EUROPEAN CLUSTER COLLABORATION PLATFORM

Clusters meet Regions event “AGORADA+ discusses Croatian digital transformation and interregional cooperation“

The new ECCP series of events “Clusters meet Regions”

Input paper to the event “AGORADA+ discusses Croatian digital transformation and interregional cooperation”

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Executive summary

The following paper presents observations on the Croatian clusters' ecosystem and outlines some key considerations for the future development of the region. These considerations may pose some open strategic questions, which can be addressed in the workshops of the "Clusters meet Regions" event. The following key takeaways are summarised below:

Context: Economic profile of Croatia

- Established tourism and agriculture industries define Croatia as a diversified economy, creating steady economic growth in the 2000s and 2010s. As the services sector contributes to 58.9% of Croatia's GDP overall and employs 66.1% of the active population, tourism has become a key segment of its economy. Overall, Croatia can be broadly categorised as a specialised industrial ecosystem Agri-textile and Agri-tourism.
- On a national level, Croatia is defined as a "Moderate Innovator", with high scores in "Product innovators" and "Business process innovators".
- On a regional level, Continental Croatia (HR04) is the more established region, encompassing a greater area and population share of the country and being classified as "Moderate Innovator" in the Regional Innovation Scoreboard. High innovation performances regarding scientific publications indicate a prioritisation in science-driven development. However, low innovation scores pertaining to R&D expenditures in both public & business sectors as well as "PCT patent applications" present an inconsistent innovation capacity in Croatia.

Clusters in Croatia and their importance for regional economic development

- With 10 out of 15 cluster organisations that are registered on the ECCP located in Zagreb the capital of Croatia has the highest concentration of cluster organisations in the country.
- Country studies on the cluster ecosystem point on the one hand to the difficulties cluster development efforts face in the Croatian context of high structural economic disparities. On the other hand, they underline the necessity for effective and collaborative cluster initiatives to overcome them.
- Empirical insights from the European Cluster Panorama 2021 and Ketels & Protsiv (2021) prove how clusters can have a strong impact on economic growth and innovative business activity within regions. The former study also highlights the role of cluster organisations in Croatia.

Cross-border cooperation and the involvement of Croatian clusters in European networks and support initiatives

- No Croatian cluster organisation was neither part of a European Strategic Cluster Partnership nor an INNOSUP-1 project in the 2014-2020 funding period.
- In the 2021-2027 period, the Croatian Defense Industry Competitiveness Cluster participates in the Eurocluster consortium of the project LEVIATAD that aims at creating the first Eurocluster of Excellence on Naval Defense.

The S3 Strategy 2014-2020 of Croatia

- The Strategy 2014-2020 of Croatia covers 5 priority areas: Energy & Sustainable Development, Food & Bioeconomy, Health & Life Quality, Security, Transport & Mobility.
- The Croatian S3 Strategy for the 2021-2027 period is currently being drafted and has not yet been published.

01

Context: Economic profile of Croatia

1. Context: Economic profile of Croatia

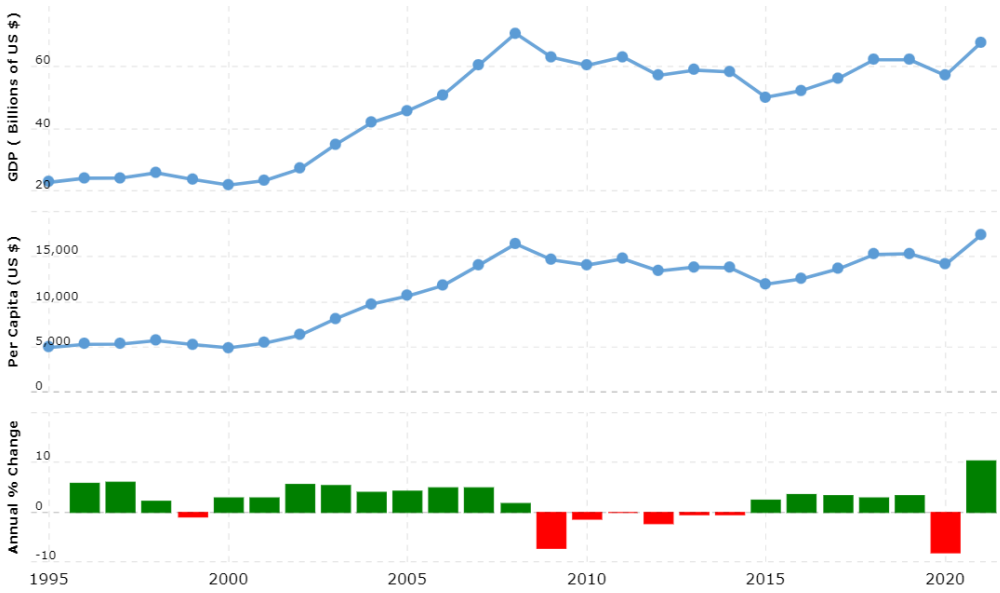
This section will provide a short context about the socio-economic profile of Croatia.

Broad overview of Croatian economy & productivity levels

Croatia's economy has been undergoing significant changes in the past decades. Particularly until the early 1990s, where Croatia was part of Yugoslavia, its economy was defined by its socialist self-management[1]. Toward the late 1990s and early 2000s, the Croatian government began to shift to a free-market economy that thrives in increasingly growing business activity and a specifically growing start-up scene. Joining the EU (2013) and the Eurozone (2023) have contributed to this, given that a high percentage of Croatia's trade flows connected to EU countries (e.g.: 68% of exports to EU, 78% from EU in 2018)[2].

In other regards, Croatia is characterised by its relatively low population (4.068 million) and steadily growing economy in recent years, further reflected in last year's 2021 GDP that amounted to €67.84B[3]. While the overall economic output accounting for its number of people (GDP per capita) amounting to €17,702[4] is below the EU average of 30.800, Croatia's annual GDP grew by 10.4% from 2020 to 2021 and thus performs above the EU average[5]. This makes Croatia the second most developed economy of the Balkan region, after Slovenia[6], with SMEs playing a significant role in this process.

Figure 1: Croatia GDP Per Capita 1995-2022



Source: World Bank (2022)

[1] Bartlett, W. (2020): The Yugoslav Successor States: From Self-Management Socialism to Political Capitalism. Studies in Economic Transition. Available under: The Yugoslav Successor States: From Self-Management Socialism to Political Capitalism | SpringerLink (last accessed 08.11.2022).
[2] Funderbeam (2021): An Overview of the Croatian Economy. Available under: An Overview of the Croatian Economy – Funderbeam (last accessed 20.10.2022).
[3] Tradingeconomics (2022): Croatia GDP. Available under: Croatia GDP - 2022 Data - 2023 Forecast - 1990-2021 Historical - Chart - News (tradingeconomics.com) (last accessed 31.10.2022)
[4] The World Bank (2022): The World Bank in Croatia. Available under: Croatia Overview: Development news, research, data | World Bank (last accessed 31.10.2022).
[5] Macrotrends (2022): Croatia GDP Per Capita 1995-2022. Available under: Croatia GDP Per Capita 1995-2022 | MacroTrends (last accessed 14.11.2022).
[6] Crédit Agricole Group (2022): Croatia: Economic and Political Overview. Available under: Economic and political overview in Croatia (groupecreditagricole.com) (last accessed 20.10.2022).

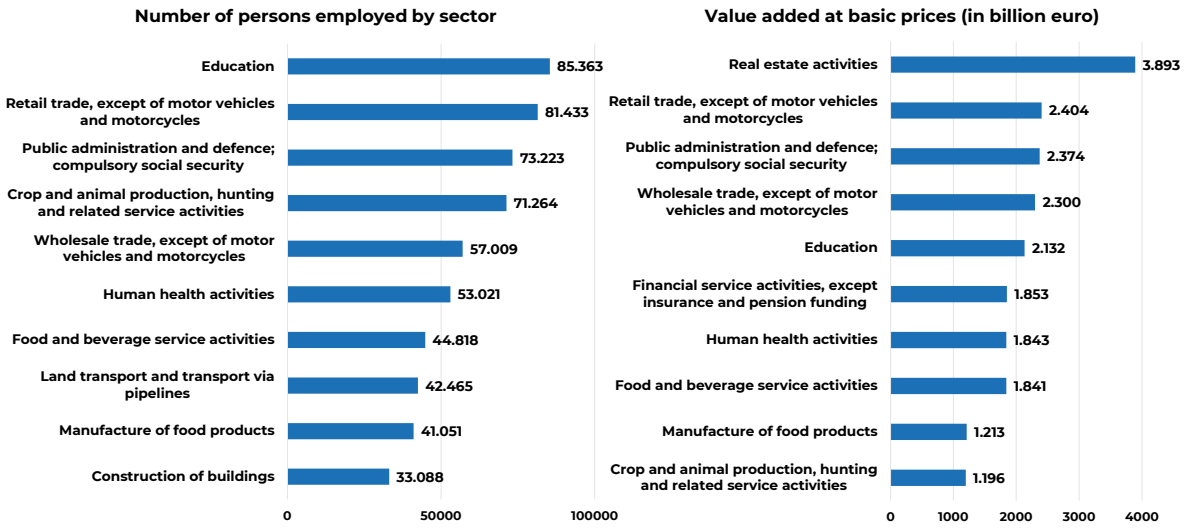
Furthermore, Croatia possesses agricultural land and forestry that amount to 1.3 million and 2.2 million hectares, respectively. This has helped the country to build up an agricultural infrastructure and turn self-sufficient in its crop production (encompassing wheat, corn, sugar beet, fruits, wine & olive oil). It should also be mentioned that long-standing industrial establishments oriented around agriculture, forestry and mining have played a significant role in Croatia's history. On a final note, a consistently growing tourism sector and the government's prioritisation of becoming an energy powerhouse showcases Croatia's long-term and forward-thinking plans[7].

