OECD Regional Development Studies

Regional Innovation in Piedmont, Italy

FROM INNOVATION ENVIRONMENT TO INNOVATION ECOSYSTEM

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Please cite this publication as:
OECD (2021), *Regional Innovation in Piedmont, Italy: From Innovation Environment to Innovation Ecosystem*, OECD Regional Development Studies, OECD Publishing, Paris, *https://doi.org/10.1787/7df50d82-en*.

ISBN 978-92-64-60443-8 (print)
ISBN 978-92-64-58885-1 (pdf)

OECD Regional Development Studies
ISSN 2789-7990 (print)
ISSN 2789-8008 (online)

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Foreword

Piedmont, Italy, is often considered the birthplace of Italian industry, beginning with textiles in the 19th century, moving to the automotive and aerospace industries in the 20th century, and, more recently, shifting towards IT and services. Piedmont is still one of Italy's leading innovation regions and has a strong manufacturing base. Yet it faces several economic challenges, including the loss of manufacturing jobs, which declined by 16% between 2004 and 2018. Diversifying the regional economy beyond its traditional strengths in core industrial activities will be important, not least given the large share of small- and medium-enterprises and entrepreneurs operating in low-value added activities, and the relatively few high-innovation firms.

The COVID-19 pandemic, with its differentiated impact on regional and local economies, has heightened the need for inclusive, sustainable and resilient economies. It has also accelerated the need for an innovative industrial transition in Piedmont – one that can tackle short and long term challenges presented by the transition, especially relating to employment, but also leverage on opportunities.

To deepen the understanding of how the region of Piedmont can best use innovation policy as a lever to advance its industrial transition, help boost productivity, and drive competitiveness, the OECD Centre for Entrepreneurship, SMEs, Regions and Cities (CFE) worked with the Piedmont Regional Government in re-evaluating its approach to innovation, including its innovation policy design, implementation and governance. As part of this process, the regional government and regional innovation stakeholders, together with the OECD, identified past and present innovation challenges, as well as present and future opportunities to reinforce innovation and innovation diffusion in the region. This report reflects the insights gained during the OECD's work with the Piedmont Regional Government and a wide array of regional innovation stakeholders.

This report highlights the importance of a broad approach to innovation in Piedmont. Such an approach includes: promoting technology and non-technology driven innovation; building innovation competences of SMEs; better connecting regional innovation actors and stronger engagement with regional innovation cluster organisations; to create a stronger regional innovation ecosystem; and linking innovation with large-scale, regional development goals. It also means supporting innovative entrepreneurship to generate economic and industrial diversification and, through this, diversify innovation potential. In addition, an effective regional smart specialisation strategy and a resilient innovation ecosystem are central to Piedmont's industrial transition process.

This report was approved by the Regional Development Policy Committee through written procedure on 5 November 2021.

Acknowledgements

This report was produced by the OECD Centre for Entrepreneurship, SMEs, Regions and Cities (CFE), led by Lamia Kamal-Chaoui, Director, as part of the programme of work of the OECD Regional Development Policy Committee (RDPC).

The work with Piedmont was undertaken in the context of a wider OECD project on regional innovation diffusion that aims to provide policymakers with insights on how to assess the strengths and weaknesses of innovation diffusion channels in their region. The project is co-financed by the European Union via the European Commission's Directorate-General for Regional and Urban Policy (DG REGIO).

This work was co-ordinated by Maria Varinia Michalun and Sandra Hannig, under the supervision of Rüdiger Ahrend, Head of Division Economic Analysis, Data and Statistics, and Dorothée Allain-Dupré, Head of Division Regional Development and Multi-level Governance. Chapter 2 was drafted by David Burgalassi, Chapter 3 by Maria Varinia Michalun with inputs from Stephan Visser and Sandra Hannig and Chapter 4 by Sandra Hannig. This report incorporates substantial contributions, insights and comments from Pedro Marques (Research Fellow, INGENIO, Valencia, Spain).

The report draws on data collected by the OECD, including from stakeholder interviews. The OECD would like to thank the Piedmont Regional Government for its co-operation and support during this process. Special thanks are due to Giovanni Amateis, Tiziana Dell'Olmo, and Marco Manero from the Piedmont Regional Government, as well as to the Economic and Social Research Institute of Piedmont (IRES Piedmont), and in particular Filomena Berardi and Daniela Nepote. Sincere thanks are also extended to the large number of public, private, third sector and other actors who provided valuable inputs during the virtual one-week OECD mission to Piedmont in October 2020 and continuous feedback on the report. They include, among others, the innovation cluster managers, representatives from different departments of the regional government, regional (business) associations, trade unions, universities and incubators as well as the regional bank foundations.

Andrew Brenner edited and formatted the manuscript. Pilar Philip and Yingyin Wu prepared and co-ordinated the final publication, with support from François Iglesias in preparing the cover image.

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Abbreviations and acronyms

CEIP	Centro Estero Internazionalizzazione Piemonte
DSU	Documento Strategico Unitario
EAFRD	European Agricultural Fund for Rural Development
EOCIC	European Observatory for Clusters and Industrial Change
ERDF	European Regional Development Fund
ESF	European Social Fund
ESIF	European Structural and Investment Funds
EU	European Union
FDI	Foreign direct investment
FTE	Full time equivalents
FUA	Functional Urban Area
GDP	Gross domestic product
GVA	Gross value added
IBN	Innovative business network
ICT	Information and communication technology
IPP	Innovative public procurement
IRES Piemonte	Istituto di Ricerche Economico Sociali del Piemonte
ITS	Istituti Tecnici Superiori
KPI	Key Performance Indicator
KTP	Knowledge Transfer Partnership
NEET	Not in employment, education or training
NUTS	Nomenclature of territorial units for statistics

OIP	Open Innovation Platform (Tampere, Finland)
PCT	Patent Cooperation Treaty
PIMAP	The Cluster Partnership for Photonics for Advanced Manufacturing
PPP	Purchasing Power Parity
QoG	Quality of governance
R&D	Research and development
R&I	Research and innovation
RDA	Regional development agency
RIA	Regional innovation agency
RIS	Regional innovation system
RIS3	Regional Smart Specialisation Strategy
S3	Smart specialisation strategy
SDG	Sustainable Development Goal
SME	Small and medium-sized enterprise
SPRI	Sociedad para la Promoción y Reconversión Industrial
TL	Territorial Level
Transfers LR	Transfers Languedoc-Roussillon
VET	Vocational education training

Executive Summary

Piedmont's regional innovation policy aims to strengthen regional innovation capacities in order to boost regional competitiveness and foster innovative and dynamic enterprises. Since its inception, the policy has supported collaborative research and development (R&D), including through innovation clusters, and the promotion of partnerships in important areas such as the smart factory, industry 4.0, life sciences, and the bio-economy. Yet, Piedmont's strong concentration in manufacturing and sophisticated and specific innovation activities in local core industries are at risk of decline due to on-going industrial transitions. Moreover, where innovation does occur it tends to be created by larger firms, with only limited innovation by small- and medium-enterprises (SMEs) that dominate Piedmont's industrial system.

In recognition of these challenges the Piedmont Regional Government is taking a fresh look at its innovation policy design, implementation, monitoring and evaluation. The insights and recommendations in this report are particularly timely as the regional government is currently preparing the Piedmont Smart Specialisation Strategy for the 2021-2027 period and also revisiting the current innovation cluster model that supports innovation in the region.

Key Findings

The territorial context

Piedmont is a wealthy Italian region with a strong industrial heritage but weak growth and employment performance. The region is home to 4.34 million inhabitants and is in the top 20% of OECD regional economies based on economic size. Although its regional per capita GDP is 17% higher than the OECD regional average, like other Italian regions, it is stagnating, broadly flat-lining between 2004 and 2018. Piedmont was hit particularly hard by the global financial crisis as well as the sovereign debt crisis that followed in its wake in 2011, with unemployment increasing to 7.6% in 2019 from 4.2% in 2007. Manufacturing remains an important asset for the region, yet the sector is in decline and manufacturing job losses are higher in Piedmont than in other OECD regions. In addition, the region exhibits strong geographic polarisation, with a gap between the regional capital, Turin, and the rest of the territory. The Functional Urban Area (FUA) of Turin covers less than 7% of the region's geographic territory, but is home to 40% of the total regional population and 44% of its workers in business sectors.

Broadening the definition and approach to innovation

Piedmont exhibits a mixed innovation performance. While the region ranks strongly in terms of private R&D (top 15% of OECD regions), its performance is weaker in terms of public R&D. Moreover, SMEs face difficulties in collaborating in innovation. While the region is considered a "moderate innovator+" among European Union (EU) regions based on the EU innovation scoreboard, innovation policy activities are dominated by technological innovation, missing opportunities offered by other forms of innovation, which can be particularly helpful for micro-firms. In Piedmont, little is being done to "mainstream" social innovation activities, for example, and more attention could be placed on innovation in the public sector. Doing so

could create greater inclusiveness; support larger societal goals (e.g. addressing climate change); and, also, generate greater citizen satisfaction with public and administrative services.

- Opportunities to broaden the regional approach to innovation include active support for management, marketing, processes, business-models, etc. in addition to technological/R&D-driven innovation, and mainstreaming social innovation, developing public sector innovation and supporting innovation among micro- and small firms that currently are not active in the innovation space.

From an innovation environment to an innovation ecosystem

Piedmont has a very rich and dense set of regional innovation actors, including private firms, public sector entities, public-private agencies, such as the seven clusters (*Poli di innovazione*), private foundations, and others. Its main innovation challenge is not a sparse environment for innovation. Rather, it is one of system fragmentation and complexity, with many actors and initiatives pursuing individual objectives through individual initiatives, and little to associate these various efforts. The lack of coordination among these actors is likely affecting their ability to have a greater impact on the region. One challenge for Piedmont's next innovation policy is, therefore, to generate greater integration among its innovation actors and move from an innovation environment to an innovation ecosystem.

- Opportunities to strengthen the regional innovation ecosystem include better connecting innovation actors and activities through a single point of entry for regional innovation support. The Piedmont Regional Government could also create thematically oriented regional innovation platforms to bring together different stakeholders to identify solutions to common problems or to achieve common goals. A regional innovation council could help improve coordination in the innovation environment to fill a leadership void and to build an innovation ecosystem.

Reinforcing the (multi-level) governance of Piedmont's innovation policy

While Piedmont's innovation policy is well integrated in multi-level strategic frameworks, such as the Agenda 2030, European initiatives, and in national programmes managed by the Italian government, it also faces several governance challenges. One of the main challenges is the financing and investment mechanism. The heavy reliance on EU funds as a source of financing for innovation activities may limit the region's ability to pursue its own and more territorially specific innovation priorities. However, increasing own-source revenues to support innovation financing may not be realistic at the moment. Other multi-level governance challenges include low administrative capacity among small municipalities and small enterprises, reinforcing stakeholder engagement in innovation policy, and improving the monitoring and evaluation system.

- Opportunities to reinforce the multi-level governance of Piedmont's innovation policy include addressing concerns of administrative burden and red tape to optimise existing streams of investment financing for innovation. Actions to help accomplish this include: introducing a public investment strategy component in the new innovation policy; building the administrative capacity of municipal governments and micro and small firms; and improving innovation performance measurement practices.

Future-proofing the Piedmont innovation cluster model

Innovation clusters and their corresponding cluster management organisations play an important role in Piedmont to implement its innovation policy and advance the development of its seven innovation clusters: agrifood, green chemistry/advanced materials (Cgreen), energy and clean technologies (CLEVER), ICT, smart products and manufacturing (MESAP), "Made in" textiles (POINTEX), and life sciences (BioPmed). The cluster management organisations successfully support innovation and economic growth in already

innovation-oriented firms. However, greater engagement is needed with firms not actively engaged in innovation, not least to assist them in tackling challenges from on-going green and industrial transitions, the COVID-19 pandemic, and other mega trends such as demographic change.

- There are a number of opportunities to future-proof the Piedmont innovation cluster model. These include: strengthening collaboration among cluster organisations by introducing a shared cluster management platform; making better use of clusters to support skills for industry; developing a cluster internationalisation strategy; and building cluster organisation capacity to design technological and industrial roadmaps for the region.

1 Assessment and Recommendations

Innovation, already a key ingredient to place-based regional development, is expected to keep growing in importance as countries and their regions concentrate on recovering from the COVID-19 pandemic, and actively address global concerns such as climate change, changing demographics, digitalisation and territorial inequalities. Innovation policy, and smart specialisation strategies (S3), are particularly important for shaping the innovation ecosystem in all regions, and especially for regions in industrial transition.

Piedmont, Italy is considered a "moderate innovator+" among European Union (EU) regions. It is also a region in industrial transition. Regions in industrial transition tend to have a significant industrial heritage, lower than average per capita gross domestic product (GDP), average annual GDP growth rates of less than 1% since 2001 (and prior to the COVID-19 pandemic), rising unemployment rates since 2007, a lower than average percentage of the population with tertiary education, a lower than average life expectancy, and performance in the middle to bottom half of the OECD regional well-being indicator set. These characteristics can be compounded by specific trends, such as an ageing population, sectoral restructuring, and industrial decline. To attenuate and manage these trends, regions in industrial transition, including Piedmont, frequently rely on action in a number of policy areas including skills and jobs, making the most of the entrepreneurial fabric, and broadening and diffusing innovation. While action in all of these areas is important, innovation plays a strong role in revitalising a region's economic potential and reversing poor performance dynamics. Productivity is the ultimate driver of regional competitiveness, and innovation, together with innovation diffusion, can boost productivity. Yet, investing in innovation is not without risk. It can be costly and returns are uncertain, particularly among regions specialising in more traditional activities.

As part of the European Union's 2021-2027 Programming Period, Piedmont is taking a fresh look at its approach to innovation and its S3. It is seeking to make sure its innovation policy, together with the clusters and cluster management organisations that support policy implementation, is fit-for-purpose in an increasingly complex environment. Piedmont is on solid footing – it has a history of innovation, its selected areas of specialisation are highly relevant to its industrial and economic fabric, and it has gradually improved its innovation performance. Its score on the European and Regional Innovation Scoreboard has consistently increased since 2014 – moving from 87.3 in that year to 112.3 in 2021.

As a region in industrial transition with many of the common characteristics noted above, Piedmont's challenge is to use innovation policy as a lever to address growth-limiting patterns, such as low GDP growth, rising unemployment, low levels of tertiary education, and a declining manufacturing sector. Accomplishing this will require the region to reconsider its innovation priorities. An example of this is striking the right balance between research and development (R&D)/technology-driven innovation and other forms of innovation that may be more suitable to its enterprise environment – one that is populated by a high share of micro and small enterprises, many of which are not active innovators. It will also depend on transitioning from an innovation environment to an innovation ecosystem, where the existing organisational thickness in the region is matched by equivalent institutional thickness. Assessing the governance system that supports innovation policy design and implementation is also required, with a particular focus on framework conditions and investment financing mechanisms.

Piedmont relies heavily on its cluster management organisations to implement its innovation policy and advance the development of its seven innovation clusters: agrifood, green chemistry/advanced materials

(Cgreen), energy and clean technologies (CLEVER), information and communication technology (ICT), smart products and manufacturing (MESAP), “Made in” textiles (POINTEX), and life sciences (BioPmed). Putting these organisations in the driver’s seat of the regional innovation ecosystem needs to be matched with building their capacity to ensure that Piedmont remains in the sustainment stage of the cluster lifecycle model. These organisations — with guidance from the regional government and upcoming innovation policy — must proactively generate and seize opportunities to maintain knowledge heterogeneity. This can occur within the region, among its large and diverse of innovation actors, and through cross-border – including international – exchange. Building the capacity of cluster management organisations to identify and act on future industry trends will be important and help build the region’s resilience to potential new systemic shocks.

This study contributes to the OECD’s work with the European Commission dedicated to better understanding and fostering innovation diffusion in cities and regions. The report focuses on Piedmont, Italy and aims to support the regional government as it renews its regional development policy and smart specialisation strategy for the 2021-2027 EU Programming Period. The report begins with a closer look at the trends, challenges and opportunities associated with innovation-led growth in Piedmont, closely examining labour performance and the job market. It then moves to consider the current approach to innovation policy and its implementation in the region, highlighting the need to shift from an innovation environment to an innovation ecosystem. It also takes a careful look at the role of Piedmont’s cluster model and its cluster management organisations as pivotal actors in the innovation ecosystem, and their capacity to advance the region’s innovation policy. Chapter 3, which is dedicated to innovation policy and Chapter 4 which focuses on innovation clusters and cluster organisations, offer recommendations for action as the Government of Piedmont Region and other innovation stakeholders advance in the design and implementation of this next innovation policy.

