CLUSTER ECOSYSTEM ANALYSIS

A CASE STUDY ANALYSIS OF THE CLUSTERING ECOSYSTEM IN AUSTRIA

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INTRODUCTION

ACCELERATE GDT brings together 7 European partners to accelerate the twin green and digital transitions by aligning supports into regional and national cluster policies, which will in turn raise SME competitiveness, build regional resilience, increase shared value, and boost recovery across Europe. The project runs from 1st March 2023 to the 31st of May 2027.

Clusters are a central feature in the European Commissions' competitiveness and Smart Specialisation strategies (DG Research, 2019). The European Expert Group on clusters found that clusters have a pivotal role in accelerating the twin green and digital transition (GDT), building resilience, and boosting recovery. During the Covid-19 pandemic, clusters demonstrated the capacity to drive change and make European value chains more resilient. Clusters can reach European firms quickly, especially SMEs and improve their innovation potential, technological uptake, skills and internationalisation.

The EU Green Deal's aim is a clean, circular, and climate neutral economy for European industry and society. Clusters can accelerate this transition towards a green economy, by identifying and supporting their members' access to green technologies, innovation, business solutions, dedicated funding and markets, and thus facilitate the green transition.

Digital solutions and the data-based economy are transforming industry and society, and the COVID-19 crisis has further accelerated this need. The EC (2021, p.14) suggests that the "digital transition requires the uptake of solutions by virtually all businesses. The transformation generates new competitive fields as it brings in new opportunities and new ways to create value." Laggers who do not develop digital components in their business model are certain to fall behind in competitiveness and growth.

ACCELERATE GDT PROJECT PARTNERS

AUSTRIA

Capital: Vienna

Size: 83.882,56 sq. km^2

Population: 9.104.772 (2023 Census)

National GDP: EUR 447.2 billion (Statistics Austria 2022)

GDP per capita: EUR 49.400 (Statistics Austria 2022)

% of Unemployment: 4.8% (2022)

Austria is a parliamentary republic founded on the principles of democracy and the separation of powers. The highest representative of the state is the Federal President, who serves a six-year term. The legislative body consists of two chambers: the National Council and the Federal Council. The Chancellor leads the Federal Government and presides over its proceedings.

Economically, Austria relies on the service sector, which contributes approximately 70% to the gross value added, aligning closely with the EU27 average. Manufacturing follows at 28%, while agriculture and forestry comprise a smaller slice at 1.4%. This distribution is characteristic of a structural change that has been underway since the 1960s, highlighting a slow but continuous rise in the significance the manufacturing sector, both in terms of economic contribution and role in job creation. However, despite their relatively smaller share, agriculture and forestry hold strategic importance, providing critical food and energy resources (Statistics Austria 2023).

Austria is a small open economy. Austria's integration into global trade intensified following its EU accession in 1995, catalysing a trade surge. Germany is Austria's biggest trade partner, receiving 29% of exports and supplying 32% of Austrian imports. Other significant export partners include Italy and the USA (both 6%). Important import countries are China with 8% followed by Italy with 6% of Austria’s total imports. Among Austria’s important export products are machinery (16%), tractors and motor vehicles (9%) and electronic machines (9%). On the other side, Austria imports mineral fuels (12%) and machinery (11%) and electronic machines (9%) (Statistics Austria 2023).

Considering foreign direct investments (FDI), Austrian enterprises have been proactive, investing an FDI volume of roughly 240 billion euros. With Germany being the largest FDI recipient, followed by the Netherlands, the USA, and Switzerland, Austria's FDI landscape reflects a diversified investment strategy. Geographically, Austria's locational advantage has become clear after the EU's eastern expansion in 2004, transforming Austria into a strategic gateway to Eastern Europe. Its geographical location is reflected not only in terms of trade but also in the concentration of FDI, with 78 billion euros directed towards Central, Eastern, and South-eastern Europe by 2022, making more than 30% of Austria's FDI portfolio (Statistics Austria 2023).

According to the European Innovation Scoreboard 2023 by the European Commission (2023), Austria is classified as a strong Innovator. Austria is performing above the EU average but with a growth rate slower than the EU, leading to a reduced advantage over time. Austria shows strengths in public-private publications and international scientific collaborations, while it lags in broadband penetration and venture capital investments. Recent trends indicate improvements in government support for R&D and ICT specialist employment, countered by declines in ICT training within enterprises and the mobility of skilled workers.

Currently the Austrian Science, Technology and Innovation (STI) Strategy 2030 (BMBWF, BMK, and BMAW 2023) determines Austria's STI policy. The strategy aims to position Austria as a leading research, technology, and innovation country by 2030. The Austrian federal government is focusing on a new generation of policy measures known as "transformative innovation policy," which involves greater coordination with other policy areas to achieve more sustainable, systemic impacts, in line with green and digital transition.

The upcoming years will therefore focus on supporting sustainable economic transformation and advancing research to achieve climate goals, expanding science-industry cooperation, and enhancing technological sovereignty and openness. Here, the European Union provides a crucial framework that extends well beyond the Austrian STI policy. In fact, Horizon Europe plays a significant role in the Austrian STI strategy. Here, Austria aims to further increase its participation across the key pillars of the EU framework program.

LANDSCAPE AND BACKGROUND OF CLUSTERS IN AUSTRIA

The discussion on economic clusters in Austria began in 1991 during the "Forum Alpbach," an annual interdisciplinary conference of leaders in science, politics, business, and culture held in the Austrian Alps. Subsequent studies by the Industrial Scientific Institute (IWI), which combined industry and foreign trade data, identified potential fields of strength for clusters. One of these studies was crucial in forming the Styrian *Automotive Cluster*, Austria's first such organised cluster. Styrian cluster policies were the first in Austria which aimed at restructuring the regional economy (BMWFJ 2010).

Today, Austria's cluster initiatives span across various regions and industries and are significant for promoting innovation and technology transfer between businesses and academic institutions. The clusters aim to strengthen Austria's technological capabilities and economic growth. The emphasis is on creating network and profile-building instruments, national and international site marketing, coordinated training and further education of specialists, and fostering R&D cooperation leading to innovative products and solutions.

The clusters are also known for their cross-disciplinary strategies, addressing grand challenges such as climate change, resource scarcity, and demographic shifts, and integrating key enabling technologies like IoT and digitalization across sectors including tourism, health, and smart production (Leitner et al. 2015).