Croatian sector specialisations and employment levels

When forming a picture of the economic characteristics of a country, it is critical to examine how various sectors impact the economy, as these can determine long-term prospects. Drawing on Crédit Agricole Group[8], the Croatian economy is predominantly based on the services sector, contributing to 58.9% of GDP overall, whilst employing 66.1% of the active population. Hereby, tourism has become a key segment of Croatia's services sector, achieving among the best ranking against its Mediterranean competitors[8]. Meanwhile, the agricultural sector contributes 3.3% of the country's GDP, whilst employing 6.2% of the active population[8].

Figure 2 illustrates the top ten sectors of Croatia by employment, with "Education", "Retail trade, except of motor vehicles and motorcycles", "Public administration and defence; compulsory social security", "Agriculture, forestry and fishing" and "Human health activities" ranked in the top five. Next to "Agriculture, forestry and fishing", other sectors such as "Food and beverage service activities" as well as "Manufacture of food products" rank sixth and eighth, underlining the agriculture-driven economy in Croatia.

Figure 2: Top 10 sectors for employment (left) and value added (right) in Croatia (in 2018)



Source: ECCP (2022).

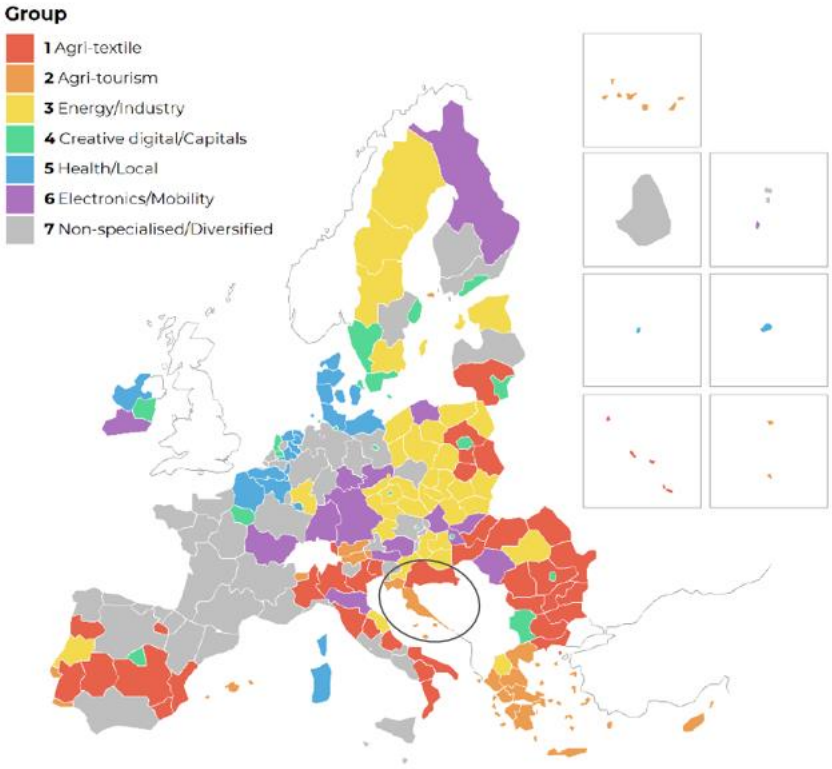
The second graph in Figure 2 provides information on the top 10 sectors of Croatia by considering "Value added at basic prices". Here, real estate activities account with almost 4 billion Euro for the

[7] European Commission (2022): First Croatian LNG terminal officially inaugurated in Krk island. Available under: First Croatian LNG terminal officially inaugurated in Krk island | Innovation and Networks Executive Agency (europa.eu) last accessed (20.10.2022).
[8] Crédit Agricole Group (2022): Croatia: Economic and Political Overview. Available under: Economic and political overview in Croatia (groupecreditagricole.com) last accessed (20.10.2022).

most important Croatian sector in terms of value added. An interesting statistic in this graph is also represented by "Real trade, except of motor vehicles and motorcycles", and "Wholesale trade, except of motor vehicles and motorcycles" where 2.4 billion and 2.3 billion Euro of value added is reported. This is mirrored by said sectors' number of employment in the aforementioned graph, illustrating the significance of retail as well as wholesale trade in the Croatian economy. On a further note, it is notable how "Food and beverage service activities" ranks in the top 10, corresponding to this sector's high ranking in terms of the number of persons employed. Nevertheless, it is notable how sectors pertaining to manufacturing are underrepresented, with only "Manufacturing of food products" found in the top 10 for employment and value added. In the grand scheme of things, manufacturing-specific sectors make up 19.2% of employment, whilst contributing to 15.7% of value added in Croatia.

In reference to the European Cluster Panorama report of 2021, one can see how specialisation patterns are visualised in the different respective regions[9]. This allows one to analyse not only the cluster organisation presence on the basis of certain typologies but gain an insight on how these can differ from region to region and country to country. As seen in Figure 3, one can see how the Croatian region Adriatic Croatia (HR03) is categorised as "Agri-tourism" and Continental Croatia (HR04) is categorised as "Agri-textile"– specialised industrial ecosystems[10].

Figure 3: Regional typology based on industrial ecosystem specialization



Source: European Cluster Panorama (2021).

[9] European Commission (2021): European Cluster Panorama 2021: Leveraging clusters for resilient, green and digital regional economies. Available under: European cluster panorama 2021 - Publications Office of the EU (europa.eu) (last accessed: 15.11.2022).

[10] Adriatic Croatia (HR03) and Continental Croatia (HR04) reflect NUTS-2 regional classifications that were in place between 2014 and 2021. New regional classifications extend to of Pannonian Croatia (HR02), City of Zagreb (HR05) and Northern Croatia (HR06), as explained in the National & Regional innovation level sub-section

On a final note, one can argue that Croatia's relatively diverse sectors open opportunities in which economic and cluster structures can support growth on regional and national levels. The predominance of agriculture- and energy driven economy is underpinned by Croatian plans regarding the S3 Strategy, in which "Food and bio-economy" as well as "Energy and sustainable development" have been considered priority areas. This will be explored in greater detail in the prospective chapter.

National innovation level of Croatia / Regional innovation level of Croatian regions

In the course of this paper, we will investigate the economic performance of Croatia in the context of clusters and how these are organised. As a fundamental pillar, we will look at the level of innovativeness in Croatia on a country-level via the European Innovation Scoreboard (EIS). This performance scoring is constituted by a total of 32 indicators subcategorised under 12 "Innovation dimensions". We continue with investigating regional-level innovativeness via the Regional Innovation Scoreboard (RIS), which utilises only 21 of the initial 32 indicators from the EIS measurement framework[11].

Croatia in the European Innovation Scoreboard 2021

One can first state that Croatia on a national level is classified as an Emerging Innovator, with its performance marked at 66.5% of the EU average. An exemplary dimension such as "Innovators" captures different aspects of innovation in the business sector[12], in which Croatia has seen considerable 'Product Innovators (SMEs)' as well as 'Business process innovators (SMEs) (see Table 1 in the Annex). Another dimension that captures innovation in the business sector is "Linkages", in which Croatia also performs well in categories such as 'Innovative SMEs collaborating with others', 'Public-private co-publications', and 'Job-to-job mobility of HRST'. These scores signal well-intact but also balanced prioritisation of both innovation processes.

Another relevant dimension is "Digitalisation", which captures a contributor to "innovation performance external to firms"[12]. Here it is notable how Croatia on the one hand scores low in 'Broadband penetration', but on the other hand performs high in 'People with above basic overall digital skills'. Broadband penetration is crucial to connect individuals to the internet and the skills to make full use of the opportunities that emerge from internet-based services help in creating innovation-oriented as well as digitally inclusive societies[13]. Thereby, one could expect greater gains in digital skills development with greater connectivity and internet access in cases where broadband penetration would be improved.

According to the EIS, Croatia has seen progress in a variety of innovation dimensions, for example with "Attractive research systems", "Digitalisation", "Finance and support" and "Intellectual assets" enjoying positive performance changes in recent years. On a more recent note, one can mention how EIS indicators pertaining to 'Broadband penetration', 'Venture capital expenditures' and 'Public-private co-publications' have reported "Strong increases since 2021"[14]. Nevertheless, it is remarkable that Croatia performs lower in other important criteria in the EIS. Particularly regarding the innovation dimension of "Firm investments", Croatia's performance is relative to 40.2% of the EU average, with its

[11] European Commission (2022): Regional Innovation Scoreboard: Methodology report. Available under: DocsRoom - European Commission (europa.eu) (last accessed 14.11.2022).
[12] European Commission (2022): European Innovation Scoreboard 2022: Methodology Report. Available under: ec_rtd_eis-2022-methodology-report.pdf (europa.eu). (last accessed 14.11.2022).
[13] Van Deursen, A.J.A.M., Helsper, E. & Eynon, R. (2014): Measuring digital skills: From Digital Skills to Tangible Outcomes project report. Available under. [PDF] Measuring Digital skills: From Digital Skills to Tangible Outcomes project report (researchgate.net) (last accessed on 31.10.2022).
[14] European Commission (2022): European Innovation Scoreboard 2022: Croatia. Available under: ec_rtd_eis-country-profile-hr.pdf (europa.eu) (last accessed 14.11.2022).