Trends, challenges and opportunities for innovation-led growth in Piedmont

There are a number of structural and economic barriers that affect Piedmont’s ability to realise the full potential that innovation offers as a motor for regional competitiveness. Despite good economic development levels, it is experiencing weak long-term growth. Two recessions in 20 years have been particularly damaging, and there is strong job polarisation. Small and medium-sized enterprises (SMEs), are at the heart of Piedmont’s productive fabric, but are experiencing job losses (especially in the manufacturing sector) and lower productivity. They will need more support to contribute to the innovation ecosystem and help mitigate the risk of the region falling into a middle-income trap. Despite its devastating impact, COVID-19 is also offering the region a set of opportunities to increase innovation and raise productivity, for example through greater digitalisation among firms, and investment in infrastructure and skills.

Good economic development levels combined with weak long-term growth patterns

Piedmont has good economic development levels. Its regional GDP per capita is 17% higher than the OECD regional average, and 2% higher than the OECD average, overall. By the same measure, it is 12th out of Italy’s 21 regions, similar to Tuscany and Friuli-Venezia Giulia. Its total regional GDP, approximately EUR 140 billion, puts it in the top 20% of OECD regional economies, and comparable to Provence-Alpes-Côte d’Azur (France), and Berlin (Germany). However, there is a strong geographic polarisation between Turin, Piedmont’s capital, and the rest of the region. The Turin Functional Urban Area (FUA) covers less than 7% of Piedmont’s territory but is home to 40% of the total population of 4.34 million people, and 44% of workers in business sectors. The urban-rural divide is reflected not only in the spatial concentration of the population but also through the growth of jobs. Between 2012 and 2018, employment in urban areas grew by 3%, but fell by 2% in non-urban ones.

Longer-term trends reveal a series of weaknesses – particularly in GDP growth and the job market. From 2004 to 2018, GDP growth in Piedmont was close to zero, mirroring the overall situation in Italy, on average. In addition, during this period two, almost consecutive recessions (in 2007-2008 then again in 2011-2014) affected Piedmont more than the rest of Italy. After a brief period of recovery, the region fell into another recessionary period in 2019, which hit the manufacturing industry in particular. This led to a drop in industrial production and hurt the job market. As a consequence, Piedmont's participation and employment rates remain weak when compared to the OECD average, and a number of benchmark Italian and non-Italian regions. The low economic performance has contributed to rising unemployment levels – from 4.2% in 2007 to 7.6% in 2019. In 2019, long-term unemployment reached almost 54% of total unemployment in Piedmont, putting it on par with regions in southern Italy, and reflecting low labour market efficiency. These job market trends are particularly acute among youth. Among this cohort, there are high unemployment rates, and high levels of both early school leavers and youth that are neither in employment nor in education or training (NEET), as well as relatively low participation rates in tertiary education, despite the presence of four universities in the region. The share of the labour force with a tertiary education is in the bottom 10% of OECD regions. Job polarisation is another worrisome factor, as demand for middle-skill jobs drops and is replaced by demand for high-skill jobs. While this may reflect a gradual shift towards a knowledge- and innovation-based economy in the region, it may also signal that trends in firm performance, innovation and employment are still adjusting, as they struggle to adapt the regional productive system to market and industrial changes.

A regional asset, industry may be facing a period of decline

Despite a pattern of decline, manufacturing remains a strong asset for the region. Yet, the loss of manufacturing jobs in Piedmont is higher than in other OECD regions, dropping by 17% between 2004 and 2018. Piedmont's service sector is strong and within it some innovative industries play a noticeable role, including ICT. Regional employment patterns tilt in the direction of services, but there is a need for nuance when considering this. On the one hand, the shift to services could negatively affect productivity and wages, particularly if job growth lies in less knowledge-intensive service areas. On the other hand, if employment in finance, ICT, professional, scientific and technical activities were to increase it could offer a solid platform for greater innovation. The trend is not yet clear, and could be affected by the COVID-19 crisis.

At the same time, labour productivity is decreasing, and employment is falling in the manufacturing sector. This is problematic given their direct role in economic growth, and indirect role in income and well-being. The industrial sector's declining contribution to productivity has played a strong role in its slowdown in the region, which may hinder investment and innovation. While from 2013 to 2018 productivity and value added grew, employment steadily declined. This decoupling can be attributed to a reorganisation of business activities and a dualist industrial structure. With respect to the latter, 40% of the region's SMEs in manufacturing are suppliers and often depend on large clients. This can result in fragmented business activities and weak local supply chains, where local suppliers may be replaced by those in other regions or countries. Furthermore, despite their importance to the industrial fabric, employment in SMEs is declining, and the level of start-ups, which could help create new jobs, is low – Piedmont stands in the bottom 25% of OECD regions.

COVID-19 is exacerbating negative economic trends yet may bring opportunity

The COVID-19 pandemic is taking a particularly hard toll on Piedmont, affecting an already weakening economy. It is estimated that containment measures introduced by the government affected 29.1% of total employment in the region, a larger share than the OECD regional average of 27.8%. Driven by the region's high degree of trade openness, GDP is estimated to have been fallen by 8% in 2020. In addition, almost all sectors (except ICT) reduced their output in 2020. While the region is now recovering – GDP is expected

to grow at a rate of about 2.7% between 2022 and 2024 – this is unlikely to be sufficient to compensate for the region's economic losses in 2020.

COVID-19 is also challenging the region's ability to unlock investment that can support innovation-led growth. It is affecting an already vulnerable economic structure, with a high percentage of SMEs. These companies employ a significant number of workers (two-thirds of Piedmont's workers are employed by firms with less than 50 employees) yet, even before COVID-19, they were reducing employment. SMEs, more dependent on debt financing than large firms, are at a higher risk of insolvency. The pandemic also underscored the importance of connectivity, digitalisation and digital literacy to maintain economic activity. The ability to telework has supported business continuity in Piedmont, where 32% of jobs were estimated to be amenable to remote working. Yet, ensuring fast digital infrastructure will be essential to Piedmont's resilience moving forward. Currently, it is in the bottom third of OECD regions in terms of share of population with broadband access. The COVID-19 crisis is also generating labour market risks that affect the quality and quantity of jobs, which in turn could aggravate job polarisation in the region.

There are opportunities associated with the COVID-19 crisis. The future resilience of Piedmont's economy may be getting a boost through improved accessibility to services (especially to digital services). Behind this has been the ability of firms and public institutions to rapidly adapt to e-commerce and other digital changes, including digitalised public and administrative services.

Innovation can play a starring role in Piedmont's economy

Innovation – together with skills and jobs, and a strong entrepreneurial fabric – can play a leading role in addressing the economic and labour market trends Piedmont is experiencing and help attenuate their impact. It can have a positive effect in terms of firm competitiveness, entrepreneurship and employment. SMEs, in particular, stand to benefit. As stated earlier, Piedmont is a moderate innovator+, with considerable innovation potential. It is strong in certain areas, but there is room for improvement in others. Piedmont's private sector leads in regional R&D investment, accounting for a total of 2.2% of regional GDP and 80% of total regional R&D investment in 2018. This places it in the top 15% of OECD regions. Meanwhile, it is in the bottom 40% of OECD regions in terms of share of government expenditure in R&D over regional GDP. In general, Piedmontese SMEs face more difficulty collaborating in innovation as compared with key European benchmark regions, indicating a need to foster shared innovation among SMEs, particularly the less innovative ones.

Overall, action that targets innovation-led development is necessary. This will likely require greater investment in R&D and skills. Initiatives to promote innovation, including the new innovation policy, should consider both how R&D investment can generate a demand for labour, and the type of labour demanded. This is particularly important given the risks associated with job automation and the structural changes linked to a net-zero transition and greener industry, including the required skill profiles. Such shifts, however, present an economic and innovation opportunity. They may activate a regional value chain that already shows potential and prospects for job creation. To nurture this potential, investment in skills associated with these transitions will be fundamental and could generate a win-win outcome for technological, low-carbon and green transitions.

Reconsidering innovation policy and its innovation governance

Innovation policy could help Piedmont succeed in its industrial transition by addressing some of its economic weaknesses, including productivity declines, low skill levels, and limited amounts of entrepreneurialism. This will depend on whether innovation policy – and its implementation – is able to transform the region's current innovation environment into an innovation ecosystem. Piedmont's regional innovation system (RIS) has a rich and diverse organisational fabric that contributes to innovation through

research, education and other related activities, and generates its well-developed organisational thickness. Yet, this organisational thickness is not currently matched by institutional thickness, as there is a limited culture of innovation and cooperation among institutions. Realising the full potential of innovation in Piedmont and creating a true innovation ecosystem where actors and activities are integrated and operate as a system rather than individual components, may rest with addressing the institutional thinness (i.e. limited institutional thickness).

The region's innovation policy for 2014-2020 is based on a smart specialisation strategy and approach to innovation that is focused on R&D-driven projects – a rather traditional approach to innovation and its definition. This may limit the ability to generate other, non-R&D forms of innovation that could be more adapted to potential innovators in Piedmont, including micro and small enterprises. Moving forward, innovation in Piedmont may benefit from a policy that is based on – and promotes – a broader definition of innovation, with an expanded network of actors, and more dynamic frameworks and structures to support its implementation.

Applying a broader definition and approach to innovation

The strong emphasis on technological innovation may not be leaving sufficient room – or financing – for other forms and approaches to innovation, such as innovation in management, marketing or product development processes in micro and small enterprises. In addition, more could be done to mainstream social innovation and promote public sector innovation. The government might also consider actively supporting innovation among targeted populations, such as women, or youth in rural areas. Taking a more innovative approach to innovation policy could also help Piedmont broaden the basis for strategic interaction and address a narrow policy implementation model, which relies heavily on cluster management organisations and may not create sufficient space for other actors to contribute.

Attracting investment by focusing on unique competences and knowledge sources

Despite high private sector R&D expenditure, investment partners for innovation must be found. One way to do so is by promoting the region based on its unique competences and knowledge resources. Undertaking a technological diagnostic of the region could help the regional government and its innovation actors identify unique knowledge resources and specialisations, which could then be used to attract foreign direct investment (FDI). This type of technological mapping can also help reinforce cross-sector networks. Using funding opportunities to build networks and generate collaboration in areas of complex specialisation — particularly among firms not active in cluster organisations or in areas where collaboration is limited (e.g. across sectors, or with universities and/or third sector parties) — contributes to institutional thickness. In addition, more attention could be placed on identifying new, related sectors that can attract innovation investment.

Helping small enterprises build productivity and their innovation capabilities

Raising SME productivity levels in Piedmont is a strategic development challenge that is key to its industrial transition, particularly given the weight of SMEs in the region's enterprise fabric. On the one hand, attention should be given to supporting productivity via non-R&D focused innovation, and building the ability of small – and even micro – enterprises to recognise innovation opportunities. On the other hand, the region will need to pay attention to value chains. Currently, Piedmont's SMEs seem to capture a limited amount of value added from their value chains, hampering their productivity. This can be linked to how larger or multi-national firms manage value chain interactions and can affect the strategies of supplier firms, potentially generating a disincentive among smaller supplier firms to innovate or generate new knowledge. If too many firms do this, it can negatively affect aggregate productivity. At the same time, when smaller firms can access, integrate and use knowledge, they are more likely to benefit from engaging with a large and/or multi-national firm. Helping smaller firms in this sense is an opportunity for generating stronger links

between Piedmont's cluster management organisations and its internationalisation agency – Centro Estero Internazionalizzazione Piemonte (CEIP). The former could help smaller firms build their capacity and preparedness to successfully engage with larger or multi-national firms, and CEIP could facilitate introductions and links between the region's SMEs and multi-nationals. All parties then have a responsibility and interest in ensuring that the relationships and networks are nurtured.

Piedmont's micro and small-sized firms need to increase their ability to innovate; yet they seem reticent to do so. Likewise, SMEs that are already innovative need to boost their innovation capacity. Building qualified expertise within firms, and increasing the skills of those people who are already employed would be a step forward. Promoting university-student placement schemes is one way to do this. In addition, priority could be given to funding projects that promote cross-sector activity and economic diversification, or that pairs experienced and less experienced innovators. Piedmont's upcoming innovation policy should include guidance or support for smaller private sector firms to attract qualified, tertiary-level educated candidates, and encourage placing researchers in firms for a specific period of time. Optimising what the *Istituti Tecnici Superiori* (ITS) offer, and to whom, could further build innovative capacity. The ITS do a good job training youth and helping address and limit skill mismatches. They are also successful at student placement. Yet, they are not optimised as educational institutions. ITS do not actively partner with each other, for example to build an integrated or multi-disciplinary approach to problem solving among their students. In addition, their enrolment focuses on youth entering the job market, but does not contribute to building skills or generating life-long learning for workers already in the workforce. ITS development is limited by their ability to attract quality students and their funding which is structured on annual rather than multi-year budgeting. Addressing these limitations could help build ITS capacity to partner with innovation actors in the region, and better support their students and, more broadly, the labour force.

Transforming to an innovation ecosystem

Piedmont's large and diverse set of innovation actors – from private firms, public sector bodies, cluster organisations, private foundations, and others – operate in a region with a longstanding tradition of manufacturing and innovation. Despite this rich innovation environment based on the number and variety of organisations, there is a relatively weak innovation ecosystem. The activities undertaken by these different actors tend to run in parallel with one another rather than in a coordinated – or ideally integrated – fashion. Piedmont's 2021-2027 innovation policy will need to facilitate stronger cooperation with an eye on greater integration if it wishes to create an innovation ecosystem. It will also need to expand the approach to policy implementation and reinforce the mix of coordination mechanisms. The heavy reliance on cluster management organisations for policy implementation, which forms part of the current model, may be preventing greater institutional thickness. These organisations play an important and appropriately leading role in advancing innovation in the region, yet they are narrowly focused in their areas of specialisation, and their membership is not growing. Overcoming this could be achieved by better integrating the specialisation areas (a move that would be welcome by the cluster managers, and which is already on the regional government's innovation agenda), adopting a focus that goes beyond R&D, encouraging greater collaboration among cluster management organisations and with other innovation stakeholders, and expanding their membership base. In addition, within an innovation ecosystem, there is room for other actors to also play a strong role (e.g. social innovators, bank foundations, public agencies, etc.).

The regional government and cluster organisation managers acknowledge that innovation actors and activities in Piedmont lack integration. A more networked and integrated approach in Piedmont could help better link innovation actors and activities and begin to address the financing challenge confronting start-ups and technology-based firms. Yet, cluster managers do not tend to actively expand their networks. This generates a fragmented environment that reinforces institutional thinness. Furthermore, such fragmentation can dilute resources and limit the region's ability to meet innovation objectives. An effective mix of coordination mechanisms could help address this. For example, a single point of entry into the

regional innovation ecosystem through a web-based platform could be valuable. What is important is that the portal provides an overview of the innovation support and financing that is on offer in the region. Creating a regional innovation platform to connect diverse stakeholders is another valuable mechanism. It could help gather a wide range of actors around a specific theme that in turn could contribute to a vast array of specialisation sectors.

A successful innovation ecosystem will depend on effective leadership, and this current shortcoming needs to be addressed. This is fundamental to ensuring effective coordination and building an integrated environment, and should be one of the objectives for the upcoming policy. Some form of regional coordination body could be useful. While creating a regional development agency or a regional innovation agency may be too onerous in the short or medium term, establishing a regional innovation council might be appropriate. These councils help catalyse and coordinate regional innovation ecosystems. They are often advisory bodies and offer guidance on the region's science, technology, and innovation needs as they relate to economic performance and competitiveness.

Refining the multi-level governance system for innovation policy

Piedmont's innovation policy and its implementation depend on the (multi-level) governance system that supports it. Indeed, the framework conditions surrounding the design and implementation of innovation policy have both pros and cons. Piedmont's innovation system must complement and operate within the parameters of EU, national and regional strategic frameworks. Its innovation policy is firmly grounded in EU Cohesion Policy. This gives it the advantage of benefiting from Cohesion Policy funding. It is also supported by the regional government's initiative to ensure that the different EU, national, and regional strategic initiatives are linked to one another and capture complementarities across strategies and across sectors. This is a strength in the region's governance system as it relates to innovation policy, and it would be important to foster ongoing cross-sector dialogue to ensure that these synergies are fully realised in practice.

