of firms have been widely studied in the literature and are often referred to as industrial clusters. There are several definitions and typologies by which clusters are categorised. In this paper, we use Markusen's (1996) typology/distinction of four different types of industrial districts: the Marshallian/ Italianate type, the hub-and-spoke, the satellite industrial platforms, and the state-anchored clusters. As part of her findings, Markusen provides an in-depth analysis of her proposed typology, however for the purpose of this paper, only a summary of the aspects is described/ used, and they can be summarized as follows: 1.the number and size of companies participating in the cluster as well as their structure and configuration 2. the internal or external orientation or integration of the companies within the geographical / institutional entity of the cluster, as well as the intraregional and interregional linkages they have developed, 3. The management of innovation created by the cluster, 4. the existence (or not) of a public entity around which the cluster is "anchored". To investigate our propositions, we follow the lead of numerous other studies on the dynamics of industrial clusters, and we proceed with the study of two cases: the Croatian Defence Industry Competitiveness Cluster and the Latvian Security and Defence Cluster**.**

Keywords: Cluster, Defence, Marshallian

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Scope

The scope of this paper is to investigate and identify in which of the four types of industrial clusters described by Markusen (1996), the Croatian Defence Industry Competitiveness Cluster and the Latvian Security and Defence Cluster belongs to. Our initial argument is that in states such as Croatia and Latvia where defence industrial capabilities are somewhat limited and the local industry mainly consists of SMEs the Marshallian type will be "dominant".

Introduction: Industrial Clusters, Geography and Institutions Building

Geographic agglomerations of firms have been widely studied in the literature and are often referred to as industrial clusters. Although, there are several definitions and typologies by which clusters are categorised (Porter, 1990, Porter, 1998, Krugman, 1991 Mytelka, Farinelli, 2000, Gordon, McCann 2000, Guerrieri, Pietrobelli, 2000, Markusen, 1996), it has become almost a common practice to begin any study/discussion on economic clusters with the "disclaimer" that there is no adequate, universally accepted definition of the phenomenon (Gareev, 2012). As Martin and Sunley, (2003) say, constructing a critical and solid review of clusters is a difficult task because there are many different varieties and types of clusters and a constant feeling that there must be "more on it than this," creating a misbelief of a chaotic concept and/ or a policy panacea.

The critique of the conceptual approach of the phenomenon of cluster is further reinforced by the dramatic changes in terms of space and time being brought about by globalisation in which the removal of bureaucratic formalities and procedures, helps companies to source capital, goods, information, and technology from around the world, often with the click of a mouse, diminishing the role of location in competition (Porter 1998). If this is true, why the odds of finding a high-performance auto company in southern Germany, or a fashion shoe company in northern Italy, is higher than in most other places (Porter 1998)? The reason is that today's globalised economy may diminish the value of geography, but the geographic concentration is still valuable (Buciuni, Pisano, 2015).

As already discussed, giving a universally accepted definition of the phenomenon we call cluster is a rather tricky task. Nevertheless, clusters expose quite specific and distinct features in many cases, which can be summarised as follows. An Industry Cluster is a group of companies sharing local resources, using similar technologies, and forming linkages and alliances. These linkages can take the form of buyer-supplier relationships, sharing of human resources, machinery and/or infrastructure, joint marketing, training, or research initiatives, associations, and lobbying (Porter 1998). Businesses and institutions engaged with one another at various levels within a cluster. Engagement allows individual companies to increase their competitive advantage (Karaev, Koh, Szamosi, 2007 and Singh, Garg, Deshmukh, 2008, and Singh, Garg, Deshmukh, 2010) through the creation of business synergies (Jankowska, Götz, Główka, 2017) and the pooling of resources, knowledge, and innovation (Keeble, Wilkinson, 1999 and Cumbers, Mackinnon, Chapman, 2003). Hence, an industrial cluster may be seen as an initiative to organise the participating members in a coordinated manner, where local rivalry/competition is used creatively to generate innovation in order to increase competitiveness by facilitating co-operation between companies, companies and R&D agencies / institutions, as well as between companies and local, regional and / or national government Morgan and Hunt (1994).

From those as mentioned earlier, one can understand that some of the main "ingredients" for the formation of an industry cluster are industry, innovation, and governmental institutions.

1. Industry: For any cluster to develop, a large concentration of interconnected companies (either 'vertically' or 'horizontally' or in terms of location), is needed (Albino, Carbonara, Giannoccaro, 2007). These companies could be dispersed over a geographical region but operate in a common or closely related business sector. Particularly for SMEs being part of a cluster and interacting with competitors and established players from the related industries may help them achieve faster growth, recognition and status within the market through improved competitiveness (Jankowiak, 2018 and Kowalski, 2014). In some cases, the structure of the clusters is hierarchical and unsymmetrical (Lan, Kai, 2009) and is defined by the existence of

companies with greater financial and institutional weight, which delineates the development and structure of a cluster (Randelli, Lombardi, 2014), acting as a hub. These companies may be located within the location of the cluster or elsewhere.

For example, in Seattle, Boeing acts as the hub for the aerospace industry, Microsoft for the software industry, while the Fred Hutchinson Cancer Center and the University of Washington "shaped" the faith and structure of the local biotechnology industry (Gray, Golob and Markusen 1996). More on that direction Randelli, and Lombardi (2014) studied the topological relationships between the leading firm and their suppliers of the Leather Products Cluster in Florence, concluding that few leading firms have emerged over time, acting as a gatekeeper for the clusters, enabling them to connect with global networks and affecting their sustainability.

On the other hand, in some cases, the "hub" companies may not be based within the cluster's geographical boundaries. Multi-National Enterprises are often attracted to clusters once clusters are recognised as 'experts' in the related industries. In fact, the inclusion of renowned foreign-owned companies in a cluster could further enhance its leadership in the related business directions and contribute to its business success, according to research carried by Julian Brikinshaw (2000).