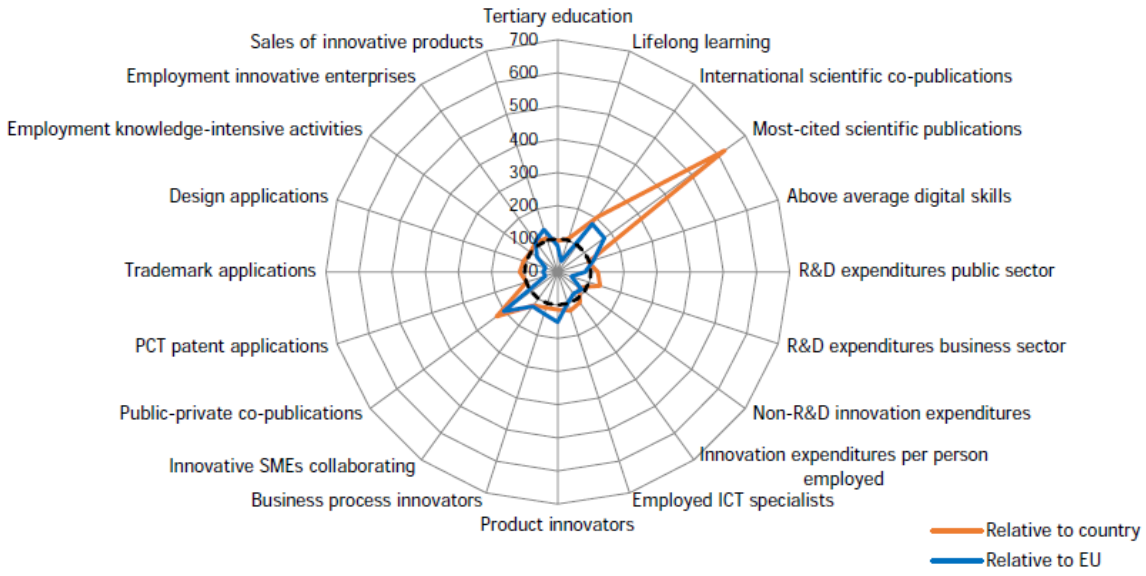
performances regressing since 2015. This is further illustrated in sub-categories such as "Non-R&D innovation expenditures" as well as "Innovation expenditures per employee", marking significant decreases in their performance changes. Environmental sustainability is also an innovation dimension in which Croatia performs weakly, with "Environment-related technologies" standing out as one of the lowest scoring indicators at 19.7% relative to the EU average and regressing since 2015.

Croatia in the Regional Innovation Scoreboard 2021

One can utilise the Regional Innovation Scoreboard to gain a better understanding of the innovativeness of Croatian regions. In the context of this paper, it is important to mention how regional classifications pertaining to Croatian regions have been subject to change recently. Before the Croatian NUTS-Region classifications were revised in 2021, the original NUTS-2 regions were classified as **Adriatic Croatia (HR03)**, and **Continental Croatia (HR04)**. As of 2021, the region of Continental Croatia was revised, leading to new NUTS-2 classified regions of **Pannonian Croatia (HR02), City of Zagreb (HR05)** and **Northern Croatia (HR06).** Taking this into consideration, this report draws on data that was collected in 2018 and therefore represents older classifications of the Croatian regions. Thereby, data pertaining to the Continental Croatia region will be interpreted as a proxy region for all Pannonian Croatia, City of Zagreb and Northern Croatia regions.

The specific region encompassing the majority of Croatia and its urban areas "Continental Croatia" is where most growth and development sets foot. This is reflected in its classification as a "Moderate Innovator" (see Figure 4)[15], with the region having seen an increase of 21.4% in its innovation performance between 2014 and 2021 (see in the Annex). Areas such as 'Innovative SMEs collaborating', 'Business process innovators' and 'Product innovators' have high innovation scores, which could indicate how an emphasis is placed on developing many different stages of innovation processes.

Figure 4: Innovation performance of the Continental Croatia region in the Regional Innovation Scoreboard (2021)

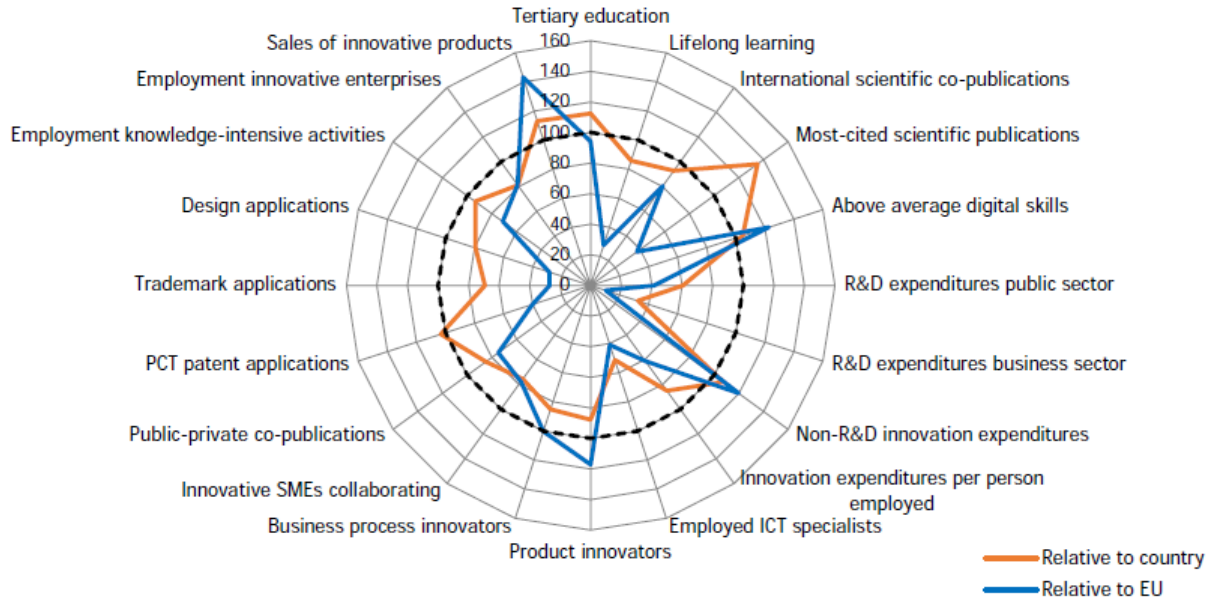


Source: European Commission (2021): Regional Innovation Scoreboard 2021.

[15] Continental Croatia accounts for 56% of the territory and 67% of the active working population in Croatia. With Continental Croatia also encompassing urban areas such as Zagreb, Osijek, Slavonski Brod, Karlovac, Sisak and Varaždin, this region naturally represented a significant part of the country's economy.

Moreover, it is remarkable how indicators pertaining to scientific publications like 'Most-cited scientific publications', 'Public-private co-publications', and 'International scientific co-publications' appear to show high innovation scores that are also above the EU-average. While the high Innovation scores pertaining to scientific publications could indicate a prioritisation in science-driven development, it is notable how this is not reflected in indicators of other research activities, such as 'R&D expenditures public & business sector' and 'PCT patent applications'. Particularly high levels of R&D expenditures in the public and private sector can contribute to innovation, which in turn is facilitative to economic growth.

Figure 5: Innovation performance of the Adriatic Croatia region in the Regional Innovation Scoreboard (2021)



Source: European Commission (2021): Regional Innovation Scoreboard 2021.

The **Adriatic Croatia** region is considered an "Emerging Innovator", with whilst reporting a 23% increase in its RIS index between 2014 and 2021 (see Table 3 in Annex). Similar to the former region, Adriatic Croatia performs high in 'Non-R&D innovation expenditures'. but relatively low in indicators pertaining to innovation input, like 'Innovation expenditures per person employed' and 'R&D expenditures business & public sector'. One can also note how Adriatic Croatia performs above the EU average in 'Product innovators', and 'Sales of innovative products', which could point to the effective development and distribution of innovative products.

Nevertheless, the indicator pertaining to 'Business process innovators' only reports an innovation performance that is on average with the EU. Agriculture-driven economies tend to thrive through "process innovations" and "product innovations", in which innovations can enhance production techniques for more efficient and healthier harvests[16]. This is important to consider especially for the region of Adriatic Croatia, which is categorised as an Agri-tourism-specialised industrial ecosystem.

[16] OECD. Agricultural productivity and innovation: Innovation for a more sustainable and prosperous agriculture. Available under: Agricultural productivity and innovation - OECD (last accessed 21.11.2022).

02

Cluster organisations in Croatia and their importance for regional economic development

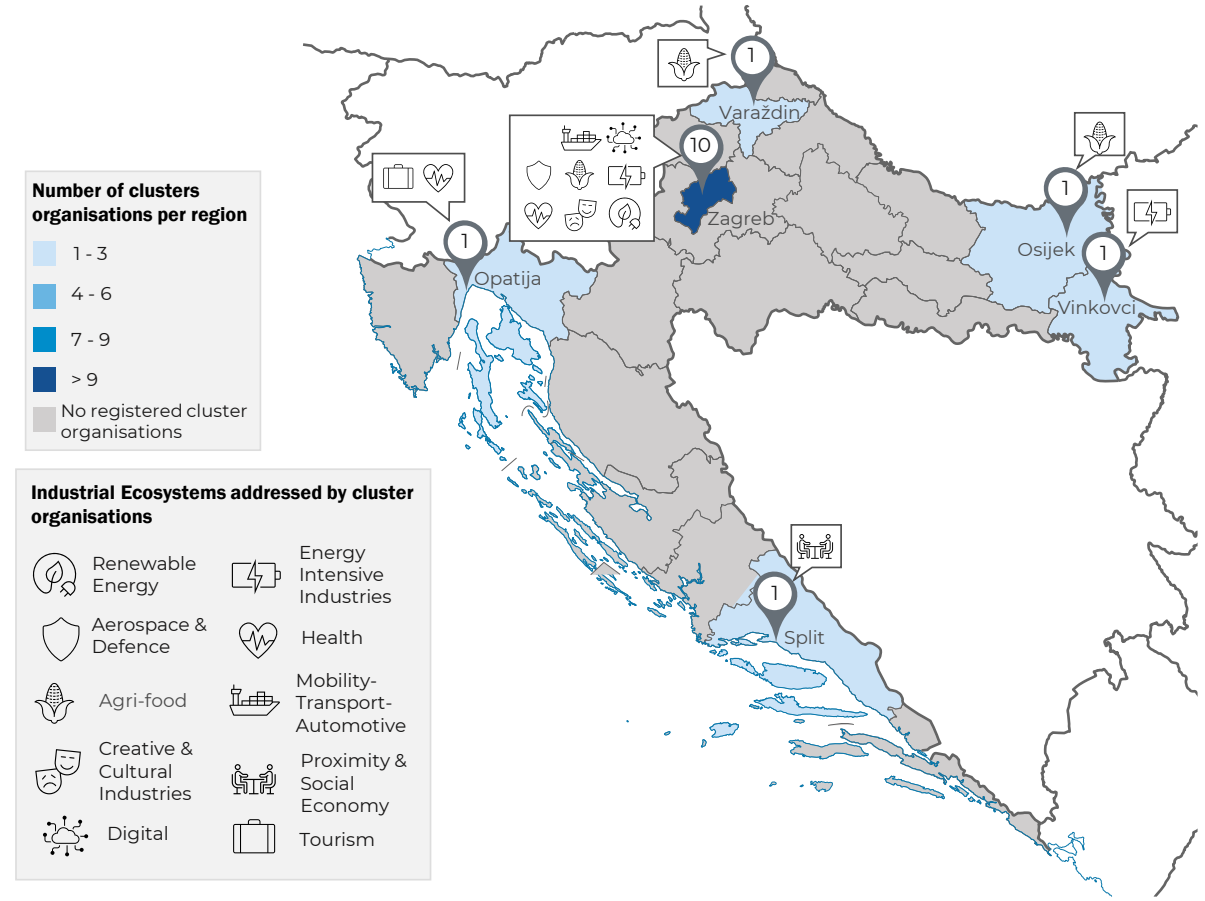
2. Cluster organisations in Croatia and their importance for regional economic development