Perhaps one of the largest framework challenges to innovation policy is the financing mechanism. The majority of its funding comes from EU Cohesion Policy and other funds. This can limit the region's scope of action. It can also create significant administrative burden and complex financing requirements, which may hamstring the ability of Piedmont's micro and small enterprises to participate in the innovation ecosystem. In addition to direct funding for innovation policy from the EU through a variety of funds and programmes, there is also indirect funding. For example, the national education budget partially finances the region's ITS. Framework conditions can be very difficult for any regional government to address on its own. Many regions, including Piedmont, may be limited in their ability to generate or use own-source funding to implement innovation policy. Thus, addressing this challenge may be a question of optimising existing resources – i.e. making the most of the various EU and national financing sources, and using existing public and private financing opportunities in a more agile manner. Other multi-level governance practices can support innovation policy and its implementation, and merit further development. These include helping build administrative capacity among small municipalities and small enterprises; reinforcing stakeholder engagement in innovation policy and project design processes; and, perhaps most critically, building evidence bases and performance measurement practices specifically for innovation policy to better understand its outcomes.

Main recommendations for action when reconsidering Piedmont's innovation policy design and implementation

Greater detail for each recommendation is found at the end of Chapter 3.

1. Broaden the definition (type) and approach to innovation

- Actively support innovation in management, marketing, processes, and business models
- Mainstream social innovation
- Foster public sector innovation
- Attract new investment partners
- Support innovation among micro and small firms
- Optimise what ITS offer to address a skills deficit

2. Transform the existing innovation environment to an innovation ecosystem

- Better connect innovation actors and activities
- Improve coordination in the innovation environment to fill a leadership void and to build an innovation ecosystem

3. Reinforce the governance of innovation policy in Piedmont

- Continue and reinforce the good practice of building links among global, EU, national and regional strategic documents
- Begin to address concerns of administrative burden and excessive red tape
- Optimise existing streams of investment financing for innovation
- Build administrative capacity of municipal governments and micro and small firms
- Enhance evidence bases and performance measurement practices

Revisiting Piedmont's cluster policy and model

Piedmont's seven innovation clusters build on a strong tradition of innovation in Piedmont. Yet, they face challenges with respect to fulfilling their strategic potential, contributing to smart industrial and digital transformation, and building their membership and activity base. Since 2015, Piedmont's cluster policy has sought to advance the region's S3, advancing regional competitiveness through well-targeted research and innovation. One of the main tasks of Piedmont's cluster management organisations is to connect the various actors within the innovation ecosystem in order to maximise the impact of innovation policy support. Moving forward, it will be important to boost the capacity of these organisations to more proactively respond to shifts in their respective specialisations and industries, and better support meeting regional innovation and development objectives.

Supporting knowledge heterogeneity for greater innovation capacity

Based on the cluster life-cycle model, Piedmont is arguably in the sustainment phase. At this stage, it is important to bring in new knowledge and to maintain or reboot heterogeneity in innovation clusters so that cluster members can continue to learn from one another while also benefiting from synergies and agglomeration externalities. The sustainment phase is followed by a stage of decline, which occurs when no action is taken to maintain knowledge heterogeneity and actors resort to inferior practices and solutions.

To avoid decline, Piedmont's policy makers and its innovation clusters will need to continue generating innovation, knowledge, growth and solutions. One way to do so is by mobilising cluster management organisations in this effort and supporting them to pursue action in three areas: i) using clusters to drive the regional innovation ecosystem; ii) using clusters to drive cross-border collaboration and internationalisation; iii) using clusters to provide strategic intelligence.

Clusters as drivers of the regional innovation ecosystem

Simply funding cluster management organisations is insufficient to ensure cluster development. Financing needs to be complemented by ongoing knowledge generation and exchange. More coordinated innovation activities within and among Piedmont's innovation clusters would help local firms understand and benefit from the interconnectedness of regional industries and value chains, and develop new products or business models based on emerging industries. Doing so would require greater coordination and collaboration among existing clusters, as well as improving the coordination between cluster management organisations and other actors in the innovation ecosystem. Greater cluster collaboration could support industrial diversification, broaden the range of activities on offer to members (and potentially non-members) and help manage the impact of megatrends (e.g. automation, or demographic, environmental and economic shifts) across all industries, especially more traditional and low-tech ones. A cluster management platform could promote greater knowledge exchange, offer support services to individual cluster managers, boost networking, and foster multi-stakeholder collaboration (including internationalisation, cross-sector and cross-cluster activities).

Clusters are well positioned to enhance knowledge sharing by encouraging university/higher education-industry collaboration. The regional government could actively encourage universities to strengthen their engagement with the region's innovation clusters, deepening knowledge exchange and networks with the local business community. Furthermore, clusters could facilitate exchanges between companies and educational institutes to ensure that the supply of skills will meet demand, thereby also contributing to reskilling or upskilling people who are already employed.

Both innovation and non-innovation inclined SMEs and entrepreneurs stand to benefit from clusters and cluster management organisations. However, support by these organisations to SMEs and entrepreneurs appears to be limited due, potentially, to the fact that other organisations (such as bank foundations) provide such support, and/or that the form of support offered by cluster management organisations is not sufficiently suited or targeted to the needs of entrepreneurs, start-up/spin-off or scale-up initiatives. Yet, given the weight of SMEs in the enterprise fabric, and the rather limited membership coverage of cluster management organisations, ensuring that the activities they carry out are as relevant as possible to the widest sector of companies in their specialisation area is critical for maintaining a healthy innovation ecosystem. For example, they could consider working thematically (e.g. green solutions, digitalisation), thereby focusing on new or emerging industries, and broadening their activity. If resources are an issue, cluster management organisations could partner with other institutions (e.g. competence and technology centres) to provide business support services to SMEs and entrepreneurs in partnership.

Clusters as drivers of cross-border collaboration and internationalisation

Piedmont could continue to build on the success of its regional innovation activities by further improving its internal and external connections, prioritising the complementarities of its clusters and combining their strengths. It could also use its cluster management organisations to more firmly position itself in European and global value chains. Doing so, however, will require improving connections and cooperation with clusters in other Italian regions, and internationally. Most of the region's clusters already have some international ties, be they with neighbouring French regions, or other European regions including through the European Cluster Collaboration Platform. Greater internationalisation can further boost knowledge heterogeneity, help clusters open their thematic boundaries, and expand value-added technologies,

industries and knowledge bases related to Piedmont's seven areas for smart specialisation: aerospace, automotive, green chemistry/cleantech, mechatronics, "Made In" (agri-food and textile), and life sciences. This, in turn, can support economic diversification in the region.

Improving cross-cluster collaboration and internationalisation may depend on developing a cluster internationalisation strategy for Piedmont. It may also call for more participation in international projects and cluster exchanges. One option is to tap into the S3 thematic platforms, which could help Piedmont coordinate with other European regions that have similar industrial structures and apply for funding that covers European-wide value chains. Building knowledge-brokering practices is another valuable mechanism, as is broadening cluster participation beyond the triple helix model to include the third sector, and other partners such as financial investors.

Promoting the region's clusters as drivers of strategic intelligence and sustainable development

Piedmont's innovation clusters and cluster management organisations are well positioned to support policy makers and other stakeholders to understand the future of their industries. To capitalise on this, action is needed to build capacity in foresight techniques and technology assessment processes and roadmaps. One main objective of foresight exercises is to ensure that all relevant stakeholders have ownership of a strategy development process and a common understanding of the problems and potential solutions available. Foresight analysis can then be applied to developing technological roadmaps that focus on the steps involved in achieving future aims, with the knowledge generated then being transferred into new products and services. This can be a very powerful tool with which to advance innovation within a region, and can be led by cluster management organisations. Doing so successfully, however, depends on the ability to work collaboratively and not competitively. It also needs to be remembered that future events and trends are difficult to predict and that even the best policy planning cannot foresee all eventualities. The COVID-19 pandemic is a good example.

The region's clusters could also advance social and environmental innovation practices using Piedmont's Strategy for Sustainable Development as guide. In general, clusters are able to contribute to sustainable development by creating new and sustainable technologies for emerging industries, generating new business activities and connecting local firms to sustainable value systems, for example. Some of Piedmont's clusters already have a strong sustainability focus. However, more could be done to promote sustainable development areas that depend on input from a variety of industries, such as smart mobility, or the circular economy. This is an opportunity also to actively engage the third sector in the innovation ecosystem and to continue to generate knowledge heterogeneity within the innovation clusters themselves.

Main recommendations for action when reconsidering Piedmont's cluster policy and cluster model

Greater detail for each recommendation is found at the end of Chapter 4.

1. Remain in the sustainment stage of the cluster life-cycle model

- Encourage stronger engagement between cluster management organisations and other innovation stakeholders
- Reinforce the value of an expanded definition of innovation beyond R&D
- Ensure that cluster management organisation support services are relevant to micro and small firms
- Foster the development of projects that today are beyond scope of cluster organisation support services
- Facilitate access to funding for start-ups

2. Reinforce clusters as drivers of the regional innovation ecosystem

- Strengthen collaboration among the seven cluster management organisations
- Reinforce interaction and exchange among cluster management organisations, universities and other knowledge institutions
- Use the clusters and cluster management organisations to foster the development of skills for industry and meet employer skill demands
- Ensure cluster management organisations continuously support SMEs and entrepreneurship

3. Engage clusters as drivers of cross-border collaboration and internationalisation

- Encourage clusters to open thematic boundaries and/or add related technologies or industries
- Develop a cluster internationalisation strategy in collaboration with the cluster management organisations, or support them to develop an integrated strategy for the ecosystem
- Foster greater participation in cross-border and/or international projects
- Prioritise region-wide diffusion of knowledge, contacts (i.e., networking) and good practices to help internationalisation
- Expand beyond a triple helix model by proactively involving the third sector, financial investors and other actors in innovation activities
- Reinforce dialogue and partnership opportunities between CEIP, innovation stakeholders and cluster management organisations

4. Promote clusters as strategic intelligence hubs for the region

- Develop the strategic capacity of cluster management organisations, and work with them to build strategic insights in industry developments
- Build cluster management organisation capacity to design technological and industrial maps
- Create opportunities and incentives for clusters to contribute to larger-scale goals (e.g. the Sustainable Development Goals, the international climate agenda, etc.)

2 Innovation-led growth in Piedmont, Italy: Trends, challenges and opportunities

This chapter analyses the main trends, challenges, and opportunities for innovation-led growth in Piedmont and compares it with other OECD regions. It illustrates the economic trends and the performance of Piedmont, including the latest figures on the effects of COVID-19, and how manufacturing remains a driver of productivity and growth. It then explores Piedmont's regional innovation performance, linking this with global trends and the potential effects of COVID-19, all of which could shape innovation and regional growth in the future.

In Brief

- Innovation is a key driver for regional competitiveness; however, Piedmont faces a series of structural and economic obstacles that hinder its regional innovation potential.
- Long-term development patterns have eroded Piedmont's economic base. Two severe recessions in 20 years and low economic performance weakened the regional job market, increasing cyclical and structural unemployment, and resulted in a strong pattern of job polarisation.
- Productivity growth will need to be fostered, especially among small and medium-sized enterprises (SMEs), which are facing the largest difficulties.
- Human capital and skills need to be reinforced. A low share of the labour force in Piedmont has a tertiary education. Moreover, a considerable amount of youth are unemployed, which is an obstacle for the region as it strives to reach its potential. Matching conditions between labour supply and demand need to be improved as well.
- Innovation can help the regional economic system reverse the productivity slowdown and promote firms and employment performance, including among SMEs.
- Piedmont has the potential to promote innovation-led growth, by enhancing the participation of SMEs in innovation production and diffusion while also taking steps to enhance entrepreneurial skills.
- While COVID-19 is challenging the regional economy, it is also providing opportunities to boost innovation and raise productivity, including through digitalisation and investment in infrastructure and skills.

Introduction

Regions and cities are facing some of the most challenging moments in recent times. Global trends, such as the health, economic and social impact of the COVID-19 pandemic, the globalisation of production and consumption, the 4th Industrial Revolution, climate change and demographic pressures (ageing and migration) are some of the most striking phenomena shaping the geography of development, with significant long-term and territorially-differentiated economic and social outcomes. These global phenomena have led to rising spatial inequalities and an economic landscape that is increasingly polarised along geographic fault lines. This is particularly noticeable in regions experiencing long-term economic decline or stagnation (OECD, 2019[1]), urban shrinkage, and that are at risk of being caught in a "middle-income trap", i.e. those whose economic output might not be able to grow further (Iammarino, Rodríguez-Pose and Storper, 2020[2]).

Regions with economies rooted in manufacturing, especially those specialised in traditional and low-tech manufacturing are particularly at risk of falling into a development trap and are often challenged by a process of industrial transition. Such regions suffer from increased competition fostered by globalisation, given their generally higher production costs compared to low-income regions. At the same time, they also have lower productivity and innovation levels than high-income regions, thus affecting investment levels. To help these regions avoid or exit such a trap, it is more advantageous to focus on building capacities and competitive advantage rather than on managing decline. 'Place-based' policy responses become

critical in such instances, as they promote a region's internal or inherent development assets, thereby making it easier for regions to seize the opportunities inherent in trade openness and economic integration.

A series of characteristics are common to regions in industrial transition, such as Piedmont, although these traits may be present to a greater or lesser extent in each place. These characteristics include lower than average per capita gross domestic product (GDP), annual GDP growth rates of less than 1%, rising unemployment rates and a lower than average percentage of the population with a tertiary education. They can be compounded by specific trends, such as an ageing population, sectoral restructuring, and industrial decline. To attenuate these characteristics and manage such trends, regions in industrial transition, including Piedmont, frequently rely on action in a number of policy areas including a focus on skills and jobs, making the most of the entrepreneurial fabric, and broadening innovation (OECD, 2019[3]).

Innovation plays a key role in fostering the regional economic potential and reversing poor performance dynamics. Productivity is the ultimate driver of regional competitiveness, and innovation, together with innovation diffusion, can boost productivity. However, innovation investments can be costly and their returns are uncertain, especially in regions specialising in more traditional activities.

This chapter analyses the economic features and development drivers of Piedmont in an international comparative perspective, focusing primarily on the OECD area[1]. The chapter describes Piedmont's regional performance, such as GDP and GDP per capita. In recent years, the level and nature of Piedmont's economic activity has been driven by a process of industrial transition. Compared to OECD regions overall, Piedmont's industry still plays a large role in the regional economy. However, manufacturing jobs in Piedmont are falling, especially in SMEs, and the region has lost a share of its competitive advantage, as measured by productivity, despite a recent, slight recovery. Within this context, innovation can contribute to reversing the region's weak productivity dynamics.

The chapter begins with a look at the main economic trends of Piedmont, with a specific emphasis on the growth rate of regional GDP and job market performance. Then, the chapter focuses on the sectorial trends, including in manufacturing, taking into account key indicators such as gross value added (GVA), productivity and employment. The chapter moves on to analyse the main trends in the region's innovation activity, including research and development (R&D) investments, patenting, collaboration in R&D activities and skills and employment. Then, a dedicated session illustrates how COVID-19 has affected the regional economy and discusses how the pandemic could affect future regional economic and innovation trends.

Piedmont: a wealthy region with low economic and labour performance

This section highlights the main features and trends characterising Piedmont's regional economy. OECD evidence shows that Piedmont has good economic development levels, yet it exhibits weak long-term growth patterns that erode its economic base. The region was severely hit by recessions in the last two decades. Low economic performance has resulted in a weakening of the regional job market, with rising cyclical and structural unemployment, as well as a strong pattern of job polarisation.

Structural and territorial features of the regional economy

Piedmont is an upper-mid income region, with a regional GDP per capita 17% higher than the OECD regional average (OECD, n.d.[4]) and 2% higher than the OECD average, overall in 2018 (OECD, 2021[5]). In the same year, Piedmont's GDP per capita reached EUR 31 445 (USD 46 075 in purchasing power parity), placing it 135th out of 387 OECD regions[2] and 12th out of 21 Italian regions. Piedmont's GDP per capita is comparable to Tuscany and Friuli-Venezia Giulia (Italy), Aragon (Spain), Lisbon (Portugal), Schleswig-Holstein (Germany), and North Middle Sweden (Sweden). In terms of total regional economic size, with 4.34 million inhabitants, more than 426 000 active firms and a regional GDP of approximately EUR 140 billion, Piedmont is in the top 20% of OECD regional economies. Piedmont's total regional GDP

is comparable to regions such as Provence-Alpes-Côte d'Azur (France), Berlin (Germany), North-Holland (the Netherlands), Warsaw (Poland), and Oklahoma (United States). The region exhibits a marked geographic polarisation, with a divide between Turin and the rest of the territory. The Functional Urban Area (FUA)[3] of Turin covers less than 7% of the region's geographic territory, but hosts 40% of the total regional population and 44% of its workers in business sectors (ISTAT[6]). The second largest FUA in Piedmont, Novara, is three times smaller than Turin in terms of surface area, but is more than 10 times smaller in terms of population and workers in business sectors (less than 4%). More than 43% of the region is mountainous, contributing to the spatial concentration of population in some parts of the region and to an urban-rural divide. Between 2012 and 2018, jobs in Piedmont's business sectors grew by 1% and employment in urban areas grew by 3%, yet employment fell by an average of 2% in non-urban areas (ISTAT[6]).