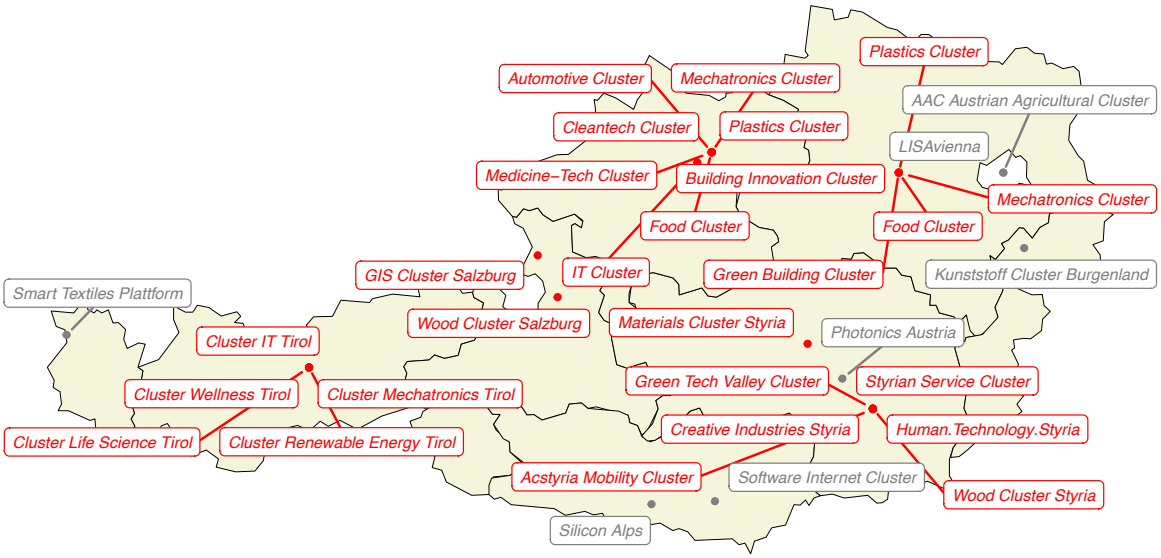
The clusters played an important role in advancing Austria's a competitiveness by following smart specialisation strategies. This includes focusing on harnessing synergies across various

thematic and strategic initiatives. The clusters' role in facilitating innovation, the challenges they address, and the strategies for future economic and technological development in Austria is decisive (ÖROK 2016).

Today dozens of clusters (Figure 1) have been established throughout the country, particularly in Styria, Lower Austria, Upper Austria, and Tyrol. These federal states have been following cluster policies through their regional development agencies. As will be explained further below, other federal states do not have a cluster policy tradition.

As a matter of institutionalising the wide-spread cluster landscape in Austria and aligning this more with the STI policy in the country, the Cluster Platform Austria was launched in 2008. While the clusters are largely a regional policy instrument in Austria, the National Cluster Platform encourages the involvement of diverse clusters and network initiatives—member-driven, non-profit entities focused on specific industries or themes that foster economic, research, and innovation growth (BMWFJ 2010).

Figure 1 Austrian clusters according to the Cluster Platform Austria and clusters identified in the case study (red)



Source: *Cluster Platform Austria;* ***Graphic:*** *Technopolis*

Today, the National Cluster Platform identifies 72 clusters and networks in total. However, it's important to recognise that clusters and networks are not identical concepts, as they have distinct characteristics and serve different functions (as detailed in Table 1).

Clusters are defined by their geographic concentration, thematic focus on specific industries or value chains, and the interdependencies between firms, including competition and

cooperation. Networks, by definition, are not limited by geographic proximity or specific industry sectors. They are structures designed primarily for cooperative purposes and do not encompass competitive dynamics, which, in clusters, can enhance competitiveness. Networks exist specifically for active collaboration and don't automatically include the competition element found in clusters that can spur competitiveness. Clusters allow even non-active participants to benefit from positive externalities. By focusing on networks alone, other critical elements of cluster development, such as human capital development or new business formation, are not addressed. Thus, while promoting networks can solve certain issues, it does not tackle other reasons for policy intervention in cluster development. Networks are integral components of clusters and can be employed to achieve specific objectives, but they are not synonymous with clusters (CRIE and Technopolis 2015).

A comparative overview is provided for clarification in Table 1.

Table 1. Contrasting Clusters and Networks

Aspect	Clusters	Networks
Geographical Concentration	High, with businesses physically close to each other	Not required, members can be dispersed
Industry Specificity	Yes: often focused on a single industry or related sectors	No: can span across various industries
Interaction	Involves both competition and cooperation	Primarily based on cooperation without competitive forces
Competitiveness	Enhanced through both internal competition and collaboration	Collaboration may not directly affect competitiveness
Membership	Can benefit both active and passive participants	Generally, requires active engagement for benefits
Economic Development	Affects talent development, innovation, and entrepreneurship	More focused on solving collaborative issues
Strategic Role	Integral to broader regional development strategies	Serve specific purposes within or outside clusters
Synonymity	Clusters can encompass networks	Networks are a part of clusters but not equivalent to them

Source: based on CRIE and Technopolis 2015

Based on this conceptualisation, a detailed analysis of the Austrian Cluster Platform clarifies the specific clusters, reducing the number of actual 27 clusters with a geographical focus in the different regions (Figure 1; Table 2).

Table 2. Austrian regional cluster programs

	Name	Sector	Region
1	Plastics Cluster Burgenland	Chemistry	Burgenland
2	Software Internet Cluster	IT	Carinthia
3	Green Building Cluster	Construction	Lower Austria
4	Food Cluster	Food	Lower Austria
5	IT Cluster	IT	Upper Austria
6	Plastics Cluster	Chemistry	Upper Austria/Lower Austria
7	Mechatronics Cluster	Machinery	Upper Austria/Lower Austria
8	Automotive Cluster	Automotive	Upper Austria
9	Cleantech Cluster	Environ. and Energy Technologies	Upper Austria
10	Food Cluster	Food	Upper Austria
11	Medical Technology Cluster	Medical	Upper Austria
12	Building Innovation Cluster	Construction	Upper Austria
13	Wood Cluster Salzburg	Wood	Salzburg
14	GIS Cluster Salzburg	Information Systems	Salzburg
15	Creative Industries Styria	Creative Industries	Styria
16	Green Tech Valley Cluster	Environ. and Energy Technologies	Styria
17	Holzcluster Steiermark	Wood	Styria
18	Human.Technology.Styria	Medical	Styria
19	Styrian Service Cluster	Services	Styria
20	Materials Cluster Styria	Chemistry	Styria
21	Acstyria Mobilitätscluster	Mobility	Styria
22	Cluster Renewable Energies Tirol	Environ. and Energy Technologies	Tyrol
23	Cluster Information Technology Tirol	IT	Tyrol
24	Cluster Life Science Tirol	Medical	Tyrol
25	Cluster Mechatronics Tirol	Machinery	Tyrol
26	Cluster Wellness & Life Quality Tirol	Medical	Tyrol
27	LISAVienna	Life Sciences	Vienna

Source: Cluster Platform Austria

Our analysis highlights that, although federal states such as Carinthia, Burgenland, and Salzburg in Austria have established sectoral clusters, they typically do not integrate these clusters into their regional policy frameworks. Vorarlberg is observed to have no such clusters. Meanwhile, Vienna has terminated their cluster policies some years ago (e.g. automotive cluster). However, Vienna supports the biotechnology cluster through LISAVienna, which operates under a distinct funding scheme (see Box 1 and section on AWS).

In contrast, Upper Austria, Lower Austria, Styria, and Tyrol have implemented cluster policies for more than twenty years, capitalizing on regional strengths and integrating clusters with

their policy framework (see next chapter). In this report we will now focus our analysis on these federal states and their cluster policy framework.

ANALYSIS OF THE AUSTRIAN CLUSTER ECOSYSTEM

UPPER AUSTRIA

Upper Austria's economic landscape is dominated by the automotive sector, featuring major original equipment manufacturers, as well as being home to Voest Alpine, the nation's biggest steel producer. The region underwent significant structural changes in the 1980s not least due to the privatization of state-owned companies and more recently, with transitions in the automotive industry due to electric cars and sustainability ambitions.

The region wants to maintain its industrial roots while transitioning to a knowledge-based economy, a move strengthened by the presence of two universities and the country's strongest University of Applied Sciences, FH Oberösterreich, in terms of research output and intensity.