The involvement of cluster organisations in regional economic governance, policy design and implementation at the regional level is of central importance for economic development. This chapter will provide an overview of the cluster landscape in Croatia and will aim to describe their activity at the regional level within its governance and policy.

Cluster organisations in Croatia

The European Cluster Collaboration Platform serves as a one-stop-shop for cluster organisations at the European level. Therefore, the number of registered cluster organisations and other innovation actors in Croatia on the ECCP gives the first impression on the intensity of cross-border activities and cooperation of Croatian clusters in European networks. Out of the around 1,094 registered EU-27 cluster organisations on the ECCP, there are **15 cluster organisations from Croatia**.

Figure 6: Overview of registered cluster organisations and their regional and sectoral distribution in Croatia



Source: ECCP (2022). Own elaboration based on https://reporting.clustercollaboration.eu/all; last accessed 03.02.2022. A full overview of the Croatian clusters is provided in Table 4 in the Annex.

Figure 6 displays the geographical distribution of the registered cluster organisations across the country: the vast majority of the Croatian cluster organisations is situated in the capital city of Zagreb (10). The rest is dispersed across the country, with one registered cluster organisation each in Osijek (County of Osijek-Baranja) and Vinkovci (County of Vukovar-Srijem) in the east, Varaždin (County of

Varaždin) to the north, and Opatija (County of Primorje-Gorski Kotar) and Split (County of Split-Dalmatia) at the Adriatic coast. For the great number of remaining regions, however, there are no registered cluster organisations on the ECCP. How does Croatia compare to its regional neighbours in terms of cluster organisations? Its direct neighbour Slovenia, also former part of the Yugoslavian state and with only around half of the Croatian population[17] (2.1 vs. 3.9 million), still hosts more cluster organisations (19). Moving on, the comparison with Hungary provides a more favourable picture for Croatia, as it hosts not even twice as many cluster organisations (28) with a 2.5 times larger population. So, while Croatia clearly lags behind compared to Slovenia in this regard, it can be seen on par with the more longstanding EU member Hungary. Rather than the number of cluster organisations, their highly concentrated territorial distribution appears to be more concerning.

Figure 7: Overview of organization, structure, and thematic orientation of cluster organisations in Croatia

Organisation

- Majority of cluster organisations rather small with 1-5 employees (10 cluster organisations)
- Rest is medium-sized with 6-10 employees (5 cluster organisations)

Member structure

- More than half of the cluster organisations (8) have less than 50 members
- Six cluster organisations have between 50 and 100 members
- One cluster organisation with over 100 members
- SMEs (59%; ØEU:71%) most prevalent followed by the research sector (14%; ØEU: 8%) & large companies (10%; ØEU: 10%)

Thematic orientation

- Cluster organisations in Croatia can be related to 10 different EU industrial ecosystems
- Collaboration often sought in digitalisation, internationalisation, partnering for projects & technology scouting

Source: ECCP (2022).

The cluster organisations in Croatia can be related to **ten out of 14 different EU industrial ecosystems**[18] (see also Table 4 in the Annex). The ECCP data presented in the map above is complemented with information provided from the regional authorities including four cluster organisations that are currently not registered on the ECCP. All four additional clusters are regional associations of local tourist boards and, according to the regional authorities, represent a subset of existing tourism clusters all over Croatia, which, however, remains incomplete due to data limitations. The EU Industrial Ecosystems[19] that are the most addressed by Croatian cluster organisations registered on the ECCP are Energy Intensive Industries, Agri-Food, and Health.

[17] Population data for 2022. Source: Eurostat. Available under: https://ec.europa.eu/eurostat/databrowser/bookmark/40fd4e5f-3ace-4618-86a5-e9ecfea67ac2?lang=en (last accessed 20.10.2022).

[18] see 'European industrial strategy'. Available under: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en (last accessed 20.10.2022).

[19] see 'Industrial Ecosystems'. Available under: https://clustercollaboration.eu/in-focus/industrial-ecosystems (last accessed 20.10.2022).

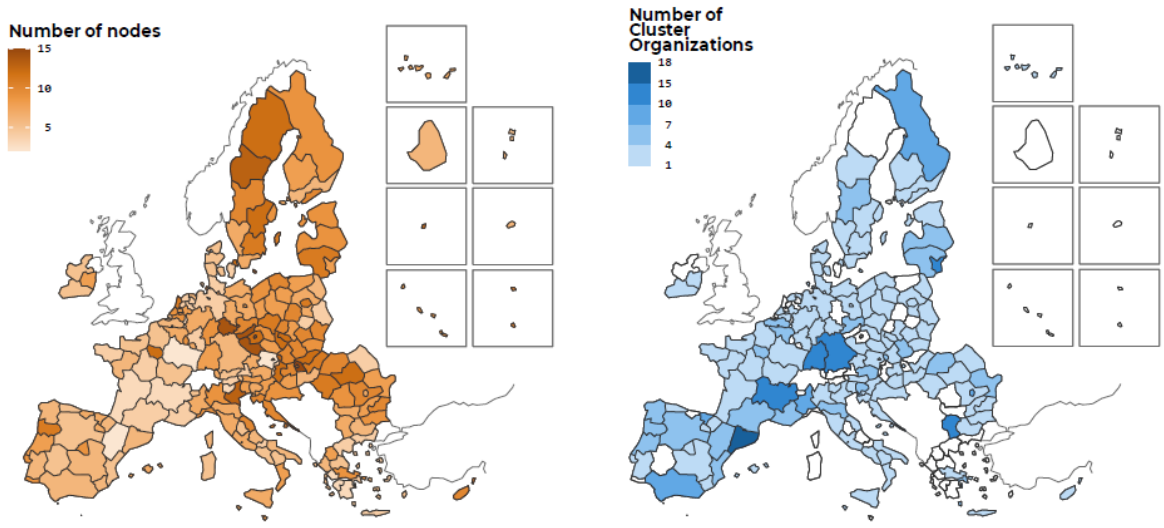
Similar to the majority of European cluster organisations registered on the ECCP cluster organisations in Croatia are rather small.[20] The majority of the Croatian cluster organisations have between 1-5 employees and less than 50 members, while only six are between 50-100 members and one with over 100 members, namely the Croatian cluster of competitiveness of creative and cultural industries. SMEs account for most of the members of Croatian cluster organisations (59%), followed by the research sector (14%) and large companies (10%). Compared to the EU average, large companies are equally represented (EU: 10%) in contrast to the research sector (EU: 8%) which is significantly more prevalent in the membership of Croatian cluster organisations, while SMEs make up for a smaller part (EU: 71%). Croatian cluster organisations seek collaboration primarily in the areas of digitalisation, internationalisation, partnering for projects and technology scouting.

Moreover, four of the cluster organisations from the country have obtained the Bronze Label from the Cluster Excellence Label. Furthermore, the Kvarner Health Tourism Cluster has been the Health and Medical Tourism Cluster of the Year at the IMTJ Medical Travel Awards 2016 while the Klaster poljomehanizacije (Agricultural mechanisation cluster) has won the Best Cluster in Croatia Award in 2011 and 2015.

The importance of clusters for regional economic competitiveness

The European Cluster Panorama Report (2021) examines the relationship between clusters and regional competitiveness. The stand-out findings of this report showcase how the presence of cluster organisations is positively correlated with economic indicators such as GDP per capita, labour productivity, as well as business R&D expenditure. While public R&D expenditure is merely positively correlated with industry-relevant nodes[21], it does indicate how specific regions could earn greater public support, when specific industries pertain to a local significance. Particularly indicators pertaining to R&D expenditures are key in measuring economic performance concerning innovation.

Figure 8: Distribution of region-relevant sector specialization nodes and cluster organisations in EU-27



Source: European Cluster Panorama (2021).

[20] see ECCP (2021): European Cluster Panorama Report 2021. Available under: https://clustercollaboration.eu/sites/default/files/2021-12/European_Cluster_Panorama_Report_0.pdf (last accessed 20.10.2022).

[21] From the European Cluster Panorama Report (2021): Industry-relevant specialisation nodes: When the region is specialised in the sector (or industrial ecosystem) and regional employment in the sector is relevant in the EU context (industry employment share > 1%).

In Figure 8 as seen above, one can see how Croatian clusters have an average number of region-relevant specialisation nodes[22], but as well as an average number of cluster organisations, in comparison to other European regions.