The region shows geographic imbalances when taking into account its administrative provinces[4], where GDP data are available. The province of Turin contributes 55% of the regional GDP, while the remaining 45% is distributed across the other seven provinces. Furthermore, the Piedmontese provinces are highly differentiated in terms of GDP per capita. While the GDP per capita of Turin and of Cuneo are considerably higher than the OECD average, and Novara and Alessandria show values in line with the OECD average, the other provinces show lower GDP per capita compared to the OECD average. Verbano-Cusio-Ossola and Asti, for instance, have a GDP per capita significantly below the OECD average (Table 2.1).

Table 2.1. Share of regional GDP and GDP per capita in Piedmont provinces (2017)

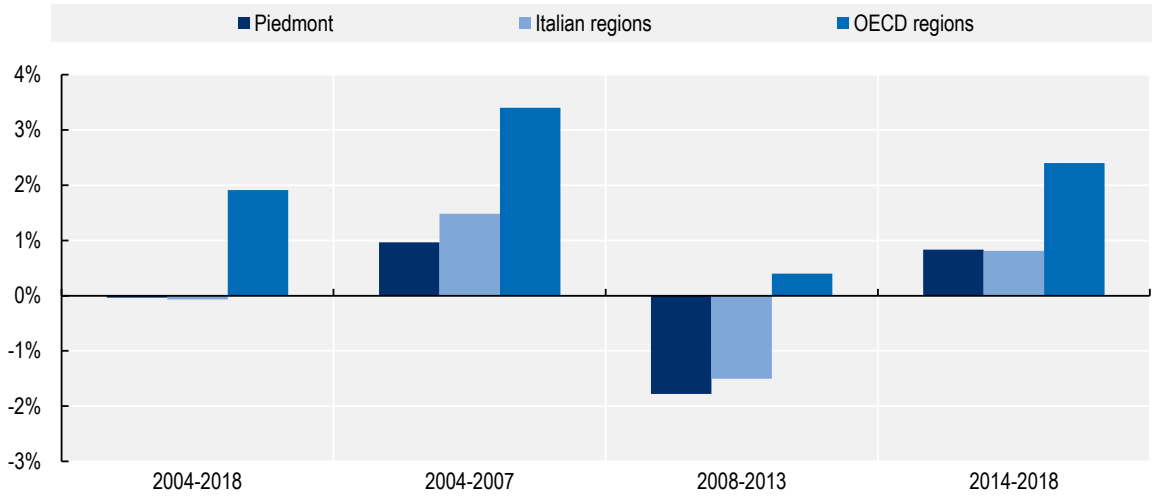
Province	Share of regional GDP	GDP per capita (USD)	GDP per capita (OECD=100)
Turin	55%	47 228	109
Vercelli	3%	39 419	91
Biella	4%	39 165	90
Verbano-Cusio-Ossola	3%	35 561	82
Novara	8%	42 907	99
Cuneo	14%	46 865	108
Asti	4%	36 895	85
Alessandria	9%	41 589	96
Piedmont	*100%*	*46 075*	*106*
Italy (National average)		*44 699*	*103*
OECD average		*43 518*	

Source: OECD elaboration from OECD Regional Statistics Database.

Economic trends

Piedmont shows weak long-term development trajectories and was severely hit by recessions. Despite its strong performance in terms of GDP levels, the Piedmont's performance in other areas is less stellar compared to other OECD regions. From 2004 to 2018, the regional growth rate of GDP in Piedmont, as well as in Italy, on average, was very close to zero, while the average GDP growth rate for OECD regions was almost 2%. Piedmont was particularly hurt by the Great Recession of 2007-2009, resulting from the financial crisis, and also by a second recessionary period that affected Italy between 2011 and 2014. Piedmont, on average, was more affected by both recessionary periods than the rest of Italy (Figure 2.1).

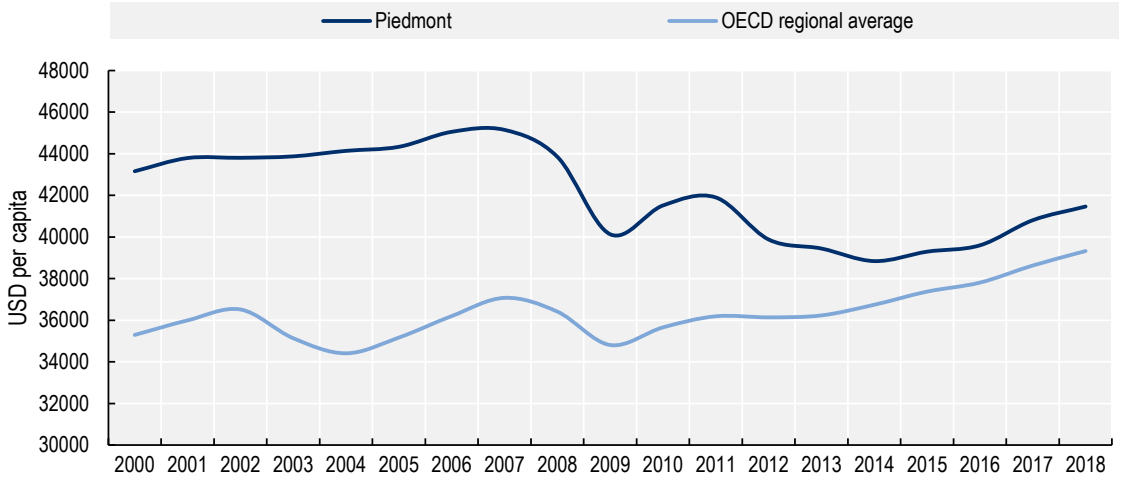
Figure 2.1. Annual growth rates of real GDP in Piedmont, Italian regional average, OECD regional average (2004-2018)



Note: Average annual growth rates, constant Purchasing Power Parity, base year 2015.
Source: OECD elaboration from OECD Regional Statistics Database.

Despite a recovery beginning in 2015, by 2018 the region's economy still had not bounced back to pre-crisis (2007) levels, and Piedmont's regional GDP increased at a slower pace than the OECD regional average. In 2007, GDP per capita in Piedmont was 26% higher (USD 8 000) than the OECD regional average. In 2015, however, GDP per capita in Piedmont was only 10% higher (less than USD 2 000) than the OECD regional average (Figure 2.2). Additionally, in 2019, the region entered into another recessionary phase, which primarily affected the manufacturing industry and resulted in a decline in industrial production (Bank of Italy, 2020[7]).

Figure 2.2. Gross Domestic Product per capita in Piedmont and OECD regional average (2000-2018)

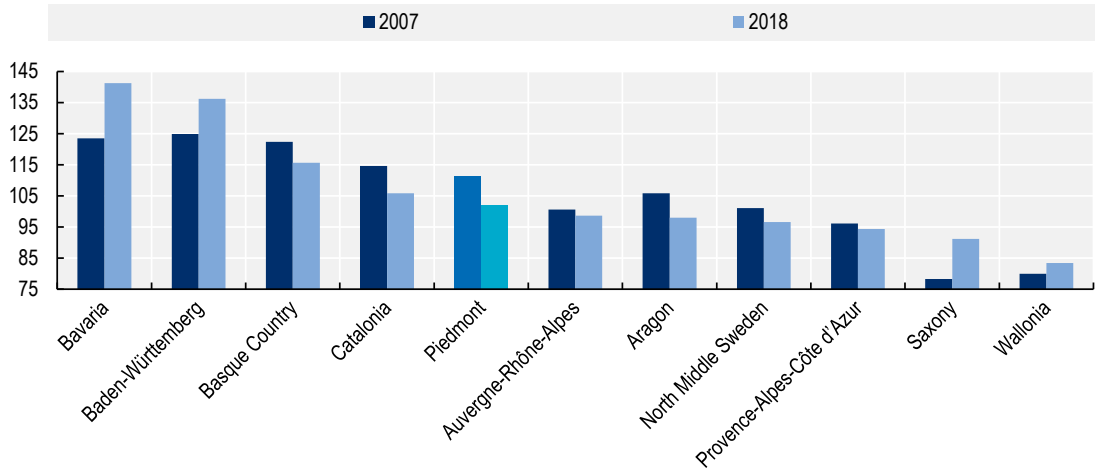


Note: USD, constant Purchasing Power Parity, base year 2015. The values of Piedmont and the OECD regional average refer to the left axis, the difference between Piedmont and the OECD regional average refers to the right axis.
Source: OECD elaboration from OECD Regional Statistics Database.

Patterns of decline are also evident when comparing Piedmont with a sample of OECD benchmark regions: Auvergne-Rhône-Alpes and Provence-Alpes-Côte d'Azur (France); Wallonia (Belgium); the Basque Country, Catalonia, Aragon, Valencia (Spain); North Middle Sweden (Sweden); Bavaria, Baden-

Württemberg and Saxony (Germany). In terms of GDP per capita, Piedmont ranks 5th among these 12 regions. However, in 2007 Piedmont's GDP per capita was 7% higher than the average of the benchmark regions (11% higher than the OECD average), while in 2018 the level was 1% below the average of the benchmark regions (2% higher than the OECD average). From 2007 to 2018, while some regions, such as the German regions[5] and Wallonia[6], increased their level of GDP per capita compared to OECD regions, Piedmont lost its share in a pattern similar to that seen in Catalonia, Aragon, and the Basque Country. As compared with benchmark regions, Piedmont experienced the largest loss of GDP per capita (Figure 2.3). The German regions (Baden-Württemberg, Bavaria, Saxony) and Wallonia are the only regions where GDP per capita increased. As the rest of the chapter will show, GDP levels and the dynamics of benchmark regions are generally coupled with higher labour market and innovation performance.

Figure 2.3. GDP per capita in selected OECD benchmark regions (2007-2018)



Note: OECD average=100
Source: OECD elaboration from OECD Regional Statistics Database and OECD Economic Outlook

The job market in Piedmont faces rising unemployment and polarisation

Piedmont's long-term, weak growth patterns and its slow recovery from two, back-to-back recessionary periods are reflected in its job market conditions. The labour force participation rate increased by 6% in Piedmont in the last years (from 67.8% in 2007 to 71.6% in 2019) and the employment rate also increased moderately (from 64.9% in 2007 to 66% in 2019). However, despite the rising participation rate, when compared to the OECD average, Piedmont's job market figures remain weak (

Table 2.2). Participation rates and employment rates are still below the OECD average, as well as those of the OECD benchmark regions (Box 2.1).[7] In addition, despite outperforming the Italian average, Piedmont also demonstrates markedly lower participation and employment rates when compared to Italy's benchmark regions – Bolzano-Bozen, Emilia-Romagna, Aosta Valley, Trento, Lombardia.[8]

Table 2.2. Job market indicators in Piedmont (2019)

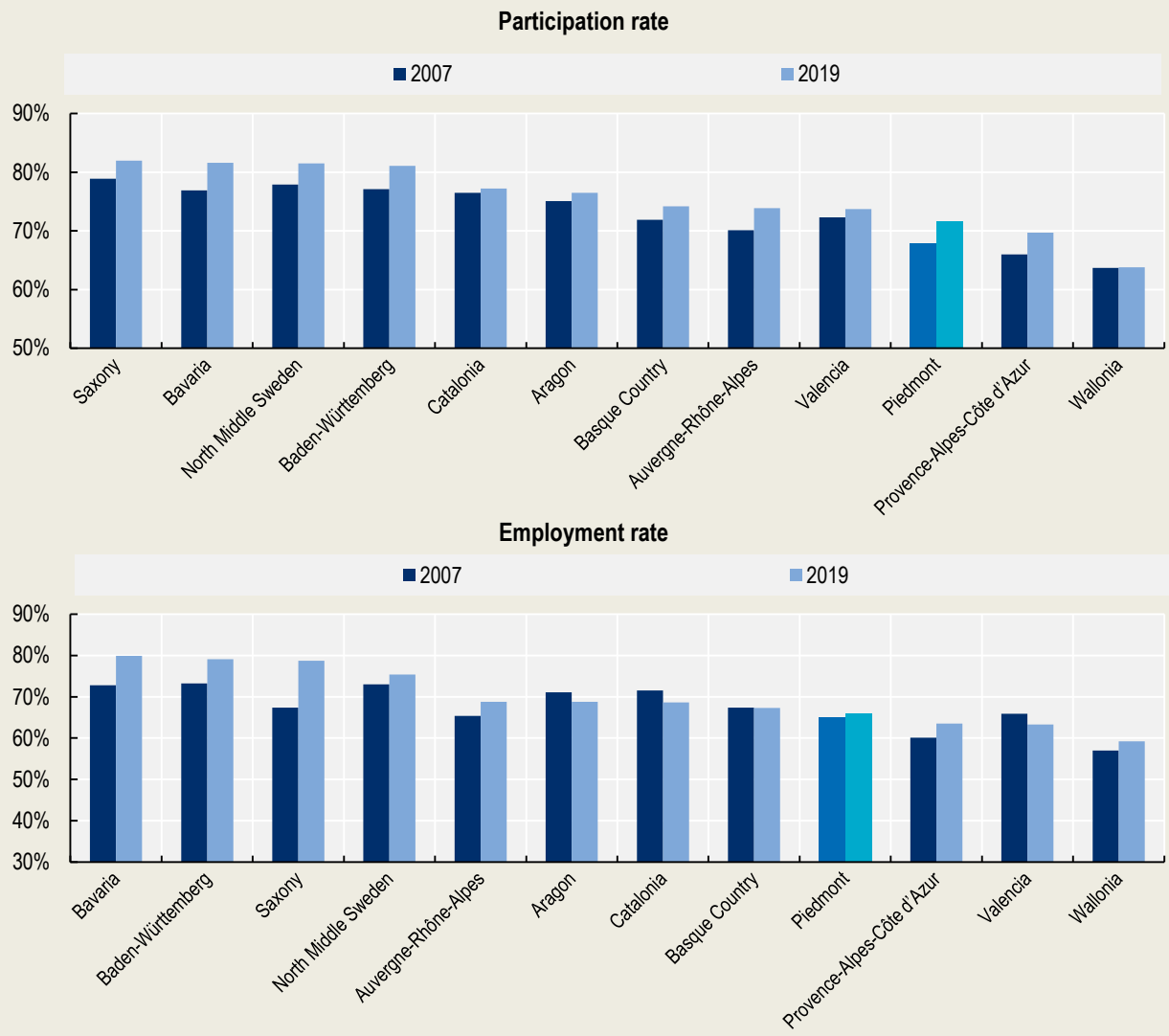
	Piedmont	Italy	OECD
Participation rate (% labour force over working age population 15-64 years old)	71.6%	65.7%	72.8%
Employment rate (% employment 15-64 over working age population 15-64 years old)	66%	59%	68.7%
Unemployment rate (total, % of labour force 15+)	7.6%	10%	5.4%
Long-term unemployment rate (% of long-term unemployed over total unemployed)	53.7%	57%	25.8%
Female unemployment	9.2%	11.1%	5.6%
Youth unemployment (% unemployment 15-24 over labour force 15-24)	26.8%	29.2%	11.7%
NEET (15-29 year-olds, % in same age group)	17%	23.7%	12.8%

Source: OECD elaboration from OECD Regional Statistics, OECD Employment Outlook Statistics, Italian Statistical Bureau.

Box 2.1. Participation and employment rate in OECD benchmark regions

Low rates of labour force participation and employment are evident when comparing Piedmont with a series of OECD benchmark regions (Figure 2.4). The comparison shows that regions with better economic performance, such as the German regions and North Middle Sweden, are also those with higher participation and employment rates.