2. Innovation: Any industrial cluster can be seen as a 'hub' (Rialland, 2009) where knowledge and associated technologies are circulated/shared. By establishing a knowledge exchange co-operation platform, the cluster facilitates the enhancement of its members' scientific and technological levels, initiating a dialogue which is oriented towards the generation of innovation. Through this process, the member companies become part of a "technological circle," the success of which is further reinforced by the interpersonal relationships developed between the innovation/R&D managers of the cluster's companies. These good interpersonal relationships and face-to-face interactions facilitate the circulation of "tacit knowledge" (Seeley, 2007), in other words, knowledge which is difficult to circulate, mainly due to the nature of the message it conveys. In contrast to "explicit" knowledge that can be easily transmitted and after that perceived and re-used, "tacit" knowledge usually requires an in-depth explanation of "how something is done". Placing the headquarters of any new cluster in a 'central' location (of the specific geographical region that the cluster

is to cover), aids in this type of interaction, as companies can more easily have daily face-to-face meetings, visit each other's factory, or spend time in their offices (Malmberg, Maskell, 2002, Diez, 2001, Guerrieri, Pietrobelli, 2000, Bembenek, Piecuch, 2014).

Furthermore, in a cluster initiative, the generation of innovation lies mainly with the technological 'experts' familiar with the dynamics and trends of the specific global markets rather than in the hands of inexperienced executives of smaller firms. This, in turn, aids smaller firms that now have access to a more structured and "explicit" knowledge, changing the focus of their business development outlook towards the future, rather than just building on the past experiences and portfolio (Giuliani, Bell, 2005). The reason is that the technical experts feed the district with knowledge absorbed from external sources, behaving as 'gatekeepers of knowledge'. This may have adverse effects in creating innovation/ knowledge for the cluster as the "innovations building process" depends on a few dominant actors' strategies (Morrison, 2008).

Innovation building may be considered a gradual and interactive process whereby new knowledge is built upon previous knowledge through interacting and exchanging with other innovation/'knowledge' stakeholders/entities. Hence, the knowledge that companies could potentially accumulate through their activities in the cluster will be dependent both on previous knowledge owned and, on the level, and quality of interaction, both at the personal and at the company level, with other entities within the cluster (Knoben, 2009, Cassi, Plunket, 2015). This type of knowledge could be characterised as "knowledge spillover" as it is unintentionally transmitted to others beyond the company boundaries (Breschi, Lissoni, 2001 and Audretsch, Feldman, 1996).

It is widely accepted that regions with an accumulated knowledge 'capital' can more easily produce new knowledge when compared with other areas/regions which are less advanced in the related scientific domains (Boschma, Ter Wal, 2007). This is because, as discussed previously, in such a case, companies have a more extensive "knowledge/innovation base" upon which they can build their efforts. Additionally, when knowledge is assembled in a specific area, a 'critical mass' in terms of know-how is established. Companies of this area can more easily initiate a dialogue, create

innovation synergies and form strategic alliances. Nevertheless, geographical proximity cannot be assessed in isolation and as Boschma (2005) advise, there are five more dimensions of proximity (cognitive, organisational, social, institutional and geographical) that matter. This proximity/ies will permit for more frequent face-to-face interactions, which in turn will facilitate the circulation of "tacit knowledge" (Seeley, 2007). Tacit knowledge (as discussed in previous) is challenging to transfer, mainly because of the nature of the message it conveys, often requiring a detailed explanation by someone to "show how something is done". During such a process, tacit knowledge becomes explicit, meaning knowledge that has been articulated and codified (Nonaka 1994).

Overall, it can be deduced that companies acting in a 'synchronised' manner/direction (such as is the case typically in clusters) are more dynamic and competitive, mainly since they "share" their knowledge and they built upon this enlarged 'pool' of knowledge capital. This process of "collective efficiency" (Schmitz, 1997) is adopted by the participating companies and, hence, the cluster as a whole. In turn, this leads to the more rapid evolution of the respective clusters and the creation of new businesses, as the knowledge acquired/shared will eventually lead to enhanced production processes, higher quality products/services, etc, ultimately leading to economic growth and exports (Schmitz, 1997).

3. Government: While until recently, government actions may not have been designed to promote cluster development, nevertheless, related policies have had a catalytic effect on the creation of these. In more recent years, governments have identified the strategic importance of clusters and have implemented dedicated actions and/or policies intended to accelerate clusters' growth (Jankowiak, 2012). Even in the case of 'mature' clusters, such as Ottawa's Silicon Valley North, concerted actions on the part of the government (e.g. as far as R&D spending, tax incentives and government procurement), proved to be largely beneficial for the cluster's development (Ghent, 2004). Similarly, in the case of the Bangalore's Software Cluster, it was a deliberate public policy by India's government, which gave rise to the formation of 15 related software technology parks (Nair, Ahlstrom, Filer, 2007).

Still, the argument is not if governments can create clusters, but if they can provide the business, innovative institutional, and regulatory environments vital for cluster success (Guidelines for Cluster Development A Handbook for Practitioners[2], last accessed on 09/03/2021). Although the debate is still open and vivid (Barkley, Henry, 2002) one can safely conclude that the key role for government is to enable *the creation of clusters.* Whether in the form of providing direct access to finance or in less direct ways through creating enabling policy frameworks, strategic action plans and the provision of trained, motivated public service employees (Guidelines for Cluster Development A Handbook for Practitioners, last accessed on 09/03/2021[3]).

Figure 1: (%) Initiation and Funding of Clusters
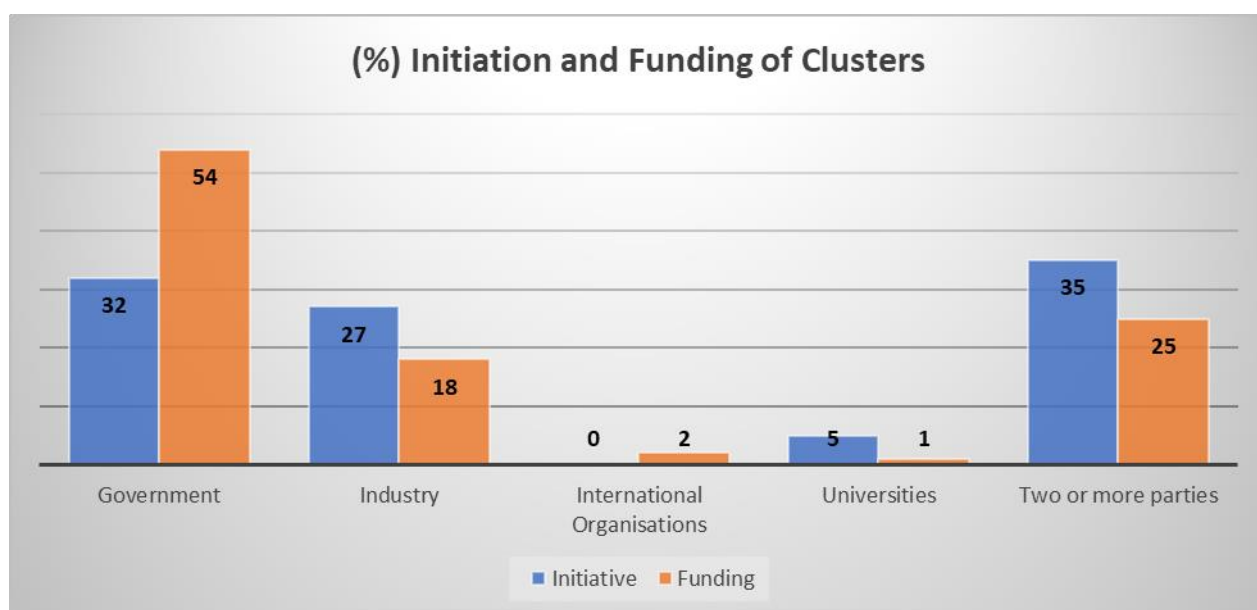
Source: Sölvell Ö., Lindqvist G., Ketels Ch., 2003, The Cluster Initiative Greenbook