Next to clusters having an enabling and facilitating effect on economic performance and growth, other studies have provided complementary information on the impact clusters can have. For example, Ketels & Protsiv (2021)[23] provide a thorough account of the positive relationship between cluster presence and industry-level wages across European regions. Key takeaways emphasise how particular clusters relate to sector-specific industries, as opposed to the mere "concentration of economic activity in a specific field" (pp. 217). On top of that, the data showcases how the influence and strength of clusters has an independent relationship with economic outcomes. Their findings suggest how the degree and nature of competitiveness within clusters must be understood on a location-to-location basis. This further reflects on what they refer to as the "business environment quality" that can have striking knock-on effects on wage levels. Most importantly, Ketels & Protsiv delineate how "cluster strength" has a unique impact on "wages and prosperity". A visual depiction that highlights this trend can be seen in the map of Ketels in the Annex.

In the context of Croatia, the statistical data and analysis of Ketels & Protsiv (2021) suggest how the cluster portfolio strength (share of payroll accounted for by strong clusters) is less developed, while its cluster mix (bias towards cluster categories with higher wages) is at the average of European regions. The visualisation of the results can be found in the Annex.

Several studies analyse the institutional and structural challenges of Croatian cluster development. According to Dragičević and Obadić (2014)[24], a crucial problem in the early days of the last decade was the lack of regional and national coordination of cluster-related policies and initiatives. This problem was compounded by the high regional economic disparities within Croatia. Within the regions, a general lack of mutual trust among different actors and stakeholders prevented the necessary cooperation and coordination between them needed for regional cluster initiatives to be successful. As bottom-up processes were blocked, the government had to rely on top-down approaches, which produce their own problems.

From a more structural perspective, Bečić and Švarc (2015)[25] found that the Croatian economy was suffering from a situation of "long-term technological backwardness, excessive tertiarisation of [the] economy in the low-profit/skills sectors, [and] serious underinvestment in science and knowledge-based industries" (p. 270). Especially lacking technological specialisation was diagnosed as a consequence of horizontal business and innovation policies conceived too broadly and without thematic prioritisation. The authors perceive a more focused cluster development strategy guided by an advanced understanding of smart specialisation that links specific priority sectors with key enabling technologies and skills in cross-cutting themes such as ICT as a remedy to move the Croatian economy out of its development trap.

[22] From the European Cluster Panorama Report (2021): Region-relevant specialisation nodes: When the region is specialised in the sector and the employment share of that sector is relevant for the region (regional employment share > 1%).

[23] Ketels, C. & Protsiv, S. (2021): Cluster presence and economic performance: a new look based on European data, Regional Studies, 55:2, 208-220, DOI: 10.1080/00343404.2020.1792435. Available at: https://www.tandfonline.com/doi/full/10.1080/00343404.2020.1792435 (last accessed 20.10.2022).

[24] Dragičević, M. & Obadić, A. (2014): Cluster Policy and Cluster Governance in Croatia, Conference: The 7th International Conference for Entrepreneurship, Innovation and Regional Development - ICEIRD 2014 Conference, Nicosia, Cyprus. Available under: https://www.researchgate.net/publication/278714962_Cluster_Policy_and_Cluster_Governance_in_Croatia (last accessed 20.10.2022).

[25] Bečić, E. & Švarc, J. (2015): Smart Specialisation in Croatia: Between the Cluster and Technological Specialisation, Journal of the Knowledge Economy, 6, 270-295. Available under: https://link.springer.com/article/10.1007/s13132-015-0238-7 (last accessed 20.10.2022).

In a survey study Anić et al. (2019)[26] followed up on the top-down Croatian Competitiveness Clusters (CCC) policy[27] that was created to support cluster development and smart specialisation from 2016 onwards. Although only capturing its early-stage outcomes, it confirms the problems analysed by previous studies. Evaluating the feedback of 250 cluster members from 13 CCCs, the authors finds that the "perceived performance of CCC is very low" and "the members of CCC have not been able [...] to see any value of their participation in CCC" (p. 2242). Reasons are both the structural problems of low innovation activity and productivity as described by Bečić and Švarc (2015) and the crucial institutional problem of low level of trust between key actors as argued by Dragičević and Obadić (2014). On top of that, business support and programme management were weak and there was only limited commitment and involvement by the participants. The study confirms the general finding of the low performance of top-down cluster policies.

To resolve these problems, Anić et al. propose better funding, partly through hitherto not existing membership fees, to provide cluster organisations with their own office spaces and other equipment. Stronger management teams should guarantee a more effective communication with EU and national institutions as well as organize local and international events to foster business-research collaboration. Increased funding should also go into investment in human capital and physical infrastructure needed to sustain joint research projects and disseminate research results and new technologies. Most importantly, these efforts should be aligned with the expectations of cluster members to help them meet their own objectives and encourage sustained engagement.

In conclusion, the data and case studies presented in this chapter underline the need for effective and collaborative cluster development initiatives to support Croatian businesses in ramping up their innovation and productivity levels. The EU Cluster Panorama Report (2021) in connection with Ketels & Protsiv (2021) makes the case for cluster organisations as a proven method to stimulate innovation and long-term growth on a regional level.

[26] Anić, I.; Corrocher, N.; Morrison, A.; Aralica, Z. (2019): The development of competitiveness clusters in Croatia: a survey-based analysis, European Planning Studies, 27:11, 2227-2247. Available under: https://doi.org/10.1080/09654313.2019.1610726 (last accessed 21.10.2022).

[27] For further information on Croatia's cluster policies, see the Croatia Factsheet on the ECCP (2021). Available under: https://clustercollaboration.eu/sites/default/files/2021-12/eccp-factsheet-croatia.pdf (last accessed 15.11.2022).

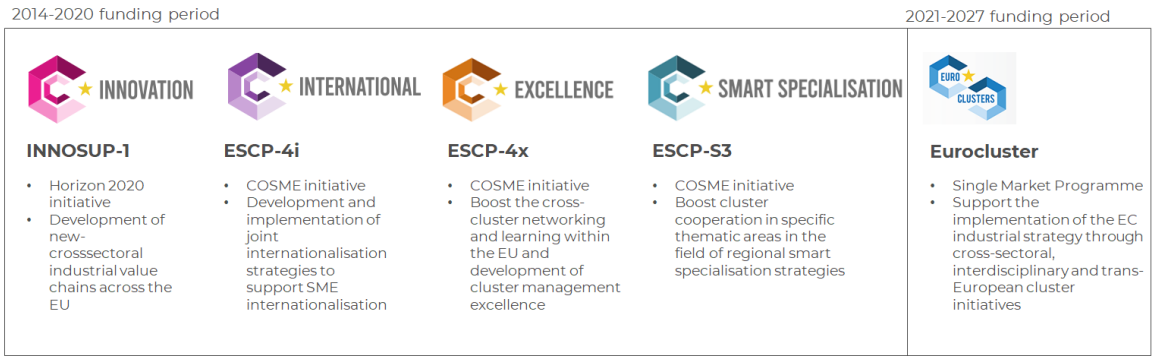
03

Cross-border cooperation and the involvement of Croatian clusters in European networks and support initiatives

3. Cross-border cooperation and the involvement of Croatian clusters in European networks and support initiatives

Findings from the Evaluation Study of and Potential Follow-Up to Cluster Initiatives under COSME, H2020 and FPI of the European Commission (2021) show that **cross-border cooperation** is perceived by innovation stakeholders as a highly relevant activity for clusters to support sustainable growth and resilience-building of their SME members.[28] To gain an overview of the existing cross-border cooperation of Croatian clusters, a closer look will be taken in this chapter on the involvement of Croatian clusters in European support initiatives with a focus on the **2014-2020 funding period** as well as the Joint Cluster Initiatives (Euroclusters) for Europe's recovery of the **2021-2027 funding period**.[29] (see Figure 9). Besides direct cluster support initiatives, the chapter also outlines the involvement of Croatian cluster organisations in cross-border INTERREG projects.

Figure 9: Overview of EU support initiatives in the funding period 2014-2020 and 2021-2027



Source: ECCP (2022)

Involvement in EU initiatives in the EU funding period 2014-2020

In the 2014-2020 funding period, no Croatian cluster organisation was involved in the **European Strategic Cluster Partnerships or the INNOSUP-1 initiative**. However, due to its strategic location, Croatia collaborated with all neighbouring countries on many cross-border, interregional and transnational projects in the 2014-2020 funding period. Croatian organisations like regional and local authorities participated in EU projects such as the Interreg Italy-Croatia CBC Programme or Interreg Slovenia-Croatia CBC Programme. Moreover, there were also plenty of transnational projects in which Croatia participates such as Interreg Central Europe, Interreg Danube and Interreg EURO-Med, as well as the interregional programmes Interreg Europe and URBACT.

Overall, **INTERREG projects with Croatian participation** aimed at reducing the negative effects of borders, solving common challenges, dealing with low levels of research and innovation, environmental pollution, exploiting unused growth potential (and especially the development of cross-border facilities and clusters for research and innovation), deal with the integration of the cross-border labour market and cooperation between educational institutions, and much more. Topics that

[28] Prognos et al. (2021): Evaluation Study of & Potential Follow-Up to Cluster Initiatives under COSME, H2020 & FPI (DG GROW, Unit D2 - Industrial Forum, alliances, clusters). Study on behalf of the European Commission. Available under: https://op.europa.eu/en/publication-detail/-/publication/a2c3e9e1-3deb-11ec-89db-01aa75ed71a1/language-en/format-PDF/source-241039860 (last access on 15.11.2022).

[29] For more information on the Euroclusters see: https://eismea.ec.europa.eu/funding-opportunities/calls-proposals/joint-cluster-initiatives-euroclusters-europes-recovery_en (last access on 18.10.2022).