Figure 2.4. Participation and employment rates in OECD benchmark regions (2007-2019)

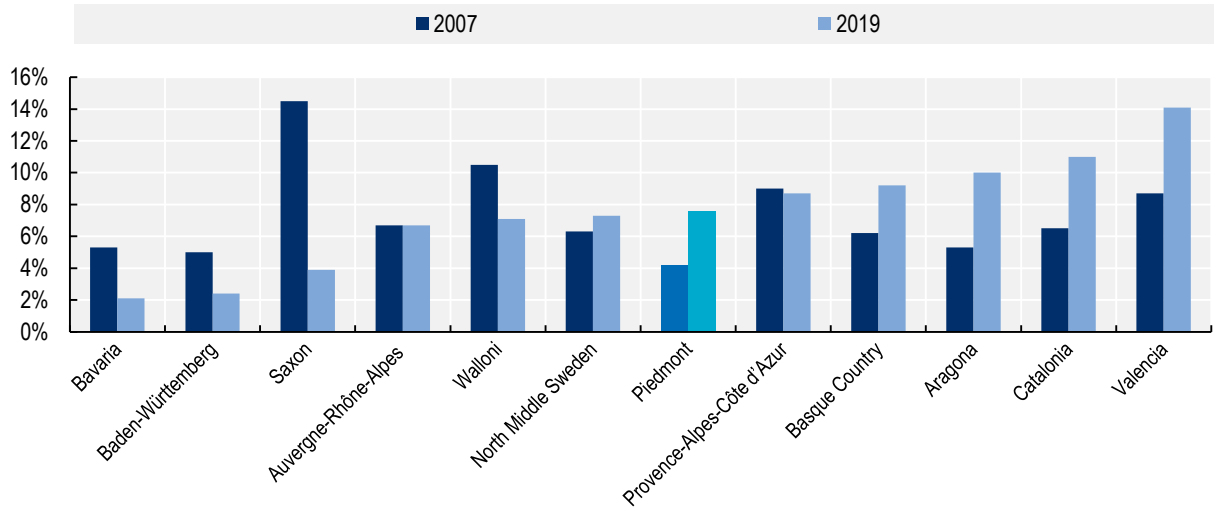


Source: OECD elaboration from OECD Regional Statistics Database.

The region's low regional economic performance contributes to rising unemployment levels. Piedmont's unemployment rate almost doubled between 2007 and 2018, rising from 4.2% to 8.2%, dropping slightly in 2019 to 7.6% (OECD, 2021[8]). Despite remaining below the OECD average until 2012, by 2019 the unemployment rate was 40% higher than the OECD average. Unemployment in Piedmont also shows a

considerable gender gap. While the unemployment rate for men is 6.3% (9.1% in Italy, 5.25% in the OECD area), the unemployment rate for women is 9.2%, against the OECD average of 5.6%. As for labour market participation and employment rates, in the 2007-2019 period Piedmont witnessed a rise in unemployment also compared with benchmark regions (Figure 2.5). While before the 2008-2009 recession Piedmont was in first place, having the lowest unemployment rate among benchmark regions, by 2019 it had fallen to 7th place out of 11. Country patterns clearly emerge from the comparison among benchmark regions, linking unemployment with general national economic performance. German regions outperform the others, which has been associated with strong economic performance and active policies that match labour supply with labour demand (IZA, Germany/IZA, Germany, 2019[9]).

Figure 2.5. Unemployment rates in OECD benchmark regions (2007-2019)

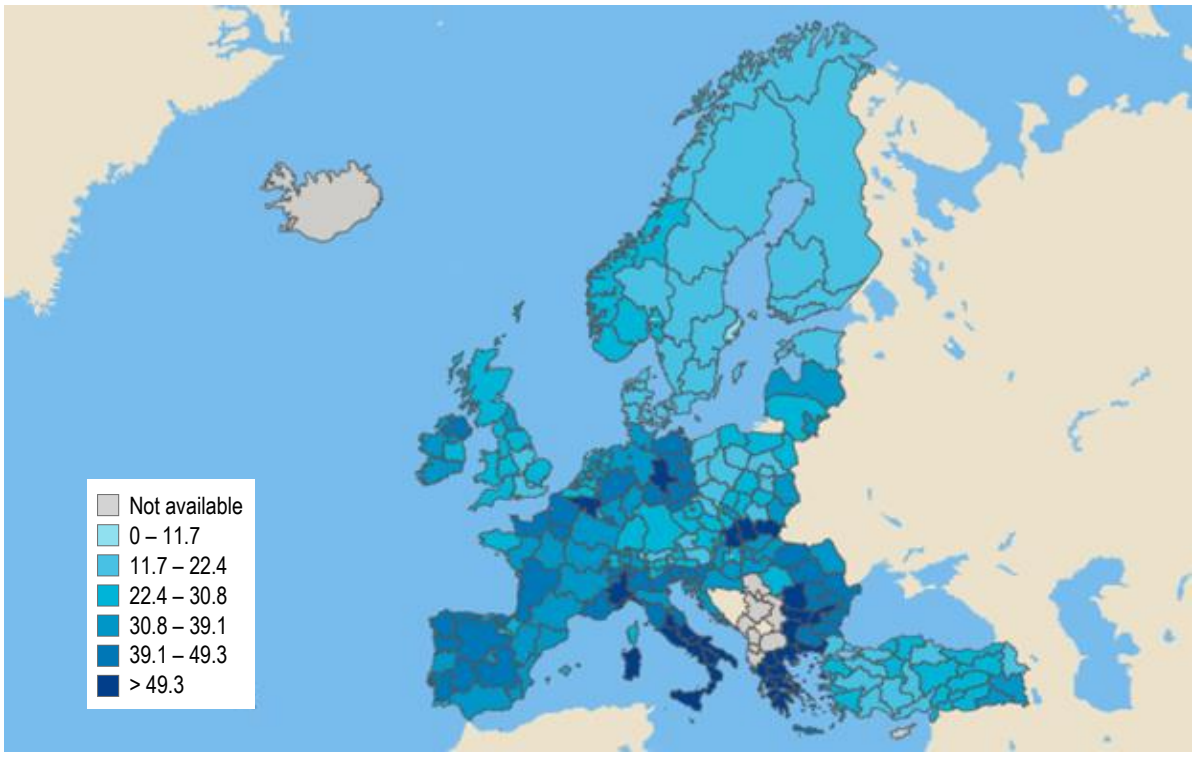


Source: OECD elaboration from OECD Regional Statistics Database.

Long-term unemployment highlights structural weakness in Piedmont. Long-term unemployment (i.e. people who have been unemployed for one year or more), represents the structural part of unemployment and indicates low labour market efficiency. It is a large threat for regions due to the harmful impact on regional economies. For instance, long-term unemployment, even if tackled by policies, often has persistent effects and can lead to economic stagnation or decline (OECD, 2020[10]). Hence, regions should actively work from both the supply side (skills and employability) and the demand side (support to firms), as well as in improving public employment services to prevent workers from falling into long-term unemployment. Long-term unemployment also has high potential risks. For instance, it is often coupled with mental and material stress for those affected and their relatives, and it produces a loss of human and social capital. It often affects already disadvantaged groups, such as youth and women, as well as low-skilled people. In 2019, long-term unemployment in Piedmont was almost 54% of the total unemployment, meaning that more than half of the job seekers in Piedmont have been unemployed for one year or more. The OECD average (based on national data) was around 26%. This puts Piedmont in the top 15% of OECD regions in terms of long-term unemployment. In a national comparison, Piedmont ranks 8th out of 21 Italian regions with respect to long-term unemployment levels, with values similar to those in southern Italy. The phenomenon is particularly marked in the provinces of Alessandria (59.5%), Asti (58.7%), and Novara (57.2%). The high share of long-term unemployment is also evident when comparing with other OECD regions (Figure 2.6).

Figure 2.6. Long-term unemployment in OECD European regions

% share of long-term unemployment over total unemployment (2019)



Source: OECD elaboration from OECD Regional Statistics Database

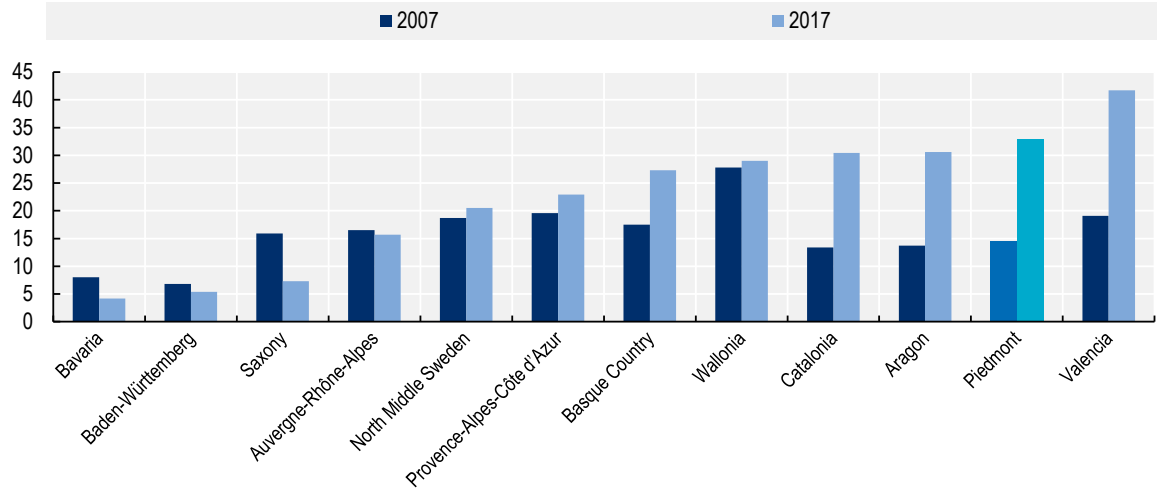
Piedmont exhibits the highest share of long-term unemployment compared to the benchmark regions. The share of long-term unemployment in the best performing benchmark region, North Middle Sweden, is 18%. Baden-Württemberg and Bavaria have respectively 24.3% and 28.2%. The Spanish regions of Catalonia, Basque Country, Aragon and Valencia range from 36.2% and 40.3%. Provence-Alpes-Côte d'Azur has 42.5% and Auvergne-Rhône-Alpes shows 32%. Saxony (with the second largest German share of long term unemployment) and Wallonia (with the highest value in the BENELUX area) show values comparable to those of Piedmont: respectively 49% and 49.6%.

Youth are particularly affected by the job market trends. Youth unemployment and the share of youth that are neither in employment nor in education or training (NEET), have significant social and economic consequences, at the individual level, and the aggregate regional level. Young people disengaged from work and education or training are at risk of social exclusion, and they represent a loss of economic opportunities for the regional economy. In Piedmont, youth unemployment reaches almost 27% (Figure 2.7). This value, slightly above the Italian national average, contrasts significantly with an average of less than 12% in the OECD area (OECD, 2020[10]). Additionally, around 17% of Piedmont's youth are NEET, approximately 4% higher than the OECD average (Figure 2.8). Recent estimates released by the Italian Statistical Bureau updated the share of NEET in Piedmont at 20% in 2020 (Italian Statistical Bureau, 2021[11]). A high level of early leavers from education and training[9] also characterises Piedmont (Figure 2.9). Even if the rate of early leavers has improved over the period 2000-2018, there was a remarkable increase in the period 2016-2018 (passing from 10.2 to 13.6). In addition to rising youth unemployment and inactivity among the youth population, which is common to many Italian regions (Marino, F.; Nunziata, L., 2017[12]), Piedmont faces relatively low participation rates in higher education. The share of the labour force with a tertiary education is in the bottom 10% of OECD regions, despite the

presence of three universities in the region and an enrolment rate that is slightly higher than the national average.[10] This calls into question the absorptive capacity of the regional productive system. The combination of youth unemployment, NEET, early school leavers and the low share of labour force with a tertiary education is a driver of long-run stagnation and productivity. It calls for active investment in human capital and skills, as well as improving the matching conditions between labour supply and demand, especially for youth already in or about to enter the labour force.

Figure 2.7. Youth unemployment rate in benchmark regions

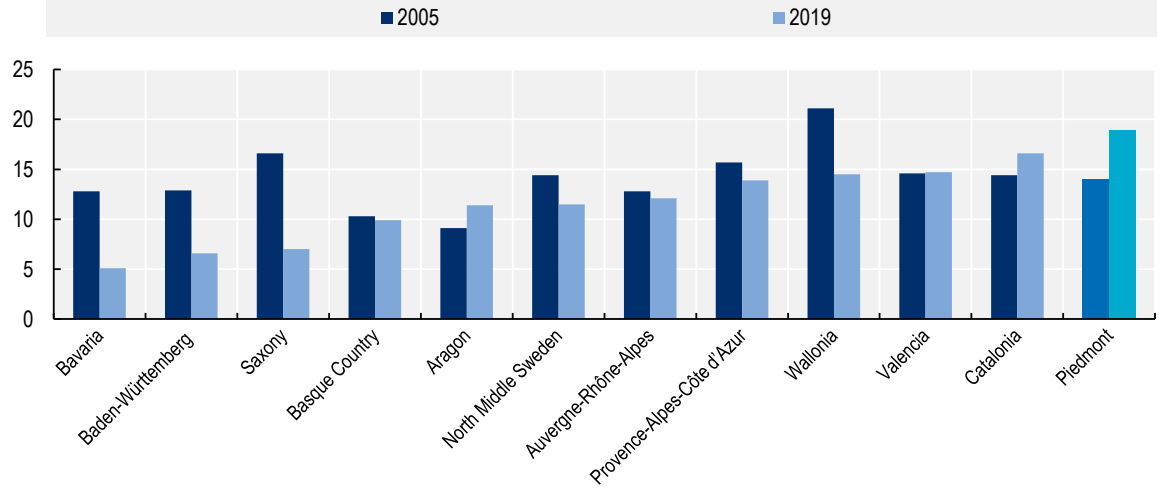
% share of unemployed over the labour force aged 18 to 24



Source: OECD elaboration from OECD Regional Statistics Database.

Figure 2.8. Youth not in employment, education or training

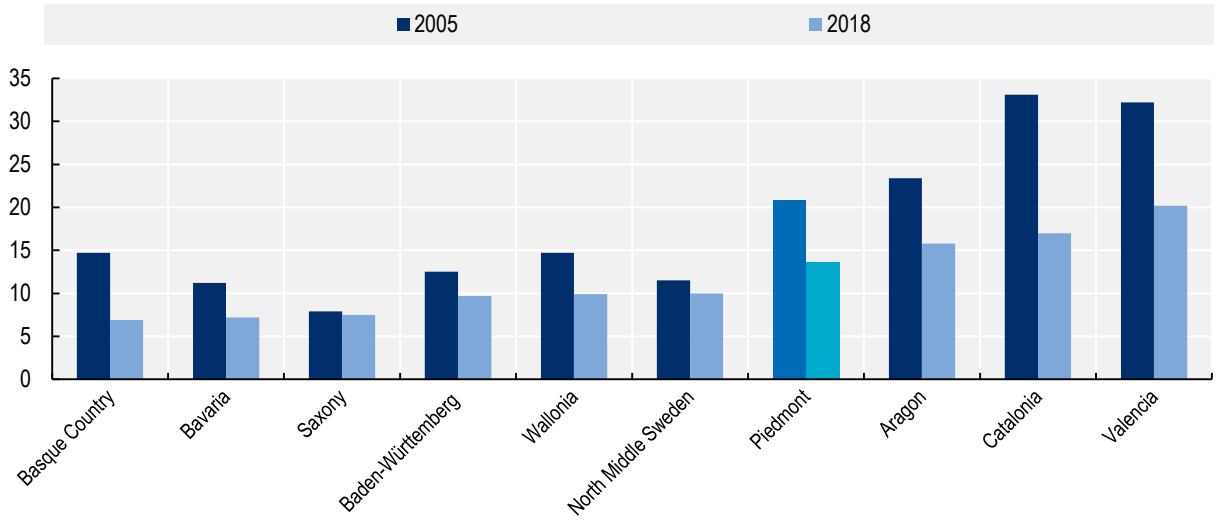
% share of NEET over total population aged 18-24



Source: OECD elaboration from OECD Regional Statistics Database.