When it comes to cluster initiatives, it should be noted that typically these are initiated primarily by governments (32%), then by the industry (27%), or equally by both (35%) (Sölvell, Lindqvist., Ketels, 2003). Therefore, government involvement at the stage of cluster initiation accounts for a total of 67% of clusters. More specifically, Sölvell, Lindqvist., Ketels, (2003) provide the below-related data:

- In 32% of the cases the initiative to set up a cluster comes from the government. In 27% of the cases, the initiative comes primarily by the

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[2] https://www.enterprise-development.org/wp-content/uploads/GuidelinesforClusterDevelopment.pdf
[3] https://www.enterprise-development.org/wp-content/uploads/GuidelinesforClusterDevelopment.pdf

industry, in 5% from universities, while in 35% jointly by two or more parties (usually by government and industry).

- In terms of financing, governments' involvement and contribution are even more critical as in 54% of the cases, the government is the primary source of funding. In comparison, only 18% of clusters are primarily funded by industry, 1% by universities, 2% by international organisations and 25% by two or more parties.

We should also mention that it is not only the central/national government that facilitates creating a cluster. The local and/or regional governments and/or institutions also play a significant role towards this direction. One can mention the endeavors of local and regional governments and institutions of Quebec, Canada and France, where their facilitating efforts are of significant importance for the creation of clusters (Gardes, Dostaler, Barredy, Rouger, 2015).

Clusters: Markusen's categorisation

It is a common belief enhanced and reinforced by a solid and growing body of literature (Markusen, 1996, Mytelka and Farinelli, 2000, Gordon, McCann, 2000, Guerrieri, Pietrobelli 2000) that there is not only one type of clusters but several types that have different characteristics. For example, Mytelka and Farinelli (2000) make two broad distinctions regarding clusters' classifications. The first is between clusters that originate as spontaneous agglomerations of enterprises and other related actors and those that are induced by public policies. On the other hand, Gordon and McCann, (2000) distinct between three models:

- Industrial-complex Model: These industrial complexes are characterised by sets of identifiable and stable relations among firms which are in part manifested in their spatial behavior. The connections are conceived primarily in terms of trading links, and it is these patterns of sales and purchases which are seen as principally governing their locational behavior.
- The Model of Pure Agglomeration: This pure agglomeration model presumes no form of co-operation between actors beyond what is in their individual interests in an atomised and competitive environment. Profitable local

interaction is made possible through a combination of chance, the law of large numbers (increasing the probability of suitable partners being available) and the natural selection of businesses benefiting from the opportunities on offer.

- The Social-network Model: In this type of cluster, the relationships between the parties of the cluster are built on rules and regulatory norms that essentially cover the totality of the cluster behaviors.

Finally, Markusen's distinctions of industrial clusters are based both on the role of large firms and the state (Clark, Huang, Walsh, 2009) and different interorganizational patterns and arrangements (Bell, Tracey, Heide, 2009). Markusen distinguishes a much more diverse picture than those as mentioned above, identifying four distinct types of clusters:

1. Marshallian clusters consist mainly of locally owned SMEs (Bell, Tracey, Heide, 2009) and are characterised by significant co-operation levels among these SMEs (Clark, Huang, Walsh, 2009). Marshallian clusters are also characterised by low degrees of co-operation or linkage with firms external to the district and a high level of "embeddedness" to the district, which creates a unique local cultural identity (Markusen, 1996). The "bonds" created between the companies of the cluster are based on "interactions" that promote trust and a "sense of belonging", reducing transaction costs and facilitating the exchange of information and knowledge through the existence of interpersonal relationships, enhanced by intensive exchanges of personnel between the firms of the cluster (Hervas-Oliver, Sempere-Ripoll, Estel -Miguel, Rojas-Alvarado, 2019). The cluster members create and share innovation (Markusen, 1996), while knowledge transfer is both intended and unintended and is often the result of proximity and employees' mobility between companies (Ferreira, Serra, Costa, Maccari, Couto, 2012). Co-operation is formally encouraged by government-sponsored industry organisations (Seeley, 2011).

2. Hub-and-spoke types of clusters have one or a few dominant firms surrounded by multiple smaller suppliers (Gray, Golob, Markusen, 1996). The clusters' structure is hierarchical and unsymmetrical (Lan, Kai, 2009). It is defined by

the existence of companies with greater financial and institutional weight, which delineates the development and structure of the cluster (Randelli, Lombardi, 2014), acting as a hub. The hub companies are located within the location of the cluster (Basant, 2002). The importance of the hub companies in the formation and sustainability of a cluster is highlighted by the work of Carbonara (2002), who researched clusters from Italy, concluding that the most dynamic of them modified their configuration and structure. The most prominent of the changes/ modifications was the increasingly important role of large firms, with a leading/ hub position within the cluster. A well-known example of a district with hub-and-spoke clusters is Seattle, in where Boeing acts as the hub for the aerospace industry, Microsoft for the software industry, while the Fred Hutchinson Cancer Center and the University of Washington "shaped" the faith and structure of the local biotechnology industry (Gray, Golob and Markusen 1996). Another example of a hub-and-spoke cluster is that of the East Midlands Aerospace cluster in the UK. The cluster's hub firm is the British engine manufacturer Rolls-Royce, and the spokes are its many second and third-tier suppliers and other SMEs (Smith and Ibrahim 2006). The leading firms of the hub-and-spoke clusters act as a "gatekeeper" for the clusters, enabling them to connect with global networks and affecting their sustainability (Randelli, and Lombardi, 2014) and also "regulating" and shaping the innovation process of the cluster (Ferreira, et al., 2012). Under this context, Malipiero, Munari and Sobrero (2005) conclude that hub companies act as "engines of innovation, internally generating new and sophisticated knowledge," and by leveraging on their intellectual and social capital, they also act as "technological gatekeepers" facilitating the absorption and internal dissemination of knowledge. Hub companies usually have stronger ties to national trade associations than local, as they tend to lobby more on the national than local level (Gray, et al. 1996).