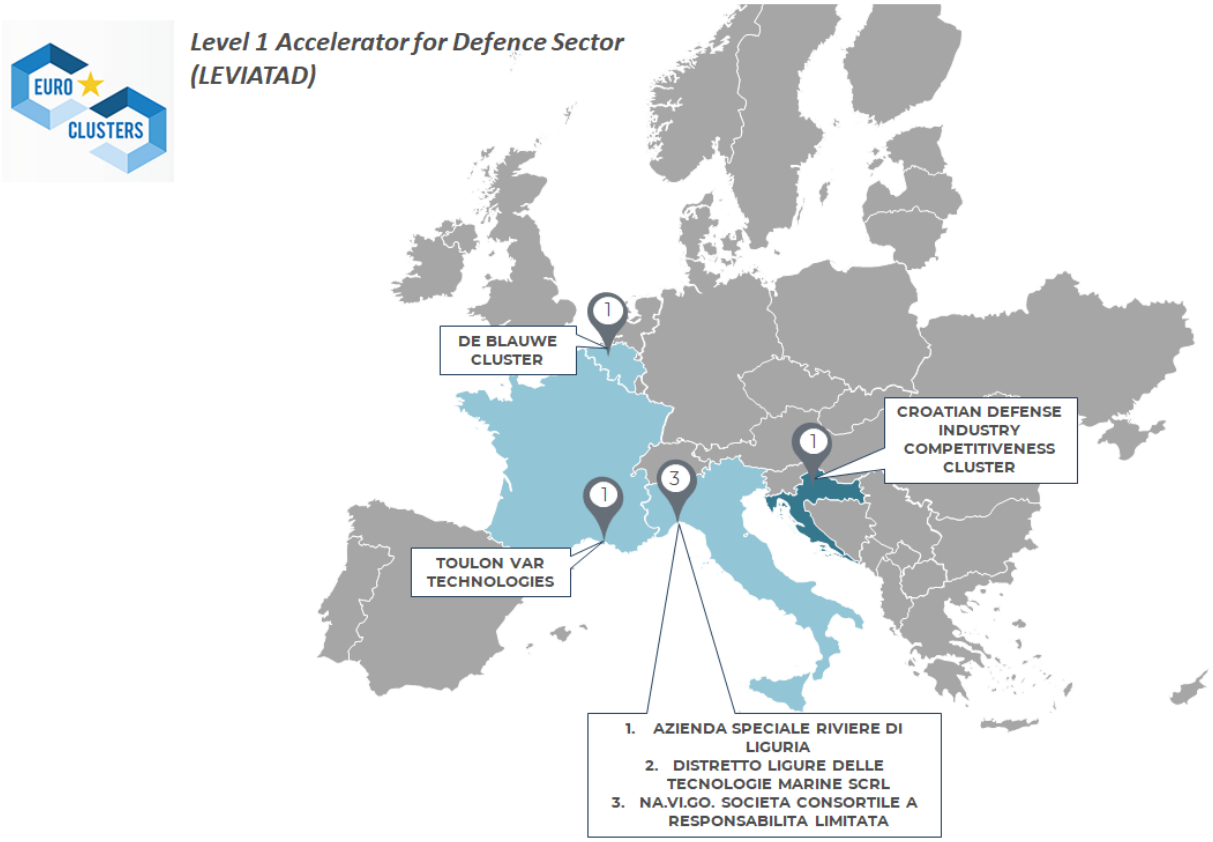
were covered include, amongst others, biodiversity preservation, zero-carbon urban mobility, industrial transition & entrepreneurship, SME competitiveness, climate change, culture and sustainable tourism, circular economy, research and innovation capacities.

In the 2014-2020 funding period**, 75 INTERREG projects** were implemented with the participation of Croatian organisations.[30] 165 Partner organisations were involved in the projects coming from the following 16 countries: Bulgaria, Germany, Hungary, Romania, Slovenia, Slovakia, Poland, Greece, Italy, Malta, France, Netherlands, Lithuania, Latvia, Serbia and Montenegro.

Involvement in EU initiatives in the EU funding period 2021-2027 (Eurocluster)

With regards to 2021-2027, the European Commission has launched the implementation of the EU Industrial Strategy. In this context, so-called Euroclusters are funded under the Single Market Programme. The Eurocluster initiative aims at supporting cross-sectoral, cross-regional European industry clusters cooperating with other economic stakeholders such as companies or business organisations.[31]

Figure 10: Overview of project consortium of Eurocluster "LEVIATAD"



Source: ECCP (2022), based on information from Funding & Tender Portal.

[30] For more information see: https://ec.europa.eu/regional_policy/en/projects (last access on the 26.10.2022).

[31] For more information to the Eurocluster call see: https://clustercollaboration.eu/eurocluster (last access 11.10.2022).

From Croatia, one organisation is participating in the Eurocluster *Level 1 Accelerator for Defence Sector (LEVIATAD).*[32] The Croatian Defense Industry Competitiveness Cluster cooperates within the consortium together with five organisations from Belgium (De Blauwe Cluster), France (Toulon VAR Technologies) and Italy (Azienda speciale riviere di Liguria, Distretto Ligure delle Technologie Marine SCRL, NA.VI.GO Società) (see Figure 10). The project focuses on creating a Eurocluster of Excellence of Naval Defense. Based on an Action Plan, the concrete objectives of the Eurocluster *LEVIATAD* are to improve the European position with regards to value chain positioning and to support innovation processes and SMEs to set up cooperations with groups of the public and private sector.

[32] For more informationen to the Eurocluster LEVIATAD see: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/999999999/project/101074868/program/43252476/details (last access 26.10.2022).

04

The S3 Strategy 2014 - 2020 of Croatia

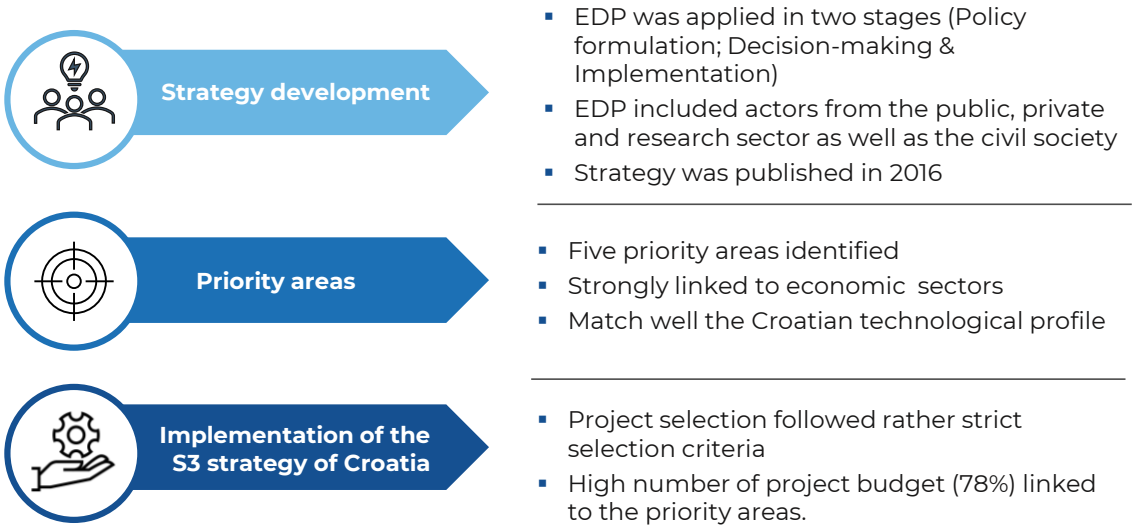
4. The S3 Strategy 2014-2020 of Croatia

Cluster organisations (can) play an important role in the design and implementation of smart specialisation strategies since in both concepts, the facilitation of economic growth and competitiveness through regional proximity, are key elements. Hence, this chapter focuses on the S3 Strategy 2014-2020.

S3 Strategy 2014-2020 of the Croatia region

A key starting point for the analysis of the Croatian S3 Strategy 2014-2020[33] is the data collected in the Study on prioritisation in Smart Specialisation Strategies in the EU.[34] This study systematically screened and assessed all available S3 strategies across the EU to discover the respective approaches to prioritisation, to analyse if priorities set within the strategies correspond to innovation capabilities and if these were translated into concrete projects. The following analyses will follow the logic of an 'ideal' S3 process (from strategy development to implementation of projects).

Figure 11: Factsheet - Croatian S3 Strategy 2014-2020



Source: ECCP (2022)

Strategy development

Regarding the Entrepreneurial Discovery Process[35] (EDP) it can be stated that in Croatia the EDP was applied in the stage of policy formulation as well as Decision-making & Implementation. In the other stage (Monitoring, evaluation and updating) the EDP was not applied in the Croatian S3 Strategy 2014-2020. The EDP that was applied in the stage of policy formulation included a broad range of actors covering the public, private, and research sectors

[33] see also the Operational Programme of Croatia. Available under https://ec.europa.eu/regional_policy/en/atlas/programmes/2014-2020/croatia/2014hr16m1op001 (last access on 13.10.2022)

[34] Prognos /CSIL (2021): Study on prioritisation in Smart Specialisation Strategies in the EU. Study on behalf of the European Commission. Available under: https://ec.europa.eu/regional_policy/en/information/publications/studies/2021/study-on-prioritisation-in-smart-specialisation-strategies-in-the-eu (last access on 09.10.2022)

[35] The entrepreneurial discovery is an interactive and inclusive process in which the relevant actors identify new and potential activities and inform the government. The government assess this information and empowers those actors most capable of realising the potential. See https://s3platform.jrc.ec.europa.eu/edp (last access on 15.11.2022)

as well as the civil society. Box 1 shows some good practices of cluster involvement in S3 strategies from other European regions and especially in the EDP.

Priority areas

The five priority areas that were identified in the Croatian S3 Strategy 2014-2020 are presented below. A full overview and the respective sub-priorities are displayed in Table 5 in the Annex.

Figure 12: Priority areas of Croatia in the Croatian S3 Strategy 2014-2020

Source: ECCP (2022)

The Croatian Strategy 2014-2020 is strongly linked to economic sectors strongly linked to economic sectors (74%), scientific fields (56%) and to a lesser extent also to technological fields (39%). This means that similar to many other S3 strategies the priorities of the Croatian S3 Strategy 2014-2020 are not solely economically, scientifically, or technologically driven but rather reflect a combined approach. In addition, when it comes to its thematic focus (measured with a Bandwidth Index[36]) the Croatian S3 Strategy 2014-2020 is characterised by a medium thematic bandwidth (42%; EU average: 36%).