Figure 2.9. Early leavers from education and training

% share over the total population aged 18 to 24



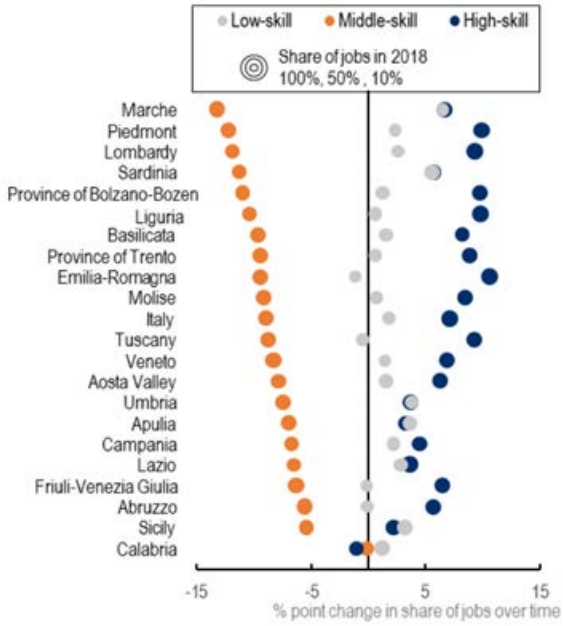
Source: OECD elaboration from OECD Regional Statistics Database

Job polarisation characterises regions in industrial transition. Job polarisation is the decline of the share of middle-skill jobs over total employment.[11] The phenomenon is mainly driven by a structural shift from manufacturing to service industries, and/or by technological change within industries (which affect the demand of jobs). Both aspects may cause employment growth in high-skill occupations (e.g. managers, human resources administrators, IT specialists, etc.) as well as in low-skill service occupations (e.g. sales assistants, logistics operators, etc.). Hence, the phenomenon is strongly interconnected with the dynamics of the industrial sectors that characterise the regional economies. It characterises many economic sectors, yet for middle-skill jobs the highest drops are in manufacturing, such as pulp and paper, textiles, transport manufacturing, and machinery (OECD, 2017[13]).[12] Thus, regions in industrial transition, such as Piedmont (as well as North Middle Sweden and Wallonia, for example) are particularly affected because of a series of interconnected factors. First, their industries were largely based on middle-skill jobs. Second, manufacturing reduced its presence, and services rose (with higher demand for both low- and high-skill jobs). Third, automation in manufacturing progressively substituted jobs consisting of routine tasks previously performed by middle-skill workers. Fourth, offshoring and fragmentation of value chains have further decreased demand for middle-skill jobs (Goos, Manning and Salomons, 2014[14]). The decline of middle-skill employment raises concerns, including its net effects in terms of total employment and wages, since such a decline may result in either a rise or fall of employment (and wages). In addition, it affects the wage distribution, with possible rising inequalities between high and low wages. Furthermore, workers who held middle-skills jobs may either transition to higher- or lower-paid occupations, as well as to underemployment or unemployment. Innovation can affect job polarisation. Hence, while promoting innovation and innovation diffusion, policies should also consider the capacity to generate jobs, the quality of the jobs generated, and whether the workforce is being prepared for the jobs of the future.

Job polarisation is strongly evident in Piedmont, pointing to a long-term trend of job polarisation. Between 1994 and 1996 in the OECD area, 42% of jobs were estimated to require middle-skills to be performed. This dropped to 31% in the 2016-2018 period (OECD, 2020[10]). The Italian job market was not spared by this phenomenon (Basso, 2020[15]), as the share of medium-skilled jobs in Italy dropped from 43% in 1995 to 32% in 2019 (OECD, 2020[10]). While Piedmont's economy is still based on intermediate professions requiring middle-skills, among Italian regions, Piedmont exhibits one of the most striking figures in terms

of job polarisation among Italian regions. In 2000, middle-skill jobs accounted for almost half of the regional employment, while in 2018 the share of middle-skill jobs was 37%. Hence, the share of middle-skill jobs dropped by more than 12%, representing the second largest drop among Italian regions, after Marche, which is another region whose economy is strongly based on (traditional) manufacturing (Figure 2.10).[13]

Figure 2.10. Job polarisation in Italian regions, 2000-2018

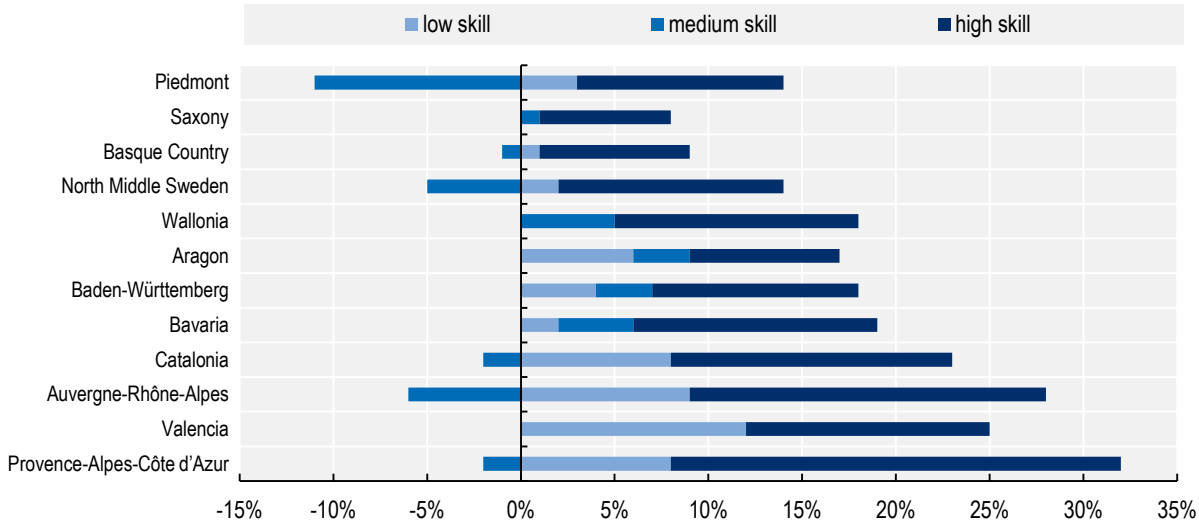


Source: (OECD, 2020[16])

Piedmont is more affected by job polarisation and a shift in labour demand from middle-skill to high-skill occupations than the benchmark regions. On average, the benchmark regions show patterns where high-skill workers provided the highest contribution to total growth in employment. In some regions, medium-skill workers diminished (e.g. Auvergne-Rhone Alpes, Provence-Alpes-Côte d'Azur, the Basque Country, Catalonia, and North Middle Sweden), in others they continued to increase although more slowly than high-skill workers (e.g. in Aragon, Baden-Wurttemberg, Bavaria, Saxony and Wallonia). Piedmont shows the lowest aggregate job growth performance and also the largest gap between growth in high skill workers and decline of medium-skill workers (Figure 2.11). This causes concerns regarding the capacity to absorb medium-skill workers, and also on the possible widening in income gaps within the wage distribution. Targeted actions to monitor the job markets and address policy responses are required, with particular attention to the transition from middle-skill jobs to better- or worse-paid jobs.

Figure 2.11. Job polarisation in selected benchmark regions, 2000-2018

Contribution to total growth by low-skill, medium-skill and high-skill workers



Note: Regions are ordered by the overall growth rate (from bottom to top)
Source: (OECD, 2020[16])

In absolute terms, more than 192 000 medium-skilled jobs were lost between 2000 and 2018. Of the middle-skill jobs lost in Italy, 1.5 out of 10 were in Piedmont. The drop in middle-skill jobs has been offset mainly by the growth of high-skill jobs, which accounted for 29% of regional jobs in 2000. This share increased to 39% in 2018: in absolute terms, the labour market added almost 200 000 high-skilled jobs in that period (Table 2.3). On the one hand, the concurrent drop of middle-skill jobs and the growth of high-skill jobs might indicate a gradual shift towards a knowledge- and innovation- based economy in Piedmont. On the other hand, it might be characterised by asymmetric effects among firms and workers, with unclear net effects in terms of firm performance, innovation and employment.

Table 2.3. Low-skill, middle-skill and high-skill jobs in Piedmont and Italy, 2000-2018

	Share (2018)		Growth rate (2000-2018)		Contribution to total job growth (2000-2018)		Absolute variation (2000-2018)	
	Piedmont	Italy	Piedmont	Italy	Piedmont	Italy	Piedmont	Italy
Low-skill	23.9%	26.5%	15%	18%	3%	4%	55 765	937 936
Middle-skill	37.1%	35.3%	-22%	-12%	-11%	-5%	-192 177	-1 153 147
High-skill	39.0%	38.3%	39%	35%	11%	11%	199 036	2 296 117
Total	*100.0%*	*100.0%*	*4%*	*10%*	*4%*	*10%*	*62 625*	*2 080 906*

Source: OECD elaboration from (OECD, 2020[16])

Industry remains a strong regional asset, but it is losing jobs

Piedmont is one of the most industrialised regions in the OECD. Around one-fifth of its jobs are in industrial sectors. This is 6% higher than the OECD regional average (Table 2.4)[14]. Services account for 61% of total jobs, against the OECD average of 66%. Within services, public services (e.g. public administration, education, and health) are less present in Piedmont than in other OECD regions, on average. At the same time, there is a higher presence of professional, scientific, technical, administration and support service

activities. Piedmont also shows a remarkable specialisation in Information and Communication Technology (ICT) activities – 3.1% of regional jobs, against the OECD regional average of 2% – meaning that Piedmont's specialisation is almost 60% higher than the OECD regional average. This indicates that, despite the long-term pattern of decline, manufacturing is still a strong asset for Piedmont, and it can underpin regional development strategies and actions. Moreover, its specialisation in ICT activities could potentially have substantial multiplicative effects for the regional economy and jobs.

Table 2.4. Employment shares by sector (2016)

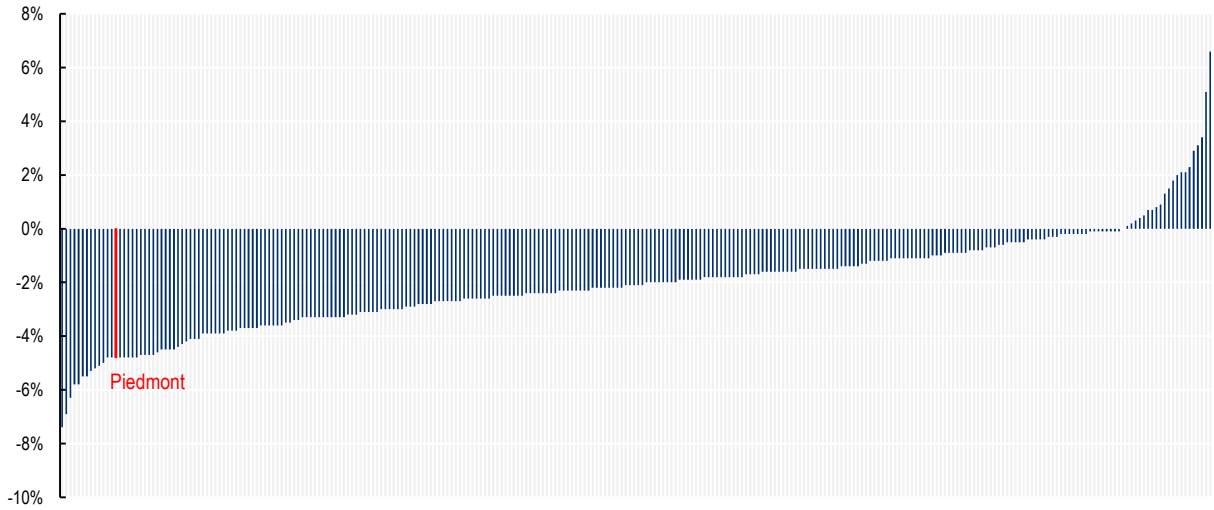
% shares over regional employment and Regional Specialization Index

	Piedmont	OECD Regional average	Piedmont Regional Specialization index (OECD regional average=100)*
Agriculture, forestry and fishing	2.4%	6.5%	36
Industry	21.1%	14.2%	149
Construction	6.1%	6.8%	89
Distributive trade, repairs, transport, accommodation, food serv. activities	23.9%	25.7%	93
Financial and insurance activities	3.0%	2.5%	122
Information and communication	3.1%	2.0%	159
Professional, scientific, technological activities, admin., support service activities	12.4%	9.9%	126
Public administration, compulsory social security, education, human health	17.5%	24.4%	71
Real estate activities	0.7%	1.5%	48
Other services	9.8%	6.4%	153

Note: *Regional Specialisation Index: values higher than 100 indicate that Piedmont is more specialised in the activity, as compared to the OECD regional average.
Source: OECD elaboration from OECD Regional Statistics Database.

The loss of manufacturing jobs is much more marked in Piedmont than in other OECD regions. Between 2004 and 2018, Piedmont's manufacturing sector shed 16% of its jobs (more than 73 400 jobs). Despite this, total employment in the region grew by 3.3% (72 000 jobs) in the same period, with the decline in manufacturing jobs offset by growth in business services. The decline in the share of manufacturing sector jobs is a common trend among OECD regions. Only 8% of OECD regions show an increase in their share of manufacturing as a percentage of total employment, and they are mostly located in the Czech Republic, Germany and Mexico. However, when compared to other OECD regions, Piedmont is experiencing one of the highest rates of decline in the share of manufacturing over total employment, which is similar to other industrial regions such as Lombardy (Italy), West Midlands (United Kingdom), Flanders (Belgium), and Aragon (Spain). Regions with the poorest performance include the Spanish regions of Catalonia, the Basque Country, La Rioja and Valencia, together with Budapest (Hungary). The highest regional growth rates are found in Mexico (Aguas Calientes, Baja California Sur, Chihuahua, Coahuila), the Czech Republic (Central Bohemian Region, Northwest), and Germany (Saxony, Saxony-Ahnalt, Thuringia) (Figure 2.12).

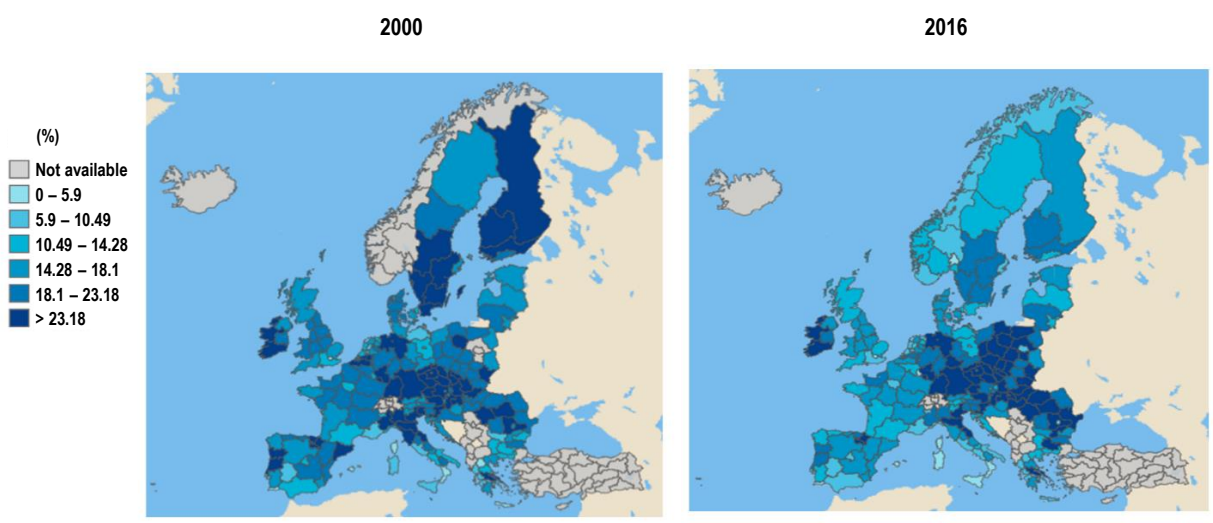
Figure 2.12. Change in the share of manufacturing sector over total employment in OECD regions (2004-2017)



Source: OECD elaboration from OECD Regional Statistics Database.

Gross value added follows the same trends. The decline in the share of value-added in manufacturing is uneven across regions in European OECD countries (Figure 2.13). Some regions, such as those in Italy, Spain, France, and the Nordic countries show significant drops, while regions in Central and Eastern Europe maintain a higher share. The link between manufacturing and economic success depends on the innovative capacity of manufacturing and its multiplicative effects in terms of demand for advanced services and high-skill employment (Iammarino, Rodriguez-Pose and Storper, 2017[17]). This is reflected in the strong role of manufacturing in many high-income regions, especially in Germany.