For over 25 years, Upper Austria has been developing a specialized innovation system through a focused and intense regional policy, enhancing its research and educational capacities. Central guiding documents for over two decades are the economic and research strategies.

The current strategy is called *#UpperVISION2030*. It is designed to ensure that the region remains competitive on a global scale and secures the long-term viability of its economy, industry, and research sectors. The strategy follows several aims: the digital transformation through the cooperation of policy, economy, and science. Importantly, the strategy aims at sustainable industrial development through responsible resource use and reuse. Further, the strategy focuses on developing competencies in artificial intelligence, robotics technologies and transforming the regions mobility sector through international partnerships.

In that regard, clusters are considered the lifeblood of the region's economic activity, playing a key role in its economic dynamics. The first cluster, the “Automotive Cluster”, was established in 1988, highlighting the start of a government-backed initiative for regional development. The rationale behind focusing on clusters in Upper Austria stems from the need to adapt to industrial transitions, deindustrialisation, and privatisation of state-owned enterprises. The concept of clusters was seen as a solution to these challenges.

Since its start, the overarching strategy of the clusters has been consistent: to enhance competitiveness through increased innovation capacity. Over the years the cluster management, *Business Upper Austria*, have pursued different activities including site management, innovation counselling, and human capital management. Over 1 million euros have been invested into human capital development. This is crucial in a region with almost full employment and includes efforts to attract foreign talent, assist with housing, and provide education.

Today, Business Upper Austria, oversees the management of eight distinct clusters in the region. These include the *Automobile Cluster, Cleantech-Cluster, IT-Cluster, Plastics Cluster*, *Mechatronics Cluster*, *Medical Technology Cluster, Building Innovation Cluster*, and *Food Cluster*. The *Plastics Cluster* and *Mechatronics Cluster* are collaborative projects between Eco Plus in Lower Austria and Business Upper Austria, representing Lower and Upper Austrian regional development agencies, respectively.

Additionally, *Business Upper Austria* runs the Softwarepark Hagenberg, a science and technology park and operates 10 non-university research centres and owns several technology centres, although they have sold off some since the 1990s.

Lessons learned over the past 25 years include the balance between top-down and bottom-up approaches. Initially, government involvement kickstarted the initiative, but over time, it has evolved into a more bottom-up approach with less direct involvement from the government.

LOWER AUSTRIA

Lower Austria, the country's largest region in terms of size, primarily concentrated on agriculture until the 1950s. Subsequently, it has been one of the regions in Austria most impacted by economic transformation. Starting in the 1990s, the region has actively sought to evolve into a knowledge-based economy, establishing technology centers and enhancing its innovation system. During the periods of former Governor Pröll, the region developed the narrative of the "Technology Offensive" in the early 2000s to spearhead this transformation.

This strategic initiative was undertaken not just to enhance the science and technology profile of Lower Austria, but more crucially, to compete with the capital, Vienna. Geographically, Lower Austria surrounds Vienna, where major investments and premier educational institutions are concentrated. The proximity to the capital provides both challenges and opportunities for Lower Austria, prompting significant efforts to develop its own strengths and distinct advantages.

The region can now look back on over two decades of successfully developing a high-technology profile, not least through the relocation of Viennese university departments and the attraction of start-ups and talents working in science.

Lower Austria's regional innovation policy has evolved over the past 15 years. Initially more focused on economic policy, it now focuses more competitiveness and STI. More recently, this has shifted towards green and digital transitions. In fact, the region's overarching strategies, including the Economic Strategy, STI Strategy, Digital Strategy, and the Climate und Energy Roadmap, are well-aligned, reflecting a coherent policy direction towards the green and digital transition.

Despite not having a strong industrial heritage, Lower Austria provides a diverse industrial landscape. Using this industrial structure, Lower Austria focuses rather on 'related variety' (Frenken et al. 2007) of industries that enables knowledge linkages between related but not similar sectors. This supports to strengthen diverse industries given the region's heterogeneous industrial structure.

Ecoplus, Lower Austria's regional development agency is the executing agency responsible for the policy instruments. The general focus is on mobilizing existing innovation potential and supporting all businesses with the capacity to enhance their competitiveness through innovation, modernization, and structural changes using new key technologies. Here, the innovation policy framework is characterised by the innovation pyramid which consists of the technopoles, the clusters and the technology and innovation partnerships (TIP). In general, the financing aspect of these strategies involves a 7-year program funded in part by the European Regional Development Fund (ERDF).

The technopoles drive regional innovation-based development in defined technology fields at the intersection of science, business, and higher education, aiming to create critical mass, international visibility, and site development. Starting in 2004 the technopoles exist as focal points located Krems focusing on medical technology, in Tulln focusing on agricultural and environmental biotechnology, in Wieselburg focusing on bioenergy, agricultural and food technology, and in Wiener Neustadt focusing on medical and materials technologies. The 'Technopol' program, which focuses on technological niches and talent attraction and retention, aims to specialize in certain topics for better visibility.

The Technology and Innovation Partners (TIP) act as a resource for companies in Lower Austria seeking innovation support. It offers personalized assistance through patent and trademark searches, collaboration and funding recommendations, technology assessments, and networking opportunities.

Since the early 2000s clusters are seen as a vital tool for regional development policy. *Ecoplus* characterise its clusters as dynamic and innovative networks centred around regional strengths and specific themes. This resonates the recent European smart specialisation approach. E*coplus* oversees four primary clusters: the *Green Building-Cluster, Food-Cluster, Plastics-Cluster, and Mechatronics-Cluster*, whereas the *Plastics Cluster* and *Mechatronics Cluster* are a joint program with Upper Austria (Liebert and Hagenauer 2020). Initially, cluster financing was project-based, whereas now they co-financed between the federal state and the ERDF.

Additionally, as new instrument two "Platforms" have been introduced with the goal of reaching out to new actors in the region, including municipalities and others. Health and bioeconomy sectors are specific areas of focus of the two platforms.

STYRIA

Styria has an industrial legacy, particularly in the metal sector, which experienced structural transformations during the 1970s and 1980s. In the 1990s, the region experienced a significant phase of economic restructuring in the metal sector, followed by the privatization of formerly nationalized companies and the establishment of cluster organizations in the 1990s (Trippl 2004).

Today, the region intensively supports research and innovation. Styria's strategy for innovation policy, reflected in their "Economic Strategy Styria 2030" and "Research Strategy Styria", presents a comprehensive approach towards fostering economic growth and

innovation. The core goal of these strategies is to transform Styria into a leading region in the knowledge-economy.

The economic strategy includes five strategic areas: (i) development and management competencies are being expanded to better support strategic, location-relevant themes and make Styria's innovation ecosystems more prominent; (ii) the innovation funding structure is being broadened, particularly for SMEs, to support highly innovative projects and encourage green and digital transformations; (iii) the focus is on invigorating the startup environment, especially in Upper Styria, with a particular aim to foster startups in the green sector; (iv) initiatives are targeting the labour shortage and enhancing regional STEM qualifications, along with supporting SMEs to improve work-life balance and family-friendly policies; and (v)

strengthening Styria's global profile with a focus on export capabilities and strategic advice on supply chain and risk management, showcasing Styria’s commitment to climate neutrality.