Regarding the correspondence of the Croatian S3 Strategy 2014-2020 with its regional profile and regional innovation capabilities, it can be stated that the Croatian strategy matches best the technological profile. This means that there is a relatively strong and positive correspondence between the S3 priority areas mentioned above and the average patent share in the three years before the strategy implementation.

Implementation of the S3 strategy of Croatia

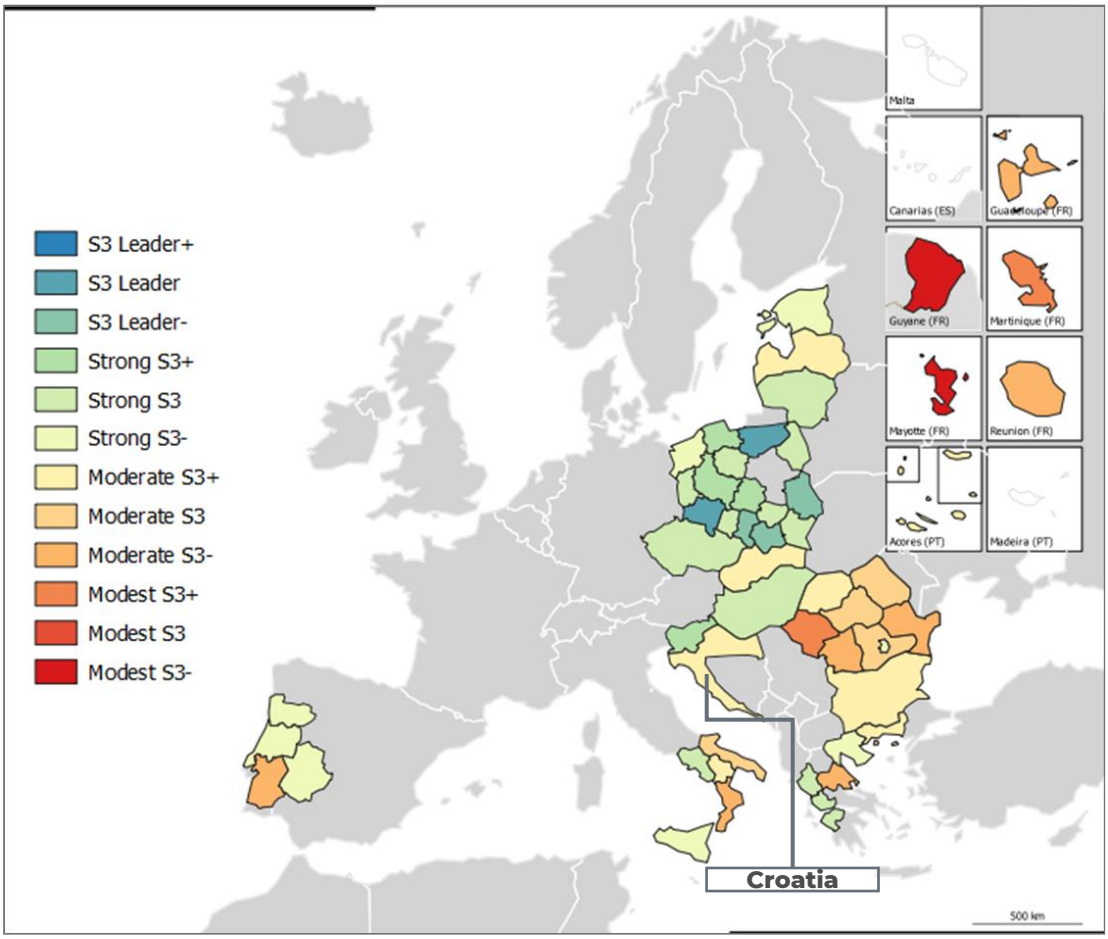
Considering the implementation of the Croatian S3 Strategy 2014-2020 it is found that overall, the project selection followed rather strict selection criteria as many projects needed an alignment to the S3 priority areas mentioned above. These rather strict selection criteria are also reflected in the high number of projects and budget that is linked to the priority areas of the Croatian S3 Strategy 2014-2020. Overall, around 72% of the Croatian ERDF-TO1 projects and 78% of the ERDF-TO1 project budget between 2014-2020 are connected to the S3 priorities. Among all 185 S3 strategies, on average 57% of the projects are connected to the priority areas and 62% of the budget.

As a concluding remark on the Croatian S3 Strategy 2014-2020, an S3 Scoreboard for Less Developed Regions is presented (Figure 13). This Scoreboard serves as a comparative assessment of all 185 smart specialisation strategies in EU Member States and regions. This reflects many of the analytical steps shown before and ranks the regional S3 strategies based

[36] The index of bandwidth indicates the thematic broadness that a S3 strategy covers. It is measured by the degree to which the strategy targets all the possible economic sectors, scientific and technological fields. If a strategy is "narrowly" defined (lower index) it means that it picked only a few economic sectors, scientific and technological fields. A "broadly" defined strategy (higher index) indicates that it focuses on many economic sectors, scientific and technological fields.

on their performance relative to their group average. These groups follow the Cohesion Region classification from the European Commission and are based on economic development.[37] In this Scoreboard Croatia is classified as a 'Moderate S3+', meaning that it performs very slightly below the group average.

Figure 13: Croatia in the S3 Scoreboard 2021 (Less Developed Regions)



Source: ECCP (2022), own elaboration based on Prognos / CSIL (2021).

Box 1: Good practices of cluster involvement in S3 strategies

Good practices of cluster involvement in S3 strategies

Berlin/Brandenburg – Cluster 'Master Plans':
In Berlin/Brandenburg cluster organisations developed 'Master Plans' for priority areas in which specific objectives and actions for implementation were laid out. Thereby, an important element of these 'Master Plans' is the highly participatory and consultative process in which the various stakeholders are involved and can postulate their opinions on the priorities.

Lombardy - Technology clusters and biannual work programmes:
While priority areas are defined in a rather generic manner in the strategy, Lombardy has foreseen biannual Work Programmes that structure priorities into macro-themes and

[37] For more information on the Cohesion Regions see: https://ec.europa.eu/eurostat/web/cohesion-policy-indicators/context/cohesion-regions (last accessed 15.11.2022)

macro-themes into development themes. The establishment of these biannual work programmes is the result of a continuous Entrepreneurial Discovery Process (EDP) to identify more specific domains of the priorities. Thereby especially technology cluster organisations played a crucial role in the S3 process and were involved in identifying areas for further development and the further definition of the priority areas in biannual Work Programmes.

Slovenia - Strategic Research and Innovation Partnerships and the role of clusters (SRIPs):
In Slovenia, lasting partnerships between different types of stakeholders were created to implement the S3 through action plans. Cluster organisations can get involved in this process and these Strategic Research and Innovation Partnerships (SRIPs). There, priority areas are implemented through one SRIP per priority area and constitute long-term partnerships between different actors such as the business communities, research organisations, and the state.

Source: ECCP (2022), based on Case Studies conducted in the context of the Study on prioritisation in Smart Specialisation Strategies in the EU (Prognos / CSIL, 2021).

The Croatian S3 strategy for the period 2021-2027 is still under development and has hence not been published yet.

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Annex

European Innovation Scoreboard 2021

Table 1: European Innovation Scoreboard - Croatia

Croatia	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**66.5**	**15.5**	**2.0**
Human resources	**53.9**	**-4.8**	**0.0**
Doctorate graduates	55.5	-11.4	0.0
Population with tertiary education	66.4	0.0	0.0
Lifelong learning	36.7	0.0	0.0
Attractive research systems	**48.8**	**29.9**	**3.9**
International scientific co-publications	74.3	54.8	11.8
Most cited publications	35.7	16.0	1.2
Foreign doctorate students	41.6	37.2	2.7
Digitalisation	**75.1**	**23.8**	**23.8**
Broadband penetration	38.5	45.5	45.5
People with above basic overall digital skills	122.7	0.0	0.0
Finance and support	**67.2**	**34.1**	**20.6**
R&D expenditures in the public sector	80.3	41.9	16.1
Venture capital expenditures	99.8	52.4	44.6
Government support for business R&D	6.2	4.6	1.8
Firm investments	**40.2**	**-35.9**	**-19.2**
R&D expenditure in the business sector	37.2	15.5	5.4
Non-R&D Innovation expenditures	62.7	-64.3	-50.6
Innovation expenditures per employee	25.3	-56.3	-11.2
Use of information technologies	**90.2**	**0.0**	**0.0**
Enterprises providing ICT training	118.8	0.0	0.0
Employed ICT specialists	59.1	0.0	0.0
Innovators	**126.9**	**87.6**	**-4.0**
Product innovators (SMEs)	133.8	94.7	-17.8
Business process innovators (SMEs)	120.9	79.9	10.7
Linkages	**111.3**	**77.1**	**9.0**
Innovative SMEs collaborating with others	106.3	68.8	-4.1
Public-private co-publications	142.2	115.5	22.2
Job-to-job mobility of HRST	102.1	67.6	14.7
Intellectual assets	**43.1**	**9.2**	**4.8**
PCT patent applications	40.1	-3.0	1.9
Trademark applications	64.7	26.5	7.9
Design applications	24.4	10.6	5.8
Employment impacts	**75.8**	**21.5**	**0.0**
Employment in knowledge-intensive activities	53.2	0.0	0.0
Employment in innovative enterprises	93.6	41.1	0.0
Sales impacts	**56.5**	**29.6**	**6.6**
Medium and high-tech goods exports	52.8	1.6	-9.0
Knowledge-intensive services exports	27.5	26.0	18.6
Sales of innovative products	98.4	70.4	12.9
Environmental sustainability	**56.9**	**-20.5**	**-14.6**
Resource productivity	73.8	15.6	-8.8
Air emissions by fine particulate matter	70.6	14.3	-0.4
Environment-related technologies	19.7	-86.7	-35.4