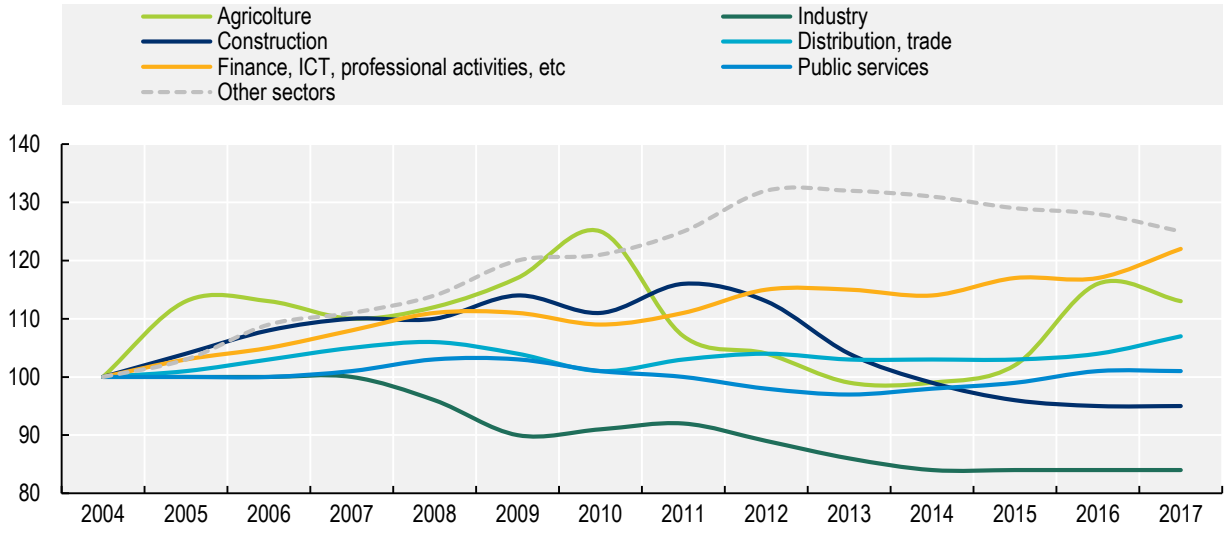
Figure 2.13. Share of Gross Value Added in manufacturing in European OECD regions (2000, 2016)



Source: OECD elaboration from OECD Regional Statistics Database

Regional employment is favouring services in Piedmont. The evolution of Piedmont's regional economy appears to be slightly favouring the service sector (Figure 2.14). From 2004 to 2017, services attracted nearly 140 000 workers. Meanwhile, industry showed the weakest performance, indicated by continuous job losses in the same years, with a particularly strong drop in the 2008-2010 period. From 2004 to 2017, industry decreased by about 74 000 workers, considerably reducing the overall regional employment, which grew by 60 500 units. Yet, not all service industries increased their employment. Between 2004-2017, positive dynamics characterised consumer services (distributive trade, repairs, transport, accommodation, food service activities), finance, ICT and other professional activities. "Other sectors", which mainly comprises the arts, entertainment and recreation, repair, membership organisation and domestic works, showed considerable growth as well, although driven by activities characterised by low productivity, such as personal services. In general, the shift to services can negatively affect productivity, and thus wages, especially in less knowledge-intensive services, such as personal services (Sorbe, Gal and Millot, 2018[18]). The rise in low productive services in Piedmont calls into question its potential to activate multiplicative effects for the regional economy. Conversely, the rise of employment in finance, ICT, professional, scientific and technical activities provides a good base for the innovation environment.

Figure 2.14. Employment in economic sectors in Piedmont (2004-2017)

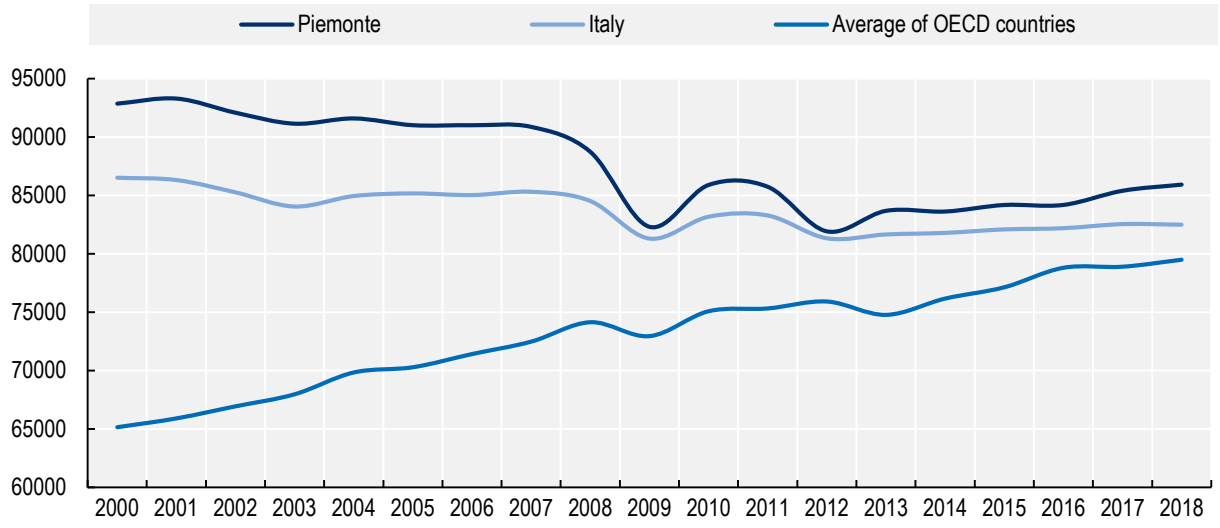


Note: Variations expressed in index numbers (2004=100)
Source: OECD elaboration from OECD Regional Statistics Database

Productivity is decreasing in Piedmont. Labour productivity represents one of the most relevant drivers for economic growth, and thus income and well-being. The drop in manufacturing's contribution to economic output in Piedmont is also reflected in decreasing aggregate productivity within the region, as expressed by GVA per worker. Despite the fact that Piedmont's productivity performance is above Italian values and the OECD (national) average, aggregate productivity dropped from around USD 90 000 in the early 2000s to around USD 85 000 in 2018, with the lowest points seen during the recessionary periods of 2008-2009 and 2011-2012. Conversely, throughout this period, productivity steadily increased in the OECD area (Figure 2.15). Given the differential in productivity between industry and services, the decline in the share of industrial activities played a key role in the slowdown of productivity in Piedmont, which in turn may hinder investment and innovation. Conversely, stagnation in productivity in Piedmont can be the outcome of low creation, diffusion or adoption of innovation in the regional economy.

Figure 2.15. Labour productivity in Piedmont, Italy and OECD countries

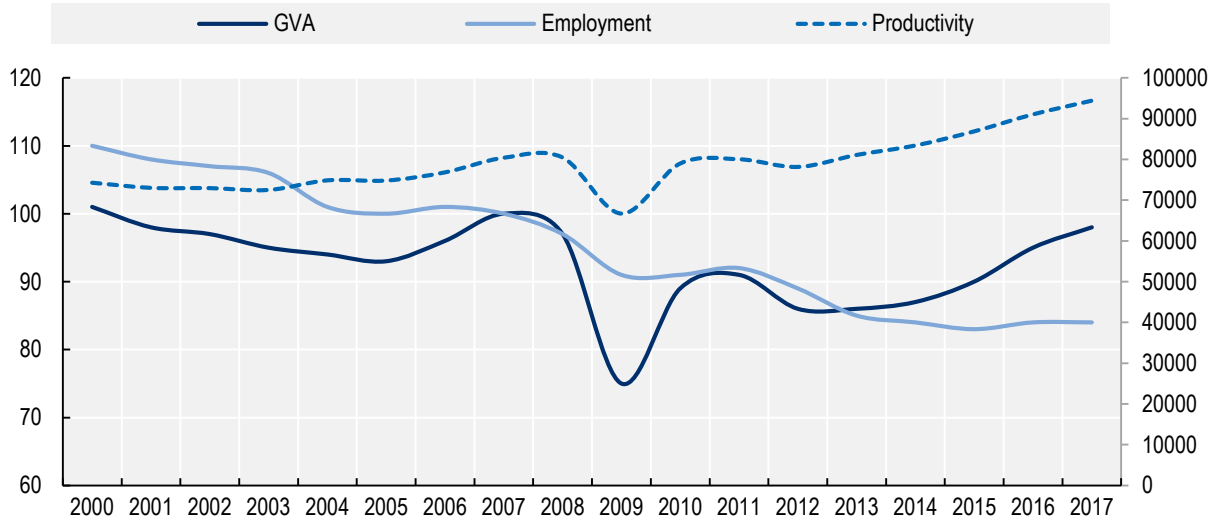
GVA per worker, constant Purchasing Power Parity (PPP)



Note: GVA is expressed in index numbers in USD per worker (constant PPP), base year 2015
Source: OECD elaboration from OECD Regional Statistics Database.

Employment is falling in Piedmont's manufacturing sector. Beginning in 2013, Piedmont's manufacturing sector picked up in terms of production and value added. However, productivity in the sector grew at the expense of employment, which continued to decline (Figure 2.16). From 2013 to 2018, the number of firms in manufacturing also dropped by about 2 500 firms. Since 2011, manufacturing firm deaths have exceeded firm creation. The de-coupling of economic outcomes (GVA and productivity) and employment can be attributed to at least two factors: first, to the re-organisation of business activities by firms and their value chains (e.g. outsourcing); second, to the region's dualist industrial structure (Delponte and Zenker, 2019[19]), namely large and leading global companies operating side-by-side with smaller firms. Among the latter, 40% of the SMEs in manufacturing are suppliers, hence they depend on (often large) clients.[15] This may have resulted in fragmented business activities and a degradation of pre-existing supply chains reliant on the supply and demand relationships between small and large firms. For instance, sometimes local suppliers have been replaced by suppliers from other regions or from abroad, weakening local supply chains (OECD, 2020[20]).

Figure 2.16. Dynamics of Real Gross Value Added, employment and productivity in manufacturing in Piedmont (2000-2017)

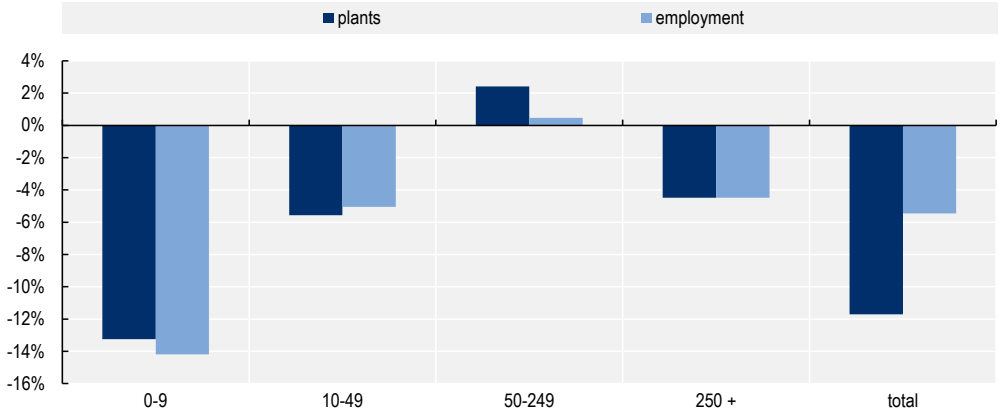


Note: GVA and employment dynamics (left axis) are expressed in index numbers (2007=100), productivity (right axis) is expressed in USD per worker (constant Purchasing Power Parity, base year 2015).
Source: OECD elaboration from OECD Regional Statistics Database

SMEs show the most marked decline and the region shows a low presence of start-ups. The dualism and fragmentation characterising the region's manufacturing industry is reflected in the fact that the decline in employment within the manufacturing sector affects SMEs more than larger companies. From 2012 to 2018, manufacturing plants with less than 250 employees dropped by 12% and their employment levels dropped by almost 6%. Smaller firms saw higher drops in employment. For instance, the number of firms with less than 10 workers fell by more than 13.2% (4 100 firms) and 14.2% (11 600 workers), respectively (Figure 2.17).

Figure 2.17. Growth rates in plants and employment in manufacturing in Piedmont (2012-2018)

% growth rates by plant size



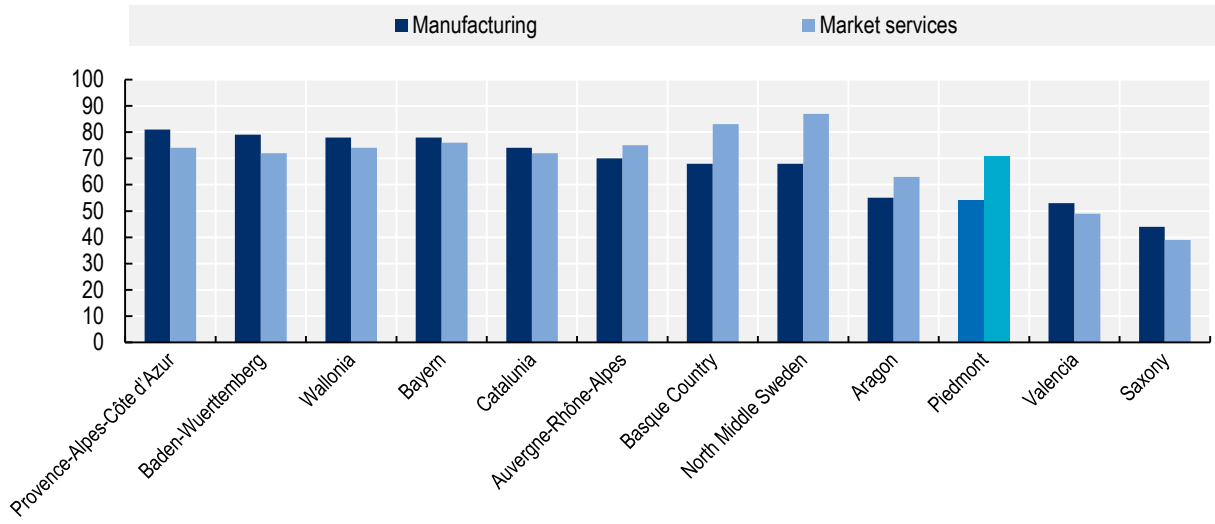
Note: 1 (0-9 employees), 2 (10-49 employees), 3 (50-249 employees), 4 (250 employees and higher), 5 (total).
Source: OECD own elaboration from Italian Statistical Bureau.

It should be noted that Piedmont has a considerably high number of SMEs within an OECD comparison, ranking just below the 70th percentile of OECD regions in terms of firms and employment. Yet it also shows a relatively low start-up rate, below the 25th percentile in terms of the share of start-up presence and employment in 2017 (OECD, 2021[21]).

Productivity poses a challenge for manufacturing in Piedmont. Aggregate regional productivity in the long run is falling in Piedmont. Additionally, the competitiveness of Piedmont in terms of productivity shows a gap between manufacturing and services. While Piedmont is in the top 30% of OECD regions in terms of productivity in market services, it is in the top 50% of OECD regions in terms of productivity in manufacturing. All benchmark regions, except Valencia and Saxony, show higher productivity in manufacturing (Figure 2.18). Additionally, Piedmont shows a more pronounced imbalance between the productivity levels of manufacturing and market services. Productivity grew in Piedmont in 2004-2017, but at a slower pace than most of the benchmark regions, where, on average, higher levels of productivity are associated with the highest growth rates. The economic crises of the last two decades, and particularly the 2008-2009 recession, shaped the manufacturing industry's productivity growth patterns in Piedmont, which dropped in 2008-2009 and 2011-2012 (Figure 2.19). This was also the case in most of the benchmark regions. While some regions recovered completely from the recessionary periods (e.g. Bavaria and Catalonia), Piedmont – despite a recovery in productivity in recent years – has not caught up to pre-2008 productivity growth. This is shown by Figure 2.19, where the dashed line illustrates the hypothetical growth rate of productivity if Piedmont would have had the same growth rates it experienced before the 2008-2009 recession. By comparing the hypothetical growth pattern with the actual growth it is possible to see that, while Piedmont productivity recovered from the recessionary period, it did not reach the previous growth pattern. The same holds for Saxony, for instance. Piedmont's lower productivity growth rates are also associated with higher loss in employment compared to the benchmark regions – where only Bavaria, Baden-Wurttemberg and Saxony have shown a positive employment change in manufacturing.