3. Satellite platform: as in the hub-and-spoke type of clusters, the structure of a satellite platform cluster is somehow hierarchical and unsymmetrical (Lan, Kai, 2009), typically consisting of an assemblage/ concertation of branch facilities of externally based multi-national firms (He, Fallah, 2011, Boja 2011). One of

the satellite platform clusters that is frequently mentioned in the literature is that of the Research Triangle Park in North Carolina, which groups together several R&D centers of high-tech multi-national firms (He, Fallah, 2011 and Boja 2011). Other examples of satellite platform clusters are the aerospace clusters of Mexico, such as the one situated in Baja California, (Gomis, Carrillo, 2016 and Romero, 2011). In such types of clusters, the remotely located "parent" company/ies make crucial decisions for the local company's consisting of the core of the cluster, thus "shaping" the structure and potentiality of the cluster (He, Fallah, 2011). Local companies provide capabilities and knowledge leading to the formation of a type of co-operation between the local "aspects" of the cluster and the externally based multi-national firms that resembles to a "multiple diamond", rather than a "single diamond" cluster composition (Rugman, Verbeke, 1993). When it comes to innovation, the multi-national "parent" companies are simultaneously a knowledge generator and a knowledge seeker, as Rugman and Verbeke (1993) conclude, also playing the role of "global pipelines" diffusing knowledge Morrison, Rabellotti, and Zirulia (2012). Such pipelines are beneficial for the accumulation of knowledge only if the "local aspects/ firms" of the cluster are either characterised by a "high-quality local buzz" or are weakly endowed in terms of knowledge as Morrison, et al. (2012) concluded. The local and/or national government's role is to provide infrastructure, tax breaks, and other generic business inducements (Markusen, 1996).

4. State-anchored: while in the types mentioned above of clusters (Marshallian, Hub-and-spoke, Satellite platform) already discussed, the initiative for the creation and the management of them is mainly taken by companies (locally-owned SMEs – Marshallian Clusters, hub companies- Hub-and-Spoke Clusters and satellite "parent" companies- Satellite Platform Clusters) in this type of clusters the activity of the member-companies are "anchored" to one or several large, governmental institutions such as military bases, state or national capitals, large public universities, etc. (Markusen, 1996). We should not fail to notice that governmental help is provided to all types of clusters. The difference in the state-anchored cluster is, as Markusen and Park (1993)

concluded in their research on the case of Changwon cluster, South Korea, the state's role as the lead agent, a factor that lessens the importance of traditional locational aspects. In the case of Changwon, the cluster was built due to the commitment of the state to build a military supply sector. In the state-anchored clusters, innovation is centrally coordinated, putting any activity in line with public objectives (the objectives of the anchor institution) (Jankowiak, 2012), while the members of the cluster are relatively unimportant to the creation of innovation (Ferreira, et al., 2012) as well as in the development of the cluster.

Table 1: Markusen's typology of clusters: A synopsis

Markusen's typology of clusters: A synopsis				
	Marshallian	**Hub-and-Spoke**	**Satellite Platform**	**State anchored**
Characteristics of the Cluster's Members	Locally owned SMEs	One, or a few, Hub firm/s – surrounded by multiple smaller suppliers	Assemblage/ concertation of branch facilities of externally based multi-national firms	A government-owned or supported entity surrounded by related suppliers (cluster members)
Innovation	Members of the cluster create and share innovation	Hub firms "regulating" and shaping the innovation process of the cluster, having the rule of knowledge "gatekeepers"	Multi-national "parent" companies are simultaneously a knowledge generator and a knowledge seeker / "global pipelines" and "agents" of knowledge diffusion	Innovation is centrally coordinated, putting any activity in line with the objectives of the "anchor" institution
Governmental Institutions	Government-sponsored industry	Hub companies have stronger	Local and/or national	Anchor institution/state is

Markusen's typology of clusters: A synopsis				
	Marshallian	**Hub-and-Spoke**	**Satellite Platform**	**State anchored**
	organisations	ties to national trade associations than local	government provide infrastructure, tax breaks, and other generic business inducements	the lead agent
Co-operation with companies and/ or other entities not part of the cluster	Low degrees of linkage with firms external to the district / high level of "embeddedness" to the district, unique local cultural identity	Defined by the Hub firm/s	Defined by the "parent" multi-national firm/s	Extended with the institution, the cluster is "anchored" to

The above-mentioned analytical framework is unfortunately static, an instant snapshot as Belussi (2015) concludes. This means that a cluster can make a transition from one type to another. Markusen, provides Detroit as an example, being "transformed" from a Marshallian district to a hub-and-spoke district (Markusen, 1996). Additionally, in "real word" clusters may have characteristics from different types of Markusen's distinction of industrial clusters. In Italy, for example, the Marshallian clusters are evolving through the consolidation of several leading firms, de facto modifying their configuration and structure to a hub-and-spoke district (Carbonara, 2002 and Belussi, 2015).

To investigate our propositions, we will use Markusen's distinction of industrial districts as a framework for analysis following the lead of numerous other studies on industrial clusters' dynamics. We will proceed with the study of two cases: the Croatian Defence Industry Competitiveness Cluster and the Latvian Security and Defence Cluster. As already set/discussed, the main research question is to investigate and identify in which of the four types of industrial clusters described by Markusen (1996) the Croatian Defence Industry Competitiveness Cluster and the

Latvian Security and Defence Cluster, belongs to. Our initial argument is that in states such as Croatia and Latvia, where defence industrial capabilities are somewhat limited and the local industry mainly consists of SMEs, the Marshallian type will be "dominant".