Important strategic areas of research strategy include the establishment of a collaborative shared space for science and innovation, leveraging cutting-edge expertise in engineering technology, the expansion of interdisciplinary themes and networks, fostering collaboration across various fields, and generating the right framework conditions for specific locations.

The operationalization of these strategies is managed by the Styrian Economic Development Agency (SFG).

Thematic and focus areas are mobility, green technologies, and health technologies, supported by technological core competencies in materials and materials technologies, production technologies, mechanical and plant engineering, digital technologies, and microelectronics. This areas a represented by seven cluster including Creative Industries Styria, Green Tech Valley Cluster, Holzcluster Steiermark, Human.Technology.Styria, Styrian Service Cluster, Materials Cluster Styria, Acstyria Mobilitätscluster.

Clusters are fundamental components in the management of locations. The clusters are centred on identifying and focusing on themes of the future and enhancing a culture of collaboration within their respective ecosystems. The pillars of contemporary cluster management include cross-cluster management and cooperation, extending beyond individual clusters and regions. The clusters are *Creative Industries Styria, Green Tech Valley Cluster, Wood Cluster Styria, Human.Technology.Styria, Styrian Service Cluster, Materials Cluster Styria, Acstyria Mobility Cluster*. The higher number of clusters highlights the importance the region is giving to policy-induced cluster formation.

TYROL

Tyrol is known worldwide as one of the tourism hotspots, situated in the Alps and regularly hosting international skiing events. Hosting a globally recognized tourism and leisure industry, Tyrol's economic landscape is further characterised by a diverse and dynamic range of businesses, including a strong manufacturing sector.

As a strategic guideline Tyrol follows two principles, aiming to develop Tirol's innovation and research capabilities in a sustainable, future-oriented, and competitive manner. They include encouraging continuous growth and innovation, promoting collaboration among different innovation stakeholders.

In 2022 the *Tiroler Economic and Innovation* Strategy was developed, involving numerous stakeholders and experts, with an intended impact period until 2030. Additionally, the Tyrolean parliament adopted a Research and Innovation Strategy since 2013. The strategy establishes broad guiding principles aimed at sustainably and competitively enhancing Tyrol's position as a region for innovation and research. It also emphasises reinforcing Tyrol's areas of strength and specialization. The strategy is further detailed in a working program, which identifies key thematic areas for focus. These include Life Sciences, Materials & Production (encompassing Mechatronics and Materials, particularly Wood), Information Technologies, Environment and Energy (focusing on renewable energies and alpine spaces), Wellness/Tourism, and the Creative Industries within the service sector.

Tyrol focuses on three strategic fields. First, reinforcing its strengths and specializations on areas where Tirol already has established expertise and competitive advantages. Second, is enhancing the efficiency and adaptability of governance to better support economic and innovation activities and, third, making the region appealing for both local and international talents.

Several key sectors are considered as focus areas reflecting Tirol's traditional strengths and emerging opportunities, these are life sciences, mechatronics, renewable energy, information technology, wood industry, wellness, and tourism.

The Tyrolean clusters are managed by the Standortagentur Tirol. The clusters are *Renewable Energy*, *Information Technologies*, *Creative Industries*, *Life Sciences*, *Mechatronics*, and *Wellness & Well-being*. A key aim is to secure collaboration with academic institutions to enable companies to advance their research and development competencies. Therefore, the cluster management organises communication and coordination structures across cluster and industry boundaries, as well as scientific disciplines. They promote cooperation, provide innovative impulses, identify trends, and bring together suitable partners for joint projects.

The Standortagentur Tirol actively encourages its cluster members to engage in interdisciplinary, cross-industry, and cross-cluster collaborations. This opens innovation potentials at the intersections of various technologies and areas of strength.

INDUSTRIAL STRUCTURE

In this chapter we provide a short summary of Austria's economic landscape building on data from Statistics Austria from 2022 (Table 3).

The manufacturing sector is the most dominant in Austria, with 31,523 companies employing 674,000 people. This sector generates a €220 billion in revenue, contributing significantly to the economy with a gross value added (GVA) of €62 billion.

The retail sector counts 97,009 companies, the highest amount of companies, employing a workforce of 711,000. It also leads in revenue generation which is around €305 billion, and contributes a substantial €43 billion in GVA, underscoring its vital role in the economy.

The construction sector also plays a significant role with 42,065 companies and 343,000 employees, contributing €60 billion in revenue and a GVA of €21 billion, indicating its importance in Austria's economic structure.

In the services sector, finance and insurance with 14,329 companies and 125,000 employees, generate a notable €47,432 million in revenue and €19,115 million in GVA, demonstrating the sector's economic significance.

Table 3. List of Austrian sectors by number of companies, number of employees, revenue (in million €) and gross value added (in million €)

ÖNACE 2008	No of Companies	Employees in 1000	Revenue (in million €)	Gross Value Added (in million €)
Mining	368	6	2,3	1
Manufacturing	31.523	674	220,2	62,8
Energy Supply	4.116	32	67,6	6,6
Water Supply and Waste	2.906	23	7,2	2,5
Construction	42.065	343	60,9	21,3
Retail	97.009	711	305,5	43,5
Transportation	16.344	206	44,5	13,9
Tourism	48.075	275	14,2	9,3
Information and Communication	30.398	142	29,2	13
Finance and Insurance	14.329	125	47,4	19,1
Real Estate	30.855	64	25,2	12
Freelance	98.910	305	39,6	18,7
Other Economic Services	26.015	265	24,1	14,6
Education	22.508	45	1,7	1
Health and Social Work	80.298	233	17,4	11,4
Arts, Entertainment, and Recreation	29837	58	3,8	1,9
other Services	43028	84	2,8	1,7

Source: Statistics Austria 2023

DEMOGRAPHIC STRUCTURE

The demographic structure of the Austrian cluster landscape spans several key sectors, each contributing to the country's diverse industrial and technological capabilities:

In the **Automotive** sector, various automotive clusters are prominent, especially in Upper Austria and Styria. The **Materials and Packaging** sector is characterized by clusters specializing in plastics and other materials. Predominant in regions such as Burgenland, Lower Austria, and Upper Austria, this sector focuses on innovative packaging solutions and material advancements.

For **Wood, Furniture, Housing, Construction sector**, there are wood clusters in Salzburg and Styria, along with organizations focused on passive house building and architectural innovations. In **Health, Life Sciences, and Wellness**, regions like Tirol and Styria are notable. This sector includes biotechnology, life sciences, wellness clusters, and various medical technology clusters, reflecting Austria's advancements in health and life sciences.

The **Food Industry** sector features various food clusters, particularly strong in Lower and Upper Austria. The **Mechatronics, Electronics, IT, and Sensors** sectors, with clusters in Tirol and Upper Austria, include organizations focusing on blockchain and smart production.

Eco-Energy and Environment areas are represented by clusters focusing on renewable energies, environmental technologies, or the emerging Bioeconomy Cluster Austria. Lastly, the **Information, Communication, Processes, and Logistics sector**, encompassing IT clusters, logistics networks, and service clusters.

Together, these sectors illustrate Austria's diverse and specialized industry sectors, contributing to its dynamic economic landscape.

Box 1. Examples of meta-clusters in Austria

In a small country like Austria, positioning clusters on the international stage can be challenging. To overcome this and enhance their competitiveness globally, several clusters have come together to form joint initiatives at the national level. This collaborative approach aims to create synergies and strengthen their international presence. These initiative enhance inter-regional networking among regions and facilitate regular knowledge exchange between regional cluster organizations, allowing Austria's cluster excellence to be showcased to an international audience.