Source: European Innovation Scoreboard (2021)

Regional Innovation Scoreboard 2021

Table 2: Regional Innovation Scoreboard Continental Croatia (HR04)

	Data	Normalised score	Relative to	
			HR	EU
Tertiary education	34.2	0.450	94	78
Lifelong learning	3.7	0.138	106	34
International scientific co-publications	4,356	1.000	206	178
Most-cited scientific publications	16.3	0.943	624	174
Above average digital skills	34.1	0.597	97	113
R&D expenditures public sector	0.60	0.401	121	83
R&D expenditures business sector	0.62	0.222	135	43
Non-R&D innovation expenditures	±	0.546	±	±
Innovation expenditures per person employed	±	0.391	±	±
Employed ICT specialists	3.8	0.489	123	98
Product innovators	±	0.813	±	±
Business process innovators	±	0.775	±	±
Innovative SMEs collaborating	±	0.607	±	±
Public-private co-publications	800.2	1.000	228	202
PCT patent applications	0.50	0.237	98	38
Trademark applications	2.79	0.204	115	45
Design applications	0.61	0.225	109	39
Employment knowledge-intensive activities	12.8	0.460	101	77
Employment innovative enterprises	±	0.654	±	±
Sales of innovative products	±	0.742	±	±
Air emissions by fine particulates	20.2	0.179	64	36
Average score	--	0.527	--	--
Country EIS-RIS correction factor	--	0.853	--	--
Regional Innovation Index 2021	--	0.450	--	--
RII 2021 (same year)	--	--	123.4	83.7
RII 2021 (cf. to EU 2014)	--	--	--	96.1
Regional Innovation Index 2014	--	0.350	--	--
RII 2014 (same year)	--	--	133.4	74.7
RII - change between 2014 and 2021	--	21.4	--	--

	HR06	HR	EU
Share of employment in:			
Agriculture & Mining (A-B)	7.7	6.4	4.6
Manufacturing (C)	20.7	17.6	16.4
Utilities & Construction (D-F)	9.8	9.8	8.2
Services (G-N)	54.6	58.8	62.9
Public administration (O-U)	6.9	7.1	7.1
Average number of employed persons per enterprise	23.3	6.6	5.2
GDP per capita (PPS)	61,500	20,300	31,200
GDP per capita growth (PPS)	15.78	5.32	3.21
Population density	257	73	109
Urbanisation	191.9	63.0	75.3
Population size (000s)	8,040	4,060	446,450

Source: Regional Innovation Scoreboard (2021)

Table 3: Regional Innovation Scoreboard Adriatic Croatia (HR03)

	Data	Normalised score	Relative to	
			HR	EU
Tertiary education	38.0	0.540	112	94
Lifelong learning	3.0	0.112	86	28
International scientific co-publications	775	0.451	93	80
Most-cited scientific publications	4.4	0.204	135	38
Above average digital skills	36.3	0.646	105	123
R&D expenditures public sector	0.31	0.200	60	41
R&D expenditures business sector	0.15	0.054	33	10
Non-R&D innovation expenditures	±	0.514	±	±
Innovation expenditures per person employed	±	0.358	±	±
Employed ICT specialists	1.8	0.204	51	41
Product innovators	±	0.720	±	±
Business process innovators	±	0.641	±	±
Innovative SMEs collaborating	±	0.406	±	±
Public-private co-publications	109.2	0.371	85	75
PCT patent applications	0.55	0.248	103	40
Trademark applications	1.70	0.123	69	27
Design applications	0.33	0.164	79	29
Employment knowledge-intensive activities	12.1	0.424	93	71
Employment innovative enterprises	±	0.487	±	±
Sales of innovative products	±	0.905	±	±
Air emissions by fine particulates	13.4	0.505	180	103
Average score	--	0.394	--	--
Country EIS-RIS correction factor	--	0.853	--	--
Regional Innovation Index 2021	--	0.336	--	--
RII 2021 (same year)	--	--	92.3	62.6
RII 2021 (cf. to EU 2014)	--	--	--	71.9
Regional Innovation Index 2014	--	0.229	--	--
RII 2014 (same year)	--	--	87.3	48.9
RII - change between 2014 and 2021	--	23.0	--	--

	HR03	HR	EU
Share of employment in:			
Agriculture & Mining (A-B)	3.8	6.4	4.6
Manufacturing (C)	11.0	17.6	16.4
Utilities & Construction (D-F)	9.9	9.8	8.2
Services (G-N)	67.7	58.8	62.9
Public administration (O-U)	7.5	7.1	7.1
Average number of employed persons per enterprise	5.0	6.6	5.2
GDP per capita (PPS)	19,900	20,300	31,200
GDP per capita growth (PPS)	5.44	5.32	3.21
Population density	56	73	109
Urbanisation	61.2	63.0	75.3
Population size (000s)	1,370	4,060	446,450

Source: Regional Innovation Scoreboard (2021)

List of cluster organisations in Croatia

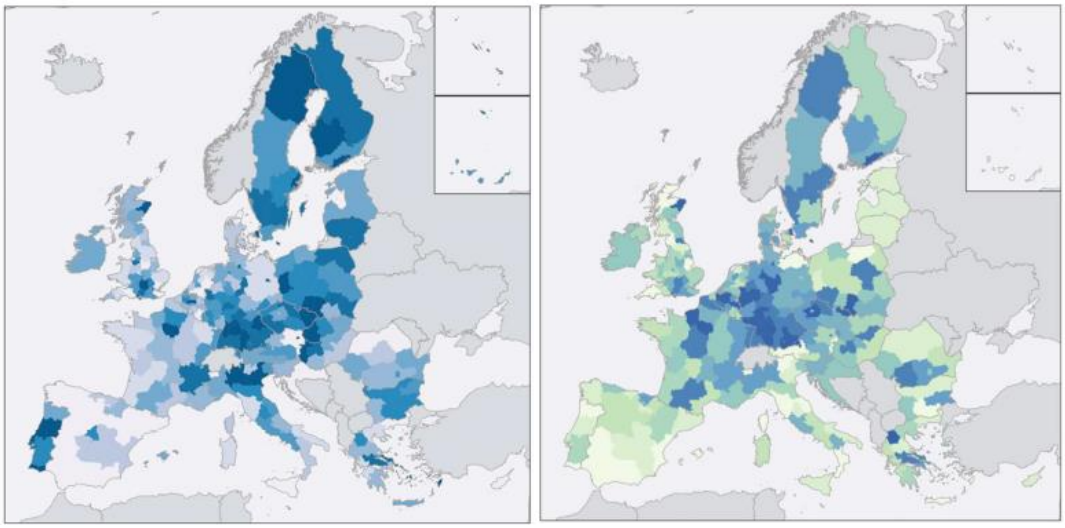
Table 4: Overview of cluster organisations in Croatia and their addressed EU industrial ecosystems

N°	Cluster organisation	Industrial Ecosystem
1	3D grupa	Energy Intensive Industries
2	Cluster for Eco Social Innovation and Development CEDRA Split	Proximity & Social Economy
3	Cluster Inteligentna Energija	Renewable Energy
4	Cluster Južna Istra	Tourism
5	Cluster Lonjsko Polje	Tourism
6	Cluster Sutla and Žumberak	Tourism
7	Cluster Slavonska košarica	Tourism
8	Croatian cluster of competitivenes of creative and cultural industries	Creative & Cultural Industries
9	Croatian Competitiveness Cluster for Electro Energetic and Production Machinery and Technology Sector	Energy Intensive Industries
10	Croatian Competitiveness Cluster for Personalised Medicine	Health
11	Croatian Competitiveness Cluster of food-processing sector	Agri-Food
12	Croatian Defense Industry Competitiveness Cluster	Aerospace & Defense
13	Croatian Maritime Industry Competitiveness Cluster	Mobility, Transport & Automotive
14	Croatian Wood Cluster	Energy Intensive Industries
15	EUVITA Cluster	Agri-Food
16	ICT Cluster Croatia	Digital
17	Klaster poljomehanizacije d.o.o.	Agri-Food
18	Kvarner Health Tourism Cluster	Health / Tourism
19	Wood Cluster SLAVONIAN OAK	Energy Intensive Industries

Source: ECCP (2022) and adapted with further data from regional authorities.

Indicators of cluster strength

Figure 14: Indicators of cluster strength: cluster portfolio strength (share of payroll accounted for by strong clusters) (left) and cluster mix (right)



Source: Ketels & Protsiv (2021): Cluster presence and economic performance: a new look based on European data. Note: Colours refer to deciles of the corresponding variables such that darker colours indicate higher values.

From the S3 Strategy 2014-2020 to the S4 Strategy of Croatia region

Table 5: Overview of priority and sub-priority areas in the Croatian S3 Strategy 2014-2020

Priority	Sub-priorities
Energy and sustainable development	Energy technologies, systems and equipment; Ecologically acceptable technologies, equipment and advanced materials
Food and bio-economy	Sustainable production and processing of food; Sustainable production and processing of wood
Health and life quality	Pharmaceutics, biopharmaceutics, medical equipment and devices; Health services and new methods of preventive medicine and diagnostics; nutricionism
Security	Cybernetic security; Defence technologies and dual usage products; anti-mine programme
Transport and mobility	Production of parts and systems with high added value for road and railroad vehicles; Ecologically acceptable transport solutions; Intelligent transport systems and logistics

Source: ECCP (2022).

Overview of industrial ecosystems

Figure 15: EU industrial ecosystems based on the European industrial strategy

14 industrial ecosystems are: aerospace and defence, agri-food, construction, cultural and creative industries, digital, electronics, energy intensive industries, energy-renewables, health, mobility – transport – automotive, proximity, social economy and civil security, retail, textile and tourism

Source: European Commission: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en