Despite the ongoing discussion about its limitations, the case study methodology is widely used across multiple scientific disciplines and fields (Thomas, 2011). There are several different kinds of case studies. The researcher has to choose between a single or a multiple case study. This decision is not always easy to make. The main difference between a single case study and a multiple case study is that in the last-mentioned; the researcher can analyse the data both within each situation and across situations (Yin, 2013). Thus, the researcher can analyse each case separately and then explore patterns of similarity or difference. When the researcher opts to use a multiple case study, this comes with both benefits and difficulties. Baxter & Jack (2008) state that examining multiple case studies can be time-consuming. On the other hand, this process allows for a wider discovering of theoretical evolution and research questions.

Even though as part of her findings, Markusen provides in-depth analysis of her proposed typology, for this paper, only a summary of the aspects is described/ used, and they can be summarised as follows:

1. the number and size of companies participating in the cluster as well as their structure and configuration,
2. the internal or external orientation or integration of the companies within the geographical / institutional entity of the cluster, as well as the intraregional and interregional linkages they have developed,
3. The management of innovation created by the cluster,
4. the existence (or not) of a public entity around which the cluster is "anchored".

Markusen's (1996) methodology/typology was selected because there is a concrete connection between a cluster and the role a government and/or a governmental institution could play in forming and managing the cluster. Defence Industry is one of the most complex industries in terms of the high technological content of its products (Matelly and Lima, 2016), the high financial risks related to

considerable development costs, and the complex supply chain structure (Dowdall, Braddon, 1995). Therefore, the cost of defence is rather high and in most cases, unsustainable. Nevertheless, the defence industry plays a vital role in national economies and the technological base of any given country, as it provides innovative products and significant socio-economic benefits (skilled jobs, etc.) (Sandler, 2008). Thus, the development of such sectors is rather important for a country. Apart from the above-mentioned socio-economic benefits, it also performs a "duty" of utmost importance, delivering sophisticated and innovative defence equipment to the local armed forces, enabling and securing their efficiency.

Therefore, the linkage between defence industry and the government is visible and tangible. In nearly every state, government policy is crucial in developing and growing a robust defence industry. Led by what Clift and Woll, (2012) describe as "economic patriotism" economic objectives and norms are in some cases subordinated to homeland interests because the government as Customer, Sponsor and Regulator (Heidenkamp, Louth, Taylor, 2013) plays an essential role in the formation of a defence industrial base. Said that it is crucial to investigate if the clusters under discussion are "anchored" to one or several large governmental institutions and/or policies (Markusen, 1996) or if other initiatives/ policies accelerate the cluster's development. To facilitate this discussion, the article will also try to understand and connect the clusters with the defence policies and priorities of the countries they are based on.

Croatian Defence Industry Competitiveness Cluster (HKKOI)

During the war period (1991–1995) Croatian defence industry developed swiftly due to the need for self-defence of the nation. Around 15% of the total state budget was allocated to developing the local military-industrial base. In the post-war period defence industry output declined. In 2002 defence sector comprised around 25 companies, and industrial production had fallen to 15% of the wartime peak achieved in 1993 (Black, Jenkins, Paoli, Kepe, Kokkoris, Hlavka, 2016). Croatian authorities tried to restructure and renovate the local defence sector to avert this (Simunovic, 1998). However, efforts to support the Croatian defence industry have

coincided with significant domestic defence spending cuts (Black et all, 2016). Domestic demand for the local defence industry products has been further depressed by the limited national defence spending (please see Tables 2 and 3), and the MoD's preference of acquiring 'off-the-shelf' solutions, rather than investing in new development projects (Black et all, 2016). This trend was averted in 2021, as according to estimations provided by NATO, Croatia's Defence Budget is expected to experience a significant increase in nominal values in 2021. This increase is also reflected in the percentual GDP allocation to Defence. In 2021 defence expenditure was 1.846 billion US$, equivalent to 2.79% of the country's Gross Domestic Product. This means an increase of approximately 800 million euros, compared to 2020, when defence budget was 1.031 billion euros.

Table 2: Croatian Defence Budget 2014-2021

	2014	2015	2016	2017	2018	2019	2020e	2021e
Milllion US$	1.064	883	837	924	966	1.002	1.031	1.846
(%) of GDP	1,85	1,78	1,62	1,67	1,57	1,65	1,80	2,79

Source: NATO, Information on defence expenditures, last accessed on 04/01/2022

According to the estimations provided by NATO, 43.5% of the 2021 defence budget was directed towards developing new military capabilities, a significant increase compared to 2020, when only 10,27% of the total budget was allocated to the purchase of new capabilities. Based on these amounts, Croatia is the NATO country that assigned the most significant amount for purchasing military equipment in 2021. It was the second last (10.3%), with only Slovenia allocating less (4.6%) in 2020 (NATO, Information on defence expenditures, last accessed on 04/01/2022[4]). The reason for that increase was the acquisition of 12 Rafale previously in service with the French Air Force. The purchase also included fleet support and training (Dassault Aviation, last accessed on 04/01/2022[5].)

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[4] https://www.nato.int/cps/en/natohq/topics_49198.htm
[5] https://www.dassault-aviation.com/en/group/press/press-kits/croatia-and-france-finalize-rafale-acquisition/

Table 3: Allocation of Defence Budget (%) by Main Category

	2014	2015	2016	2017	2018	2019	2020e	2021e
Equipment	5,56	8,01	7,51	5,69	3,37	6,55	10,27	43,50
Personnel	76,55	72,28	75,40	71,72	76,96	73,71	71,71	45,67
Infrastructure	1,24	1,98	1,26	3,59	1,00	1,41	1,65	1,40
Other	16,65	17,73	15,83	18,99	18,67	18,33	16,37	9,44

Source: NATO, Information on defence expenditures, last accessed on 04/01/2022

Croatia's defence industry is highly export oriented. Croatian defence companies consider exports as an opportunity to develop economies of scale and to avert the limited national defence spending and the 'off-the-shelf' acquisition policy (Black et al. l, 2016). This trend has limited MoD's bargaining power against local firms (Smiljanic, 2018).

Taking into consideration the above socioeconomic and political aspects, we should examine the role of the Croatian Defence Industry Competitiveness Cluster – or HKKOI, as known by its Croatian acronym. HKKOI is based in Zagreb and was officially established on May 06, 2013. HKKOI brings together the country's security and defence SMEs in co-operation with Croatia's Ministry of Defence to spin out commercial applications from military technologies. The cluster is linked to Croatia's national smart specialisation policy. It aims to develop the following dual products and/or capabilities: unmanned vehicles and vessels, advanced digital and communication technologies, anti-riot capabilities, and tools to counter biological agents.