***LISA – Life Science Austria**, serves as the umbrella organization for the internationalization efforts of Austrian life science clusters. Its primary role is to consolidate and support the international activities of five Austrian life science clusters, presenting Austria as a leading life science location. Key activities of LISA include organizing collaborative international trade fair appearances, delegation trips, exploration journeys, and other international events to present Austria's life science capabilities. Additionally, LISA focuses on public relations to strengthen Austria's position in this field, maintaining an English-language website, a regular eNewsletter, an online industry directory (the Austrian Life Science Directory), social media presence, and creating life science industry statistics. LISA also*

supports Austrian life science companies with discounted tickets for major industry events. The rationale behind LISA's establishment includes creating an Austrian flagship project for inter-regional cluster cooperation, allowing Austria to present a unified and strong brand on an international stage.

***Bioeconomy Cluster Austria** is an initiative aimed at bringing together businesses, research, political entities, and society to exchange knowledge, utilize synergies, close resource loops, and develop joint projects along value chains. Led by the Lower Austrian Platform for Green Transformation and Bioeconomy, the cluster is financed by the Ministry of Agriculture, Forestry, Regions and Water Management through the Forrest Fund. Considered to be a flagship project of the federal bioeconomy strategy, it aims to establish a widely supported network over the next three years, fostering regional economic growth and collaborative value chains, initially focusing on wood as a resource. Using wood in building, manufacturing, and energy, emphasizing its role in climate protection, job security, and reducing dependency on fossil resources. The construction of a nationwide bioeconomy network is seen as a significant contribution to these goals. The initial partners are ecoplus from Lower Austria, Business Upper Austria, Innovation Salzburg, Holzcluster Steiermark, proHolz Tirol, the Austrian Energy Agency, the Center for Bioeconomy at the University of Natural Resources and Life Sciences, Vienna (BOKU), BioBASE, Umweltbundesamt, and the Eco-Social Forum Austria & Europe.*

TECHNOLOGICAL PROFILE

Austria's innovation system experienced significant investment in research and development (R&D) over the past two decades, resulting in the second-highest R&D intensity increase among OECD countries in 2018. Austria's research system is advanced with international strengths in quantum physics and life sciences. To support innovation, there is a push for developing incentives for excellent research. Additionally, there is a focus on broadening the industrial R&D base and accelerating the transition to Industry 4.0 to enhance competitiveness and support high-growth firms, leveraging Austria's strong export-oriented manufacturing sector (OECD 2018).

In terms of improving its technological profile Austria focuses on diverse areas. The Federal Minister of Labour and Economy (BMAW) includes the following areas:

- **digital technologies** especially focusing on ICT innovations that are the foundation for pivotal technologies, enabling the rise of smart machinery and facilitating advances such as Industry 4.0, autonomous vehicles, smart infrastructure, and the Internet of Things.
- technologies in the **energy and environment** sector that are focused on building and urban systems, renewable energy systems and grids, industrial decarbonization, and the circular economy.
- Technologies to tackle the **mobility transition** and enable the shift towards a sustainable, climate-neutral, and inclusive mobility and transport system. The

"Mobility 2040" STI strategy outlines how innovations from Austria will contribute to a climate-neutral mobility system in Europe, setting the stage for systemic transformation in both urban and rural areas, with digitalization and technological innovations playing a significant role.

Further key initiatives and concepts that are part of Austria's strategic focus and harness key technologies include:

- Factory of the Future: A concept that envisions highly efficient, technologically advanced manufacturing facilities that are responsive to changing market demands and environmental considerations.
- Nanotechnology: An acknowledgment of the role this cutting-edge technology plays in advancing the manufacturing sector.
- Production of the Future: An initiative focused on modernizing production techniques to meet future challenges.
- Additive Manufacturing: the development and integration of additive manufacturing technologies into Austrian industry.

Austria's "STI Strategy 2030" is a framework established by the Austrian Federal Government to guide the nation's policies in research, technology, and innovation (FTI) over the next decade. It aims to position Austria as a competitive and innovation-friendly location, aligned with future-oriented objectives.

Key goals of the strategy include (i) advancing Austria's position to the forefront of international research and innovation, (ii) focusing on effectiveness and excellence in FTI endeavors, and (iii) emphasizing the development of knowledge, talents, and skills.

The objectives of the FTI Strategy 2030 are implemented through three-year FTI Pacts. Following the initial 2021–2023 pact, the Austrian Federal Government approved the second pact for 2024–2026 in December 2022, focusing on the following priorities:

- Supporting the sustainable transformation of the economy
- Reinforcing trust in science and democracy
- Intensifying excellence in research
- Advancing top emerging talent
- Promoting research to achieve climate goals
- Enhancing collaboration between science and industry
- Driving technology sovereignty and openness

REGIONAL CLUSTERS SUPPORTING THE TWIN TRANSITION

The following chapters highlight the

UPPER AUSTRIA

Business Upper Austria is supporting the green and digital transition through different projects and initiatives. This includes roadmaps like *Sustainable Plastics Solutions* (Business Upper Austria 2021), which brought together 35 companies, and projects like the Green Hydrogen Voestalpine Plant, showcasing sector coupling in Upper Austria.

The Automobil-Cluster is actively involved in the RIAMO project (Rural communities enabled for Integrated Automated MObility), which aims to integrate digital technologies with green transformation initiatives. The project's objective is to enhance connectivity in rural areas of Upper Austria to major transport networks, such as large train networks, by offering an on-demand shuttle service accessible via an app. This service is intended as an eco-friendly alternative to using cars for these distances.

Another project involving the automobile cluster is RECIPROCITY, which focuses on making cities more resilient to climate change and adapting them to digitalization.

The food cluster participates in the RegioLog project, in addition to its involvement in the Circular Academy. RegioLog aims to simplify the process for restaurants and canteen kitchens to purchase and track regional and/or organic food through an easy-to-use website.

Another noteworthy project is Circotronic, where the *Plastics-Cluster* is involved. This is an Interreg project that seeks to establish the foundations for a circular tech-economy in Europe. This project is specifically associated with the location in Upper Austria and represents a collaborative effort involving the *Plastics-Cluster, IT-Cluster*, and *Cleantech-Cluster*.

LOWER AUSTRIA

Lower Austria is actively focusing on the green transition of its industry clusters. To achieve this, the region is pursuing a dual strategy: firstly, by linking its clusters with the existing technopoles, ensuring a seamless integration of existing infrastructures and expertise into the green agenda. Secondly, it plans to collaborate with newly established platforms, leveraging novel ideas and innovations. This dual approach aims to comprehensively embed sustainable practices within its clusters, aligning them with contemporary environmental objectives.

The *Platform for Green Transformation and Bioeconomy* was initiated to create awareness on sustainable transformation of business practices and to push the circular bioeconomy. The *platform has* been the key initiator of the 2022 founded Bioeconomy Cluster Austria. The latter acts as meta-cluster of different Austrian cluster organisation, including proHolz Tirol*, Wood-Cluster Styria, Business Upper Austria and ecoplus (see Box 1).*

The Green Building Cluster highlights a specific project that aligns with the principles of Twin Transition, despite not being explicitly labelled as such on its website. Here, the Open Source Solarhaus App, is designed to transparently display capacity utilization and energy output for solar heat operators via a specialized app, effectively merging digital and green technologies.