HKKOI gathers approximately 50 members: entities of the private sector, entities of the public sector (professional organisations and associations), and entities of the science and research sector (HKKOI, last accessed on 09/03/2021[6]). The main objective of HKKOI is to enhance the technological capacity of its members by linking them to the value chains of larger enterprises (HKKOI, https://eng.hkkoi.hr/index.php/about-us/, last accessed on 09/03/2021). The cluster is also expanding its international presence and currently has created strategic synergies with the European Defence Agency and the region of Andalusia and the Danish cluster for small and medium-sized enterprises (CenSec). It is also trying to enhance its members' innovation capabilities by jointly investing in new development

[6] https://eng.hkkoi.hr/index.php/membership/

projects and new technologies (HKKOI, https://eng.hkkoi.hr/index.php/partners/, last accessed on 09/03/2021). The cluster structural concept is based on what is usually found in the literature as the "triple helix model" (Etzkowitz, 2002 and Etzkowitz and Leydesdorff 1995 και 2000). In this model, the industry is the 'locus of production' (i.e. the production' arm' of the co-operation), the state is the 'source of contractual relations that guarantee stable interactions and exchange' (in other words, sets the strategic goals, establishes the regulatory framework of operation/exchanges and regulates the process) and research groups/academia are the 'source of new knowledge and technology' (i.e. conduct research as guided by the other 2 partners in this collaboration and share the results as agreed). The cluster is also connected with institutions of the regional/ local government.

The main goal of the cluster is the "*Joint co-operation and networking of all stakeholders that contribute to the defence and security potential and competitiveness of the Republic of Croatia with the primary goal of investing in new technologies, innovative products with export potential and high added value and the creation of an efficient and interconnected base of manufacturers with the capacity to deliver integrated defence and security-oriented products and systems to the global market*", as explicitly stated at the website of HKKOI (HKKOI, last accessed on 09/03/2021[7]).

HKKOI is closely related to the following Croatian industrial strategies: i) Strategy of Support to Innovations of the Republic of Croatia 2014-2020 ii) Smart Specialization Strategy of the Republic of Croatia iii) Strategy of National Security of the Republic of Croatia iv) Croatian Armed Forces Long-Term Development Plan for the period 2014-2025 v) National Mine Action Strategy for the Republic of Croatia for the period 2009-2019 vi) National Cyber Security Strategy and the Action Plan for the National Cyber Security Strategy Implementation. The cluster is also closely related to implementing the EU's Smart Specialization Strategy (RIS 3) initiative, a new approach to economic development that is anchored on targeted support for research and innovation. Moreover, HKKOI aims to position itself as a platform of project identification and preparation for available funding and support programs at

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[7] https://eng.hkkoi.hr/index.php/about-us/

the EU level (Croatian Operational Programs 2020-2030, EDF, PESCO, H2020, etc.) (HKKOI, last accessed on 09/03/2021[8])

Table 4: Characteristics of Croatian Defence Industry Competitiveness Cluster – or HKKOI

Croatian Defence Industry Competitiveness Cluster – or HKKOI			
Characteristics of the Cluster's Members	Innovation	Governmental Institutions	Co-operation with companies and/ or other entities not part of the cluster
Locally owned SMEs	Triple Helix Concept	Closely related to Croatian and EU industrial strategies	Closely related to EU initiatives (funding and innovation) Trying to link members to the value chains of larger enterprises

HKKOI principally has the characteristics of a Marshallian cluster. It consists mainly of locally owned SMEs, which are closely related to each other, trying to enhance their innovation capabilities by investing in new development projects. HKKOI intensively promotes the dialogue amongst its members and, through this process, diffuses the knowledge generated within the cluster.

Nevertheless, there are some characteristics of HKKOI that are not endemic to the Marshallian clusters. For example, one of the cluster goals is to link their members to the value chains of larger enterprises, a goal that, if achieved, will "transform" HKKOI from a Marshallian to a Satellite Platform Cluster. Additionally, it is worth mentioning that the cluster is closely related to EU funding and innovation initiatives, trying to position themselves as a "mediator" between the local defence industry and EU institutions / funding, giving a solid EU "flavor" to the cluster. Through this process, HKKOI aims to be nation's focal point and a catalyst for the development, understanding and advancement of the strategic alliances that may be formed between the local industry and the EU institutions. The cluster could potentially assist its members in targeting and integrating new markets and consolidating their

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[8] https://eng.hkkoi.hr/index.php/strategic-framework/

commercial development by facilitating communication with EU institutions and diminishing one of the main characteristics of a Marshallian district. This of the embeddedness of its members to the area.

Latvian Security and Defence Cluster

Until 2014 Latvia's defence expenditure remained stable in absolute terms and as a percentage of Gross Domestic Product (GDP) at a level of around 1%-1,5%. This dramatically changed in 2015, as the country committed to increasing its defence budget to reach 2% of its GDP (Ministry of Defence Latvia[9].) In 2018 Cabinet of Ministers agreed to maintain the level of defence spending at or above 2% of GDP. In 2022 Defence Budget is expected to reach €758.35 million or 2.23% of the GDP. The breakdown of defence spending for 2022 according to data provided by the Latvian Ministry of Defence will be as follows: 34% investment, 26% maintenance, 38% personnel. In compliance with the NATO instructions[10], Latvia will try to maintain a balanced defence expenditure structure by allocating less than 40% to expenditure on personnel and administration, 30% to spending on maintenance and a minimum of +30% to the procurement of new equipment in the following years (Ministry of Defence Latvia[11].)

Latvian Defence Budget Breakdown, 2018-2024 (€Mil. and %)
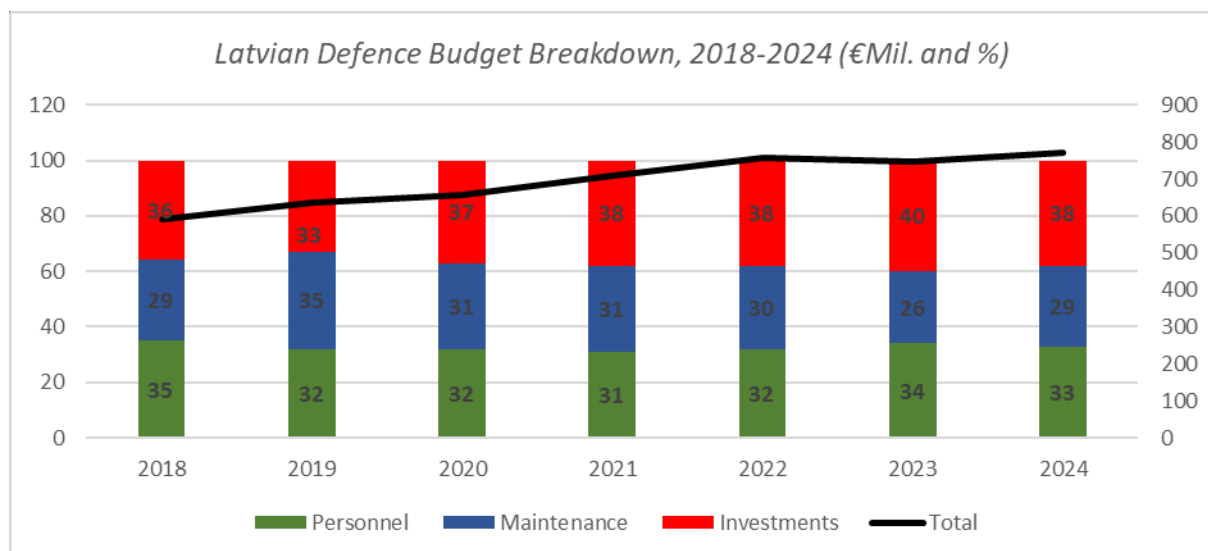
[9] https://www.mod.gov.lv/sites/mod/files/document/AM%20infografika%202018_ENG.jpg
[10] https://www.nato.int/cps/en/natohq/topics_67655.htm?selectedLocale=en
[11] https://www.mod.gov.lv/sites/mod/files/document/1.infographic_basic%20information.pdf

Table 5: Latvian Defence Budget Breakdown, 2018-2024 (€Mil.)

	2018	2019	2020	2021	2022	2023	2024
Personnel	209,81	211,30	246,02	267,85	286,86	299,47	292,13
Maintenance	169,07	220,47	200,63	222,07	230,78	192,57	222,12
Investments	210,73	202,68	202,68	217,90	240,71	255,67	255,67
Total	589,61	634,45	657,63	707,82	758,35	747,71	771,20

Source: Ministry of Defence Latvia

Still, in absolute terms, the allocated funds to the armed forces capability development projects will be low in 2022, reaching €273,2 million. A rather insufficient amount of €10 million will be allocated to the development projects of the national military and defence industry (local manufacturers and producers), including R&D initiatives (Ministry of Defence Latvia [12.])

Considering the limited demand of the Latvian forces, one can understand that it will be rather difficult and not economically viable for the country to form a defence industry on a full-blown scale. Additionally, there is still a long way ahead for Latvian companies to operate as subcontractors in the defence industry supply chain. According to a statement made by Elīna Egle, Chairwoman of the Board of FSDI Latvia, according to the data of the NATO Support and Procurement Agency, other Baltic countries have outperformed Latvia in terms of supply volume, as its supply volume accounted for 0.01% of the available 2%, while Estonia has achieved 0.037% and Lithuania 1.09% (Federation of Security and Defence Industries of Latvia, last accessed on 03/01/2022[13]).

Under this context, the Latvian Security and Defence Cluster was established within the European Union funded project No 16/A/001/3.2.1.1 "Creation of Cluster of Security and Defence of Latvia" (Cluster of Security and Defence of Latvia, last

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[12] https://www.mod.gov.lv/sites/mod/files/document/1.infographic_basic%20information.pdf
[13] https://www.federacija.lv/jaunumi/latvian-businessmen-and-researchers-interested-developing-defence-capabilities-0

accessed on 09/03/2021[14]). The Latvian Security and Defence Cluster aims to bring together the country's relevant SMEs and create a framework that facilitates a dialogue between its members and potential customers. While encouraging the development of new products and capabilities according to the needs of the Latvian Ministry of Defence, the European Defence Agency and NATO's capacity development plans (European Network of Defence-related Regions - ENDR, last accessed on 09/03/2021[15]).

The cluster currently have 90 members (European Clusters Collaboration Platform, last accessed on 09/03/2021[16]), the majority of each are SMEs. The cluster aims to help its members analyse their work processes, identify areas for improvement, provide an in-depth security and defence industry supply and demand analysis of potential markets. This process facilitates the visibility, financial viability, productivity, and competitiveness of its members. More on that direction, the cluster assists its members to target new markets and to consolidate their commercial development. It organises foreign business missions, provides information for international fairs, and aims to facilitate communication with EU and NATO funding and institutions (Cluster of Security and Defence of Latvia, last accessed on 09/03/2021[17]).

Additionally, the cluster aims to strengthen co-operation with educational and research institutions, such as the Riga Technical University, Riga Stradins University, University of Latvia and the Institute of Transport and Communications. It also creates the framework for developing high value-added products, following the needs of Latvian governmental authorities, EU, and other international organisations and targeted markets. By organising B2B meetings with some of the world's largest military manufacturers, the cluster helps the members to enter strategically important and growing global security and defence markets and supply chains. (Cluster of Security and Defence of Latvia, https://federacija.lv/cluster-0, last accessed on 09/03/2021).

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[14] https://federacija.lv/cluster-0
[15] https://www.endr.eu/organisation/cluster-security-and-defence-latvia
[16] https://clustercollaboration.eu/cluster-organisations/federation-security-and-defence-industries-latvia
[17] https://federacija.lv/cluster-0

To summarise, one can say that the cluster aims to promote and represent its members on emerging business opportunities (including EU funding opportunities) and to ensure their competitiveness in the short, medium and long-term. Through this 'centralised' representation, the Cluster members practically 'multiply' their potential to attract new business. To achieve this, the Latvian Defence Cluster:

- Engage in joint commercial activities with regards to the creation of competitive advantage, innovation and commercial success. Through this process, the knowledge acquired/produced will be appropriately assimilated and adjusted. It will lead to the creation of commercial products, according to the needs of the Latvian Ministry of Defence, the European Defence Agency, and NATO's capacity development plans.

- Promotes the dialogue among its members and potential clients through forums, committees, and workshops addressing and resolving high-priority topics that affect the country's defence and security sector and provides insight to members for new markets by conducting an in-depth supply and demand analysis of such markets.

- Identifies common and complementary needs of Latvian defence and security sectors and coordinates the search for the needed resources (including EU funding) to carry out related projects or the necessary investments to finance them.