Similarly, the Food Cluster is involved in several initiatives that align with Twin Transition goals. A notable example is the "Qualifizierungsprojekt ‘Digi Lean Prinzipien in der Lebensmittelproduktion’" (Qualification Project "Digi Lean Principles in Food Production").

This project focuses on using digital technologies to streamline food production processes, aiming to reduce food waste and the consumption of energy and resources. According to the cluster's website, this project is currently ongoing.

The "Innovationscamp 'Energy4Food' – Digitales Energiemanagement" (Innovation Camp "Energy4Food" – Digital Energy Management) project had objectives akin to those of the previously mentioned initiatives. In this project, companies were offered the opportunity to develop bespoke qualification projects for digital energy management. The aim here was to reduce CO2 emissions and production costs by implementing energy recovery technologies.

The *Plastic-Cluster* allocated two half-days during the MAT-DAYS 2023 event – a workshop that integrates artificial intelligent into the plastics industry- to explore innovations in specialized fields related to climate protection measures and efficiency. The theme for this year's MAT-DAYS was "digitalization and artificial intelligence as game changers in the plastics industry." While this event is often associated with the Lower Austrian plastic cluster, it's important to note that the cluster is a collaborative initiative between Lower and Upper Austria. Consequently, most projects, initiatives, and activities are a joint effort of both.

The Circular Academy project, an online platform offering knowledge to support SMEs in their transition towards a circular economy, involves the Upper Austrian *Cleantech-Cluster* and *Food-Cluster*, showcasing a joint approach to fostering innovation and sustainable practices.

The *Plastics-Cluster* recently issued a call for a bachelor's or master's thesis focused on comparing various online life cycle assessment tools. This initiative mirrors the collaborative approach of the *Mechatronics-Cluster*, which, like the *Plastics-Cluster*, is a joint effort by *ecoplus* and *Business Upper Austria*.

The mechatronics cluster provides an article on the webpage "No climate protection without mechatronics" that directly addresses twin transition as both a challenge and an objective of the cluster. The article explores the role of mechatronics in the context of the twin transition. The *Mechatronics-Cluste*r is also involved in the RESIST project (REsilience through Sustainable processes and production for the European automotive InduSTry), aiming to assist SMEs in the digital and sustainable transformation of the automotive sector.

A crucial asset in Lower Austria is the House of Digitalization. It was opened in 2022 and has become the central hub in Lower Austria for businesses and experts in the field of digitalization. The aim is to support local small and medium-sized enterprises (SMEs) on their journey to digital transformation and to make the concept of digitalization easily accessible to people of all ages. The house can become a relevant brokerage platform not only for digital but also green solutions.

STYRIA

Through the funding program Enabling Innovation the Styrian Mobility Cluster focuses on business strategies for digitalization or sustainability. This includes developing processes or business models for sustainable or digital transformation, activities that embed digitalization and sustainability into organizational structures, measures for creating sustainable, circular, or digital products and services, and preparation for investment projects stemming from such strategies. The promotion especially targets SMEs.

In a collaborative effort for a green future, Green Tech Valley together with several Austrian institutions, including TU Graz and the Montanuniversität Leoben, have joined forces. From March to May 2023, in the course of the Green Utopia project eight interdisciplinary student teams produced short videos depicting green utopias, envisioning the future of energy, mobility, and raw materials based on current research.

The Human Technology Cluster is part of the Styrian e-Health Council and organizer of the Styrian Health Economy Platform, where efforts are made to focus on spurring innovations in the health market. The goal is to establish Styria as a region of digital health innovation, testing, and certifying new care concepts for national and international adoption, starting with matchmaking among health stakeholders, research institutions, and companies.

Projects include the Eurocluster DESIRE, which helps SMEs access European digital health markets, and initiatives supporting individuals with care needs and medical professionals through digital tools, like AAL technologies and digital caregivers.

There's also a focus on improving the availability of health data for research and development, demonstrated by support for projects like "IDE@S – Innovative Data Environment @ Styria". Lastly, the event series "Medicine Meets Technology" connects businesses, medical professionals, researchers, users, and students to explore cooperation opportunities and challenges.

The Wood cluster is involved in several digitalisation and greening projects, highlight a strong focus on the twin transition. This includes the ForForest-Innovation-WF project under the current Forest Fund initiative. The aim is to integrate dynamic site data (water reserves, nutrients, and temperature) with existing inventory data (species, growth, stock) to obtain comprehensive information on biodiversity, CO2 storage capacity, and forest composition at individual locations. The cluster is also participating in an Erasmus + project called FOREE. The project aims to create a Train-the-Trainer course (ToT) and a Massive Open Online Course (MOOC) focusing on learning models. The goal is to transition European forestry education from purely in-person courses to a flexible, hybrid system. This includes integrating digital learning concepts, tools, and platforms, widely applying them in adult forestry training courses.

Furthermore, in response to the Austrian Public Employment Service (AMS), the cluster developed an initiative on Green Jobs. This is a collaboration with the Centre for Education-Management Styria (ZAM). The project focuses on boosting women's interest in craft jobs to address the shortage of skilled workers. Lastly the Wood Cluster joined the Bioeconomy Cluster Austria.

TYROL

Tyrolean clusters gained experiences through the 2011 launched European Union Commission's initiative, European Smart Cities and Communities, aimed to enhance energy efficiency in European cities. In the initiative SINFONIA (Smart INitiative of cities Fully cOmmitted to iNvest In Advanced large-scaled energy solutions), cluster members focused on investing in advanced, large-scale energy solutions.

Building on the foundations of Sinfonia, members of various clusters are being aided in creating and implementing new cross-industry solutions. This effort draws on the collective expertise from clusters in Renewable Energies, Information Technologies, Mechatronics, and Life Sciences, and incorporates insights from Industry 4.0, especially the "Internet of Things." Key initiatives like Ambient Assisted Living (AAL), Building Information Modeling (BIM), and Smart Energy Solutions are driving the development of these integrated and innovative approaches.

There is also the ambition to spur the digitalization to transform the Tyrolean economy and workforce. The IT Cluster Tirol supports companies in these ambitions, through networking, knowledge transfer, and facilitating cooperative projects. Currently the cluster focuses on eTourism, digital construction, healthcare, developing smart production technologies and modern communication and collaboration solutions.

An important event organised by Standortagentur Tirol was the Circular Design Week Tirol. This event focuses on the shift towards a circular economy. The event highlighted the need for comprehensive change at various levels, including policy reforms, producer initiatives, and changes in consumer behaviour. In this regard, product design plays a crucial role in environmental impact, showcasing the importance of circular design.

The Standortagentur Tirol initiated a novel platform that seeks to support business innovation. The Trend Laboratory provides insightful answers to relevant questions, making it an essential tool for making informed decisions about innovation and investment. Key questions are: What are the major fields of innovation for the future? What already exists in these areas? How can we rapidly develop and market innovations? The Trend Laboratory is an important platform to facilitate the twin transition by supporting cluster firms in the innovation process.

OTHER EXTRA-REGIONAL SUPPORT STRUCTURES AND FUNDS

AWS

The Austrian promotional bank (Austria Wirtschaftsservice, aws) is an important funding organization that is relevant for clustering activities.

One important program is Life Science Austria (LISA) (see also Box 1). It offers grants ranging from EUR 200,000 to EUR 800,000 for the new establishment and settlement of life science businesses, targeting founders and existing companies in the sector. Projects can run from 12 (with potential extension to 18) to 24 months, with applications accepted at any time and several decision dates throughout the year. The success rate for funding stands at 25%.

- LisaVienna is a central hub for life sciences in Vienna, established through a collaboration between *aws* and the Vienna Business Agency. The platform supports innovative biotechnology, pharmaceuticals, medical devices, and digital health companies based in Vienna, aiding them in developing new products, services, and processes for the international market. LISAVienna connects these companies with development partners and key customers and provides critical information for

enhancing Vienna's life sciences sector, helping to cement the city's reputation as a leading European center for innovation.

There is currently a new funding collaboration between the aws Sustainable Food Systems Initiative the LC Foodcluster. This initiative aims at fostering sustainable food systems. It focuses on establishing spaces for collective action and cross-collaboration.

- The initiative, which commenced officially in February 2023, so far set up the program, identified interested actors through a community form, and conducted "Soft launch – Kick-off" events to introduce the initiative and present key points of the funding scheme. The objectives of the initiative are twofold: for *aws*, it includes hosting regional "Soft launch – Kick-off" events, leveraging existing structures and networks, engaging regional multipliers as allies and partners, and reaching the target group with minimal organizational effort. For the LC (Food Cluster Upper Austria), the goals are to stay updated on the national level, present new opportunities for cluster partners, adopt a systemic approach, and co-create innovation beyond the region in a cross-sectoral manner. The initiative involves partnering with regional actors and clusters, adopting individually tailored agendas, and focusing on *aws* content – initiative funding and EIT Food. Key stakeholders and beneficiaries include SMEs and initiatives in the field of Food Systems, regional multipliers, and R&D institutions.

Through its program **aws Connect**, *aws* leverages its business activities to cultivate various contacts among Austrian startups, (international) investors, innovation-driven established companies, and research institutions. aws Connect is designed to use these contacts to enhance the networking of key players in the Austrian economy, connecting them through neutral matching services. This platform facilitates targeted online networking and allows members to expand their network by participating in calls and specific events. With over 2,500 registrants, ***aws Connect*** is Austria's largest independent innovation network. Detailed program descriptions and the process for registration or application to participate can be found on their website, www.awsconnect.at.

Several funding programs are listed under **aws Connect**:

- **aws AI Marketplace**: This online platform is a hub for Artificial Intelligence (AI), connecting companies and research institutions offering AI solutions with those seeking to implement AI in their future projects. It also provides foundational information about AI for newcomers to the field.
- **aws Industry-Startup.Net**: Serves as a neutral matching service for innovation-driven startups, small and medium-sized enterprises (SMEs), and large corporations (Corporates) eager to collaborate on and profitably implement entrepreneurial future projects.
- **aws i2 Business Angels:** Is an independent, neutral Austrian platform that facilitates structured and transparent matching of promising startups with financially robust and experienced investors. This platform enables startups and investors to enter into value-added cooperations that benefit Austria as an innovation hub.
- **Global Incubator Network Austria**: Fosters international collaboration by bringing together numerous participants from Austria and Asia, enabling cooperations, market entry, investments, networking, and knowledge exchange.

- **aws Equity Finder:** Austria's central and free online platform for connecting startups and SMEs with investors, swiftly increasing the visibility of startups and SMEs in the investment scene, and providing investors with insight into a variety of investment opportunities.

FFG

The Austrian Research Promotion Agency (FFG) is Austria's central institution for promoting research and innovation, aiming to support the nation's competitiveness. It offers a range of funding programs and services, from supporting basic research to financing centers of excellence. FFG also facilitates international collaborations and acts as a liaison to European research frameworks and the space sector. Established by the Austrian government in 2004 and operating in about 35 languages, FFG ensures quality and efficient use of public funds to advance Austria's research capabilities.

- The **Innovation Voucher** with offers funding for specific services from research institutions, including non-university institutions, universities of applied sciences, and universities. SMEs can receive up to €10,000, covering 80% of eligible project costs, with the remaining 20% as a deductible. For the full €10,000 grant, €12,500 in project costs is needed, with proportional support for costs below this amount. Eligible applicants are SMEs in Austria with specific financial and operational criteria. They can use the researcher database to find potential research partners. The program welcomes projects from all technological fields, emphasizing sustainability. The maximum funding rate is 80%, and certain conditions apply for eligibility, including financial thresholds and no prior receipt of the voucher in the last 12 months.

KLIMA UND ENERGIEFONDS (KLIEN)

The Climate and Energy Fund develops strategies for energy transition, mobility, climate change, and raising awareness. The goal is to cultivate an environment and economy free from CO2 emissions, enhance the innovation of Austrian businesses, and encourage the responsible use of local resources.

The initiatives of the fund act as a conduit between the political, economic, and scientific spheres, directly connecting with local areas, cities, and towns. This approach ensures that Austria's innovative solutions and technologies quickly find their footing in both national and frequently global markets.

- A recent initiative is the "FTI Initiative for the Transformation of Industry". This initiative should foster the development and demonstration of pivotal technologies that foster climate protection and enhance Austria's competitiveness. It is was born out of the recent Climate and Transformation Offensive by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology (BMK). The financial commitment for this initiative amounts to €240 million to be disbursed by the year 2026. The current call for proposals in 2023 has a budget of approximately €15 million, which is allocated to pivotal focus areas such as cooperative research and development projects that are part of innovative large-scale initiatives.

SUMMARY

Building on the *Cluster Platform Austria* as a starting point we analysed the cluster ecosystem in Austria. The platform lists 72 different programs considered as clusters. However, a closer look reveals the lack of clarity in defining a cluster. While the platform not only lists regional and national clusters in their database, it also lists platforms, science parks, initiatives and most commonly, networks.

Following the scientific discourse of differentiating clusters from networks, we have highlighted dissimilarities of both. Several points are essential: Clusters are focused on sectors replicating a whole value chain. Clusters do not require active participations of members, as proximity supports 'buzz' among firms and enhances learning. Learning is not only affected by collaboration but also by competition.

Based on these principles, among others, we have identified 26 clusters Austria that build on the advantages of geographical proximity. Most of these clusters are located in four federal states in Austria: Upper Austria, Lower Austria, Styria and Tyrol as these regions provide sophisticated cluster policies. These regions haven been pursuing clusters policy as part of their regional policy framework for more than two decades.

In a brief summary we have presented all four regions, highlighting their economic structure, their economic and STI policy frameworks and have pointed out their clusters policies.

Upper Austria, a traditional automotive and steel production region, is at the forefront of an industrial transformation. The regions vision is not just a departure from its industrial roots but a leap towards digital transformation and sustainable development. Lower Austria, from its agrarian past, has developed into a hub of knowledge and innovation. The region follows a clear strategy towards research, technology, and innovation. Meanwhile, Styria departed from its industrial legacy towards transformation. Known for its metal sector, the region has navigated through decades of economic restructuring, now positioning itself as an important location for research and innovation. Tyrol, world-renowned for its alpine tourism, its economic strategy aims to fortify its role as a hub for innovation and research. Each region, with its distinct place-specific assets, contributes to Austria's success.