- Acts as the center of intelligence and information for the Latvian defence and security sector. Contributes to the diffusion of knowledge via formal and informal channels and creates synergies with research institutions to shape the framework for the development of high value-added products, according to the needs of Latvian and international organisations (e.g. EU, NATO).

Table 6: Characteristics of Latvian Security and Defence Cluster

Latvian Security and Defence Cluster			
Characteristics of the Cluster's Members	**Innovation**	**Governmental Institutions**	**Co-operation with companies and/ or other entities not part of the cluster**
Locally owned SMEs	Diffusion of knowledge among members and creation of synergies with research institutions for the development of high value-added products	Design of commercial products, according to the needs of the Latvian Ministry of Defence, EU, and other international (e.g., NATO) institutions	Closely related to EU and other international initiatives (funding and innovation) Promotes dialogue among its members and potential clients

There are many similarities between the Croatian Defence Industry Competitiveness Cluster and the Latvian Security and Defence Cluster. As in HKKOI the Latvian cluster consists mainly of locally-owned SMEs, closely related to each other. Through the diffusion of shared knowledge, the cluster's mechanisms are trying to enhance its member's innovation capabilities. More on that direction, the cluster creates synergies with research institutions to shape the framework for the development of high value-added products, according to the needs of Latvian and international organisations (e.g., EU, NATO). When it comes to funding such initiatives, the cluster is trying to position itself as a "coordinator" of the search for the needed resources (including EU funding and funding from other international organisations).

Latvian Security and Defence Cluster mainly has a Marshallian cluster's characteristics (members are SMEs, innovation is shared, etc.). Nevertheless, some aspects are not typical for a Marshallian district. This is the central position EU and other international organisations play when it comes to funding new projects and shaping the strategic priorities of the cluster. We should not fail to notice that the

cluster's vision is to create the proper framework for the development of high value-added products, following the needs of Latvian and international organisations (e.g, EU, NATO). This concept highlights a tendency to prioritise both the needs of national and international organisations/ authorities.

Discussion – Conclusions

This paper's main scope is to investigate and identify in which of the four types of industrial clusters described by Markusen (1996) the Croatian Defence Industry Competitiveness Cluster and the Latvian Security and Defence Cluster, belongs to. Our initial argument that in states such as Croatia and Latvia, where defence industrial capabilities are somewhat limited and the local industry mainly consists of SMEs the Marshallian type will be "dominant", was partially reaffirmed. Indeed, the two defence clusters generally have the characteristics of a Marshallian cluster. They are both consisted mainly of locally-owned SMEs. Additionally, both clusters promote the interaction of industry, academia, and research organisations in their regions/ countries, thereby facilitating research processes and thus generating new business opportunities and the appropriate technology for developing new products/services. In both cases, the clusters initiate a goal-oriented dialogue, creating an innovation impetus that leads to the development and application of state-of-the-art technology. HKKOI and the Latvian Security and Defence Cluster, among their other activities, aim to disseminate the achievements of the business sector they represent by publishing its technological and business updates and promoting dialogue among its members and potential clients.

Table 7: Characteristics of Latvian Security and Defence Cluster and Croatian Defence Industry Competitiveness Cluster – or HKKOI

	Characteristics of the Cluster's Members	**Innovation**	**Governmental Institutions**	**Co-operation with companies and/ or other entities not part of the cluster**
Croatian Defence Industry Competitiveness Cluster – or HKKOI	Locally owned SMEs	Triple Helix Concept	Closely related to Croatian and EU industrial strategies	Closely associated with EU initiatives (funding and innovation) Trying to link members to the value chains of larger enterprises
Latvian Security and Defence Cluster	Locally owned SMEs	Diffusion of knowledge among members and creation of synergies with research institutions for the development of high value-added products	Creation of commercial products, according to the needs of the Latvian Ministry of Defence, EU, and other international (e.g NATO) institutions	Closely related to EU and other international initiatives (funding and innovation) Promotes dialogue among its members and potential clients

One should mention that governmental policy is crucial in developing a robust defence industry. Led by what Clift and Woll, (2012) describe as "economic patriotism", economic objectives and norms are in some cases subordinated to

homeland interests because the government as Customer, Sponsor and Regulator (Heidenkamp, Louth, Taylor, 2013) plays an essential role in the formation of a national defence industrial base.

Said that, one can safely conclude that a strong relationship between the two industrial clusters under investigation and their governments should have been established. In both cases studied, the states were helping the clusters, providing financial assistance through funding of research projects and sometimes as supporters of cluster efforts through the creation of an appropriate legislative framework. However, to assume that a cluster has the characteristics of a state-achored type cluster, it is not enough to recognise facilities from the central government. Structures must be found that give a public or non-profit entity the primary say in cluster developments (Markusen, 1996). In the state-anchored clusters, innovation is centrally coordinated, putting any activity in line with public objectives (the objectives of the anchor institution) (Jankowiak, 2012), while the members of the cluster are relatively unimportant to the creation of innovation (Ferreira, et al., 2012) as well as in the development of the cluster. In both cases studied we did not identified such "patterns".

When it comes to the clusters examined, the generation of innovation lies mainly with the technological 'experts' which are familiar with the dynamics and trends of the specific global markets. Additionally, both clusters further aid their members by representing/presenting them and facilitating contacts with new customers, disseminating its members' innovations and development competencies at international forums (such as international fairs). Moreover, both clusters provide its member companies with strategic information about new markets and related opportunities to foster their growth and introduction into new markets.

Additionally, there are some characteristics of both clusters that are not endemic to the Marshallian clusters. For example, one of the HKKOI cluster goals is to link their members to the value chains of larger enterprises, a goal that, if achieved, will "transform" HKKOI from a Marshallian to a Satellite Platform Cluster. Additionally, it is worth mentioning that both clusters are closely related to EU funding and innovation initiatives, trying to position themselves as "mediators" between the local defence industry and EU institutions/funding. In both cases, participation in EU

and other international projects is perceived as a catalyst for the development and advancement of local defence industries. It represents a pathway for increased defence co-operation and integration with what once may call a European "technological circle". In such a way, clusters will be further integrated in the European defence industry, facilitating research and generating new business opportunities and the appropriate technology for developing new products/services. Even though the sample of the study is rather limited and thus any conclusion should be perceived with skepticism, one can clearly see a specific pattern/ trend, which can be summarised as follows: both HKKOI and the Latvian Security and Defence Cluster are Marshallian clusters trying to break their geographical boundaries by enhancing their relations with EU and other international institutions.

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