In all regions the clusters play a crucial role. While the last years have seen the cluster becoming vital instruments in the economic and innovation policy frameworks (e.g., smart specialisation) of the regions, they are now seen as relevant instruments to support the twin green and digital transition.

As a mean to highlight the different strategies to tackle the twin transition, we analysed these clusters based on projects, programs and initiative:

- Business Upper Austria is leading the twin transition through diverse projects and initiatives. Key projects include the "Sustainable Plastics Solutions" and the "Green Hydrogen Voestalpine Plant," showcasing sector coupling in the region.

- Lower Austria focuses on aligning its clusters with existing technopoles and newly created platforms for green transformation as a key strategy. The Platform for Green Transformation and Bioeconomy and the Bioeconomy Cluster Austria are central to these efforts. The Green Building Cluster and Food Cluster are involved in projects aligning with twin transition principles.
- In Styria the Mobility Cluster targets business strategies for digitalization and sustainability. Collaborative projects like the Green Utopia project and the Human Technology Cluster's initiatives in digital health innovation highlight the region's focus on the twin transition. The Wood Cluster is involved in digitalization and greening projects, such as the ForForest-Innovation-WF project, aiming to integrate diverse data for comprehensive forest management, and initiatives to boost interest in green jobs.

- Tyrolean clusters have gained experience from the EU initiative European Smart Cities and Communities, particularly through the SINFONIA project focusing on energy solutions. Key is to combine insights from various clusters and Industry 4.0 concepts. The Trend Laboratory platform is an essential tool for supporting business innovation and facilitating the twin transition by providing insights into future innovation fields.

Overall the analysis of the different clusters highlights diverse and innovative ways in which Austrian regions are integrating green and digital transitions into their cluster activities, with a focus on collaboration, innovation, and sustainable development.

Importantly, firms and supporting organisations joining regional clusters can also benefit from other supporting instruments in Austria. For example, the aws, FFG, and KLIEN provide crucial financial and structural support for innovation and clustering in Austria.

The aws plays a pivotal role in funding and fostering innovation across various sectors, with programs like Life Science Austria (LISA) offering grants to life science businesses. It also runs aws Connect, Austria's largest independent innovation network, which includes several initiatives like the aws AI Marketplace and aws Industry-Startup.Net for connecting startups with investors and fostering international collaboration.

The FFG is dedicated to supporting research and innovation, with services that range from basic research support to international collaboration, acting as a bridge to European research frameworks. It offers funding like the Innovation Voucher, which provides financial aid for research services to SMEs.

KLIEN develops strategies for Austria’s energy transition and climate action, aiming for an economy free from CO2 emissions and supporting the responsible use of local resources. It acts as a bridge between political, economic, and scientific sectors, ensuring Austrian innovations are swiftly implemented in the market. One of its significant initiatives is the "FTI Initiative for the Transformation of Industry," part of the “Climate and Transformation Offensive”, with a substantial budget aimed at supporting innovative large-scale projects and industrial transformation.

Together, these cluster structures and funds not only underscore Austria's commitment to a sustainable and innovative future but also provide the necessary resources and platforms for industries and research entities to thrive and contribute significantly to the nation's economic and environmental goals.

GOALS FOR POLICY LEARNING

Past cluster policies have failed by directly replicating strategies from other regions (Hassink and Gong 2019). Such a one-size-fits-all approach is inadequate. Aspiring to become a new 'Silicon Valley' or 'Silicon Wadi' is, therefore, not a feasible objective for many regions. Especially, as cluster exist and act in the context of different regional innovation systems, their circumstances are characterised by existing assets (e.g., firms, networks, institutions, knowledge infrastructure, policy) and determine the transformation path a cluster is going.

- *Considering the wider regional innovation system clusters are embedded in, including the existing assets base, cluster should clearly position themselves in both the green and digital transition.*
- Cluster should focus on enhancing the internal strengths and capabilities, but also facing the weak spots. *Supporting mechanisms should therefore include fostering entrepreneurship, educational initiatives, and strengthening ties with scientific institutions.*
- *aws connect offers relevant funding schemes in that regard such as aws Industry-Startup.Net, aws i2 Business Angels, aws Equity Finder*

Innovation and technological progress often extend beyond regions, underscoring the importance of inter-regional collaboration as a catalyst for innovation (Giustolisi, Trippl, and Benner 2023). Linking clusters with related knowledge structures might enhance the capabilities of actors and spur novel knowledge into a cluster (Balland and Boschma 2019) especially in the ambitions to pursue both the green and digital transition. Linking clusters to others nationally and internationally also helps in mitigating the risks of a structural lock-in within clusters (Hassink 2005). The European Union's cohesion policy has recognised this, actively promoting knowledge exchange and collaborative efforts, especially between advanced and developing regions in terms of innovation. In fact, a notable strategy during the 2021-2027 programming period involves establishing regional innovation partnerships (Pontikakis et al. 2022). Thus, a key action of cluster managers should be:

- *Further facilitating the internationalization of clusters through the development of institutional linkages and capitalizing on so-called gatekeepers and transnational entrepreneurs in the region is crucial. These are actors with established external connections that can significantly spur cluster transformation.*
- *The Global Incubator Network Austria by aws offers a relevant funding scheme.*

While policy plays a crucial role in the development of successful regions and clusters, its effectiveness has limits. Recent years have highlighted the importance of change agents in regions – key individuals who can drive transformation (Grillitsch and Sotarauta 2020).

- *In pursuing the twin transition, identifying, and leveraging these change agents, such as professors, entrepreneurs, or institutional leaders, can be pivotal in initiating change and bringing fresh perspectives.*

Moreover, Austria's cluster structures are not limited to the metropolitan area of Vienna but extend to peripheral areas like Tyrol or Styria. This geographical distribution can be a challenge in attracting talent, which is increasingly crucial in the global innovation landscape (Morrison 2023).

- *Cluster activities aimed at attracting talent, including relocation support, family-friendly packages, and effective marketing, are therefore essential for the growth and success of these clusters.*

CONCLUSION AND FINAL THOUGHTS

As an economically strong and open country, backed by strength in its innovation capacity, Austria provides optimal conditions for the twin transition. Many firms are already aware of the need for change in order to secure long-term competitiveness. In that regard, the clusters in Austria provide an important structure that guides the twin transition of firms.

However, as the Austrian case has demonstrated, none has clearly mentioned the twin transition as a strategy, but it has been a latent objective, reflected by the different projects, programs, and initiatives. Projects, programs, and initiatives often work separately, each targeting either the green or the digital transition. In the future, thinking of both together — namely, how digitalization can spur the green transition and how digitalization can become greener — should be a priority.

Today, the twin transition stands high on the agenda of most of the clusters in Europe. Austrian clusters should position themselves in this environment. Clearly defining what digitalization aspects their cluster is targeting is a relevant step.

While being known as closed networks of firms in similar sectors, within the course of globalization, open innovation, and digitalization, clusters have opened up. This has been further fortified by the internationalization of clusters, e.g., through programs such as Interreg and the novel European Partnerships. Consequently, clusters not only can prevent following the declining phase of the cluster life-cycle but also become strongholds for innovation-based transition. The European Union provides a good framework for partnerships and inter-regional cluster collaboration.

While this may require building bridges, another important tool is to adopt policy instruments. Policy mixes are becoming more relevant, especially when targeting both greening and digitalizing. In the future, it will be necessary for funding institutions to widen their scope, collaborate with other institutions, and combine instruments.

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