Figure 2.18. Productivity in benchmark regions (2017)

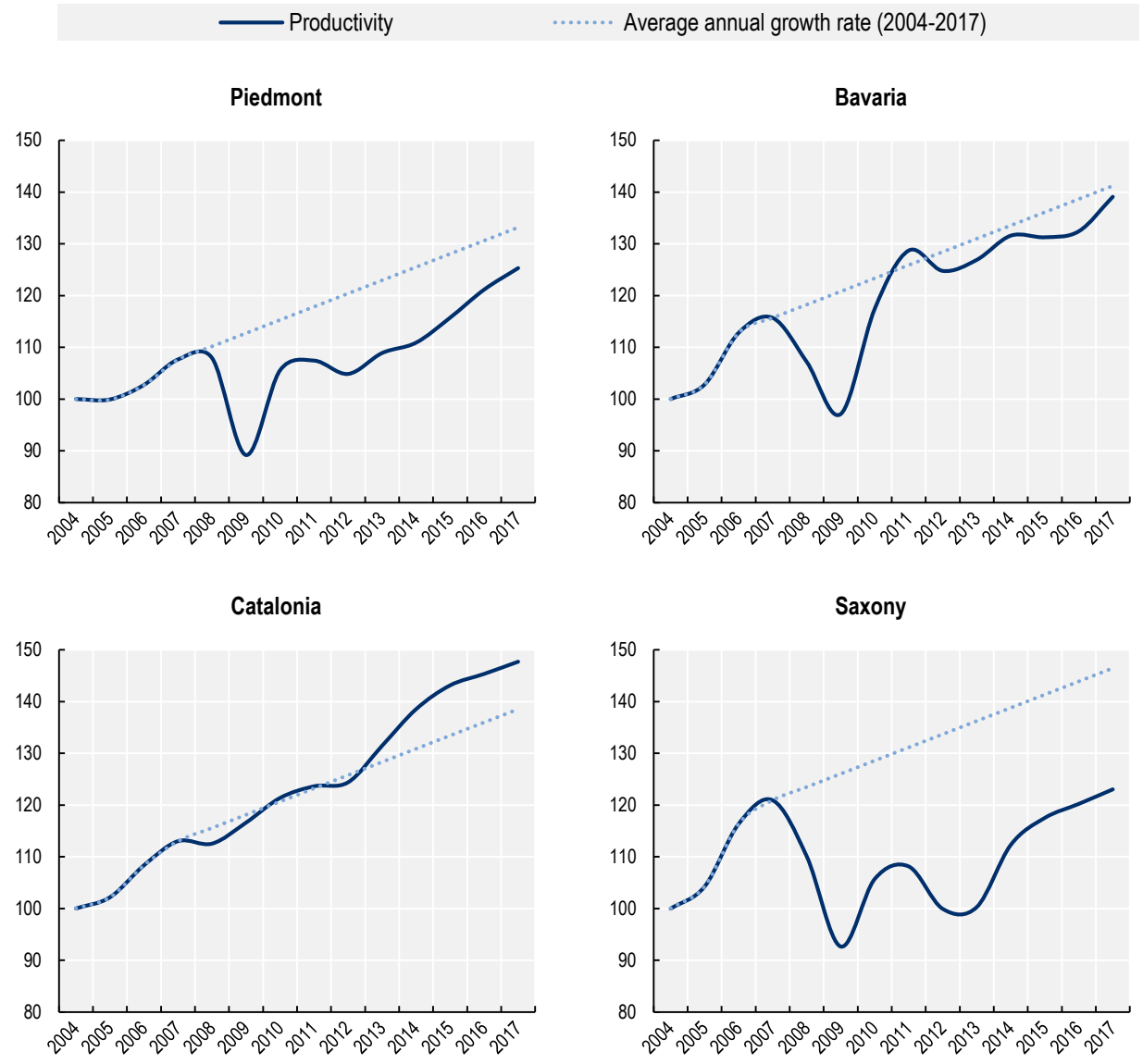
OECD percentiles in manufacturing and market services



Source: OECD elaboration from OECD Regional Database

Figure 2.19. Productivity patterns in selected benchmark regions (2004-2017)

Index numbers (2004=100)



Note: The dashed line simulates the productivity up to 2017 based on the average yearly growth rate of the period 2004-2017.
Source: OECD elaboration from OECD Regional Database.

Box 2.2. The automotive supply chain in Piedmont

Despite the general process of de-industrialisation in Piedmont, the automotive industry maintains a central place in the regional economy. The automotive supply chain in Piedmont is composed of 737 active firms, out of a total of about 2 200 in the Italian supply chain. This has a turnover of EUR 18 585 billion (38% of the national turnover), employs 60 311 workers (37% of the national workers), and generates 33% of Italian exports in the automotive components industry (Coccimiglio and Giardina, 2020[22]).

Table 2.5. The automotive supply chain in Piedmont

Firms, turnover and workers (2019)

	Firms	Turnover (EUR million)	Workers
Sub-contractors	198	1 380	6 733
Sub-contractors (machining)	96	734	2 180
Specialists	231	7 563	22 124
Specialists (aftermarket)	84	653	1 965
Engineering & design	86	4 777	4 609
Systems engineers and modelers	41	8 230	22 532
Total	736	18 585	60 311

Source: Observatory of the Italian Automotive Supply Chain (Coccimiglio and Giardina, 2020[22]).

The historical presence of the FIAT Group has led — and still leads — the strong presence of the automotive supply chain in the region. However, firms have also found other customers besides Stellantis (the current name of the former FIAT group). While almost 80% of Piedmont's firms have trade relationships with FIAT, it is the main customer of less than 50% of these firms. Many of those other customers are abroad: 30% of their revenues are exports. Still, FIAT generates an average of approximately 40% of revenues for such firms.

The regional automotive supply chain is characterised by high levels of innovation activities. More than three out of ten firms have more than one employee and invest a considerable share of their turnover in R&D activities. However, they also identify significant obstacles to innovation – the most important one being excessive costs. This is followed by the uncertainty and the instability of demand for innovative products and/or services, and by the lack of skilled workers.

Source: (Coccimiglio and Giardina, 2020[22])

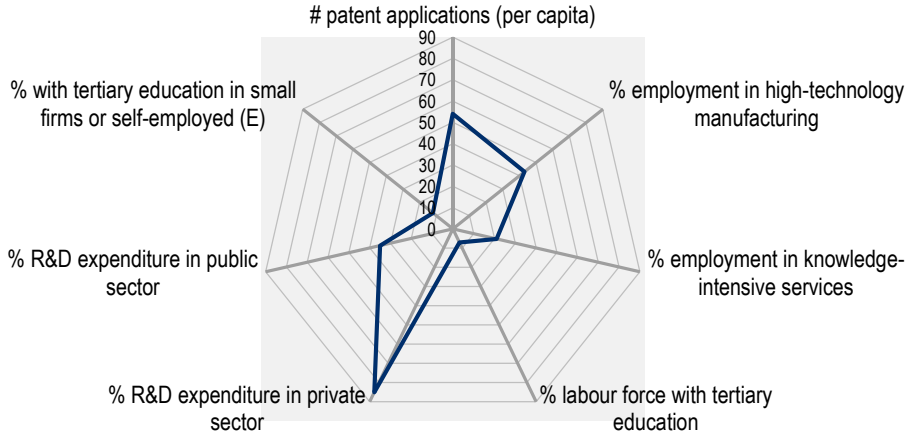
Innovation can contribute to reversing economic decline

Facts and figures on the regional economy and the labour market show the danger of long-term economic decline. To attenuate the impact and manage the trends, regions in industrial transition, including Piedmont, frequently rely on action in a number of policy areas including a focus on skills and jobs, making the most of the entrepreneurial fabric, and broadening innovation (OECD, 2019[3]). Innovation plays a key role, since it allows for greater firm competitiveness, with positive effects in terms of entrepreneurship and employment. SMEs would particularly benefit from a broadening and diffusion of innovation. The 2021 EU innovation scoreboard defines Piedmont as a moderate innovator+ (Hollanders and Es-Sadki, 2021[23]),

meaning that, while showing positive trends in some aspects related to innovation (e.g. private investments in R&D), there are also some drawbacks, related for instance to human capital and cooperation. This section reviews the main indicators of Piedmont's innovation environment and compares these with the OECD area and the benchmark regions.

At a glance, Piedmont shows considerable innovation potential, but lags behind in many aspects. As already explored, Piedmont – and in particular Piedmontese manufacturing – faces strong productivity and labour market challenges. Yet, despite the declining performance of both GDP and the labour market, parts of Piedmont's productive system are competitive, and the region shows considerable innovation potential, as well as room for improvement in some key dimensions. This is highlighted in Figure 2.20, which summarises the relative position of Piedmont versus OECD regions, with reference to some key innovation indicators available.

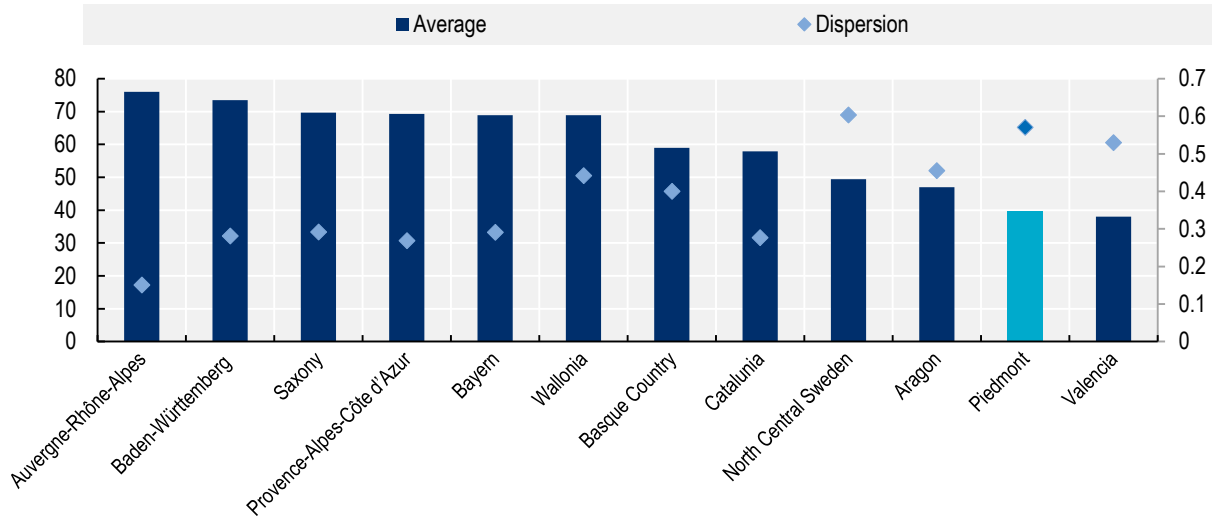
Figure 2.20. Indicators of regional innovation, Piedmont in comparison to OECD regions (2017)



Note: Each number scores the rank-position of Piedmont compared to OECD regions (100 represents the best performing region).
Source: OECD elaboration from OECD Regional Statistics Database and OECD Regions in Transition Database.

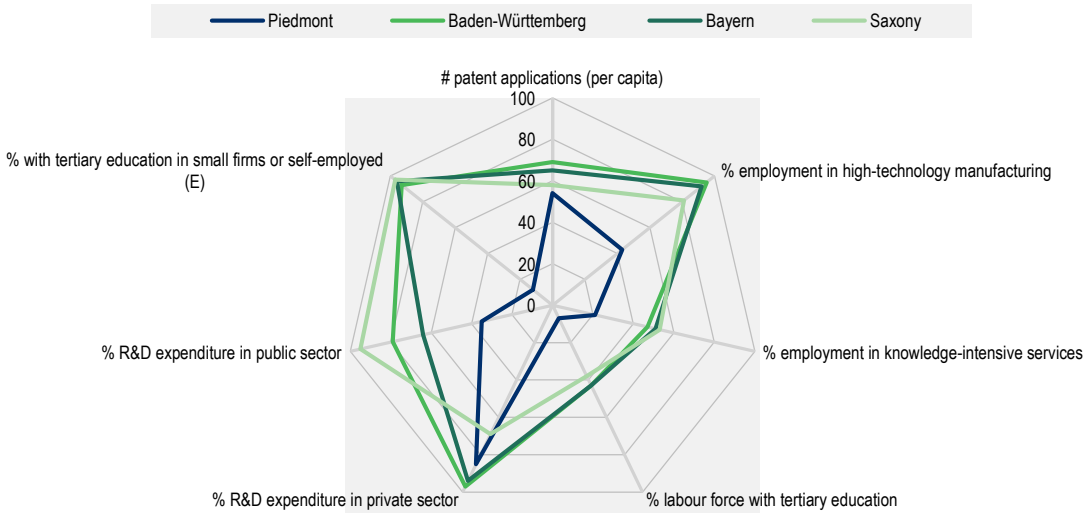
Regional innovation involves several dimensions and indicators, which are interlinked and should be tackled as a whole, with a systemic perspective. In comparison with the benchmark regions, Piedmont shows, on average, a lower value of innovation, computed by the average of all indicators featured in Figure 2.21, and a greater degree of dispersion among the innovation indicators. This means that that Piedmont shows both high dispersion levels and low innovation values (Figure 2.21). By contrast, regions with the highest scores in terms of aggregate innovation show lower dispersion (e.g. Auvergne-Rhône-Alpes, Baden-Württemberg, Saxony), meaning that there is not a large variation among the values scored by different indicators. Figure 2.22 compares Piedmont with the German benchmark regions that show lower dispersion and also higher innovation indicator scores. Innovation indicators are frequently interlinked and should be seen as a system, both when assessing innovation and when implementing policy. For example, R&D investment should also consider the effects on employment or patents.

Figure 2.21. Average values and dispersion of innovation indicators in benchmark regions



Note: Dispersion was computed by means of the coefficient of variation (ratio between average value and standard deviation) of each region. Average values on the left axis, dispersion values on the right axis.
Source: OECD elaboration from OECD Regional Statistics Database and OECD Regions in Transition Database.

Figure 2.22. Innovation scores in Piedmont and German regions (2017)



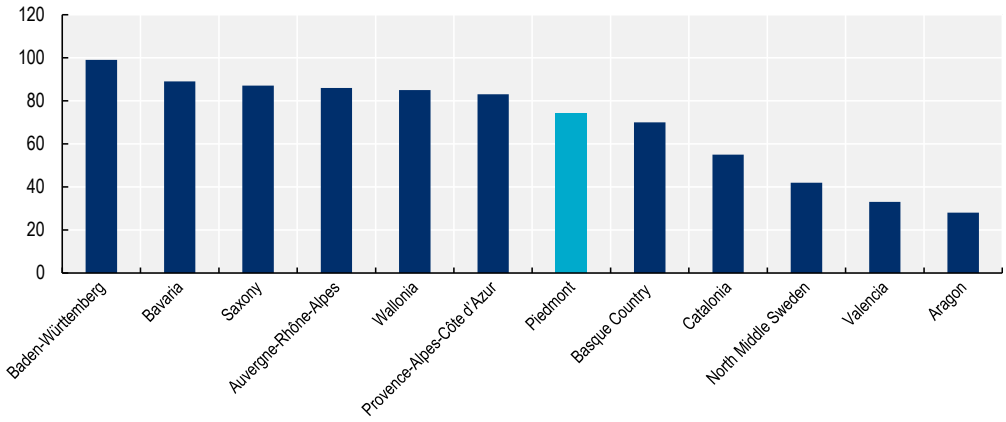
Note: Each number scores the rank-position of the region compared to the OECD regions (100 represents the best performing region).
Source: OECD elaboration from OECD Regional Statistics Database and OECD Regions in Transition Database.

R&D investments are largely led by the private sector in Piedmont. Piedmont is in the top 25% of OECD regions in terms of total R&D investment as a share of GDP. Yet, the region has a lower share than many of the benchmark regions, and with German, French and Belgian regions in particular (Figure 2.23). R&D investments are made by the public and the private sector. Piedmont performs particularly well with respect to private investment in R&D (Figure 2.24), which, in 2018, accounted for 2.2% of regional GDP, and 80% of total investment in R&D in the region. In this aspect, Piedmont is in the top 15% of OECD regions. In absolute terms, Piedmont's businesses spend roughly USD 3 billion every year on R&D. It is the third

highest value in Italy, preceded by Lombardy and Emilia-Romagna, and it is comparable to the performance of regions such as Rhineland-Palatinate (Germany), Madrid and Catalonia (Spain). The share of R&D investment increased from 1.6% to 2.2% between 2004 and 2018, bringing it close to the OECD (aggregate) average of 2.3%. The good performance of the business sector is also reflected by the R&D Personnel Employed by the Business Sector Rate (in % of total employment): Piedmont has the second highest share in Italy (1.99% of total employment in business sector), after Emilia-Romagna (2.49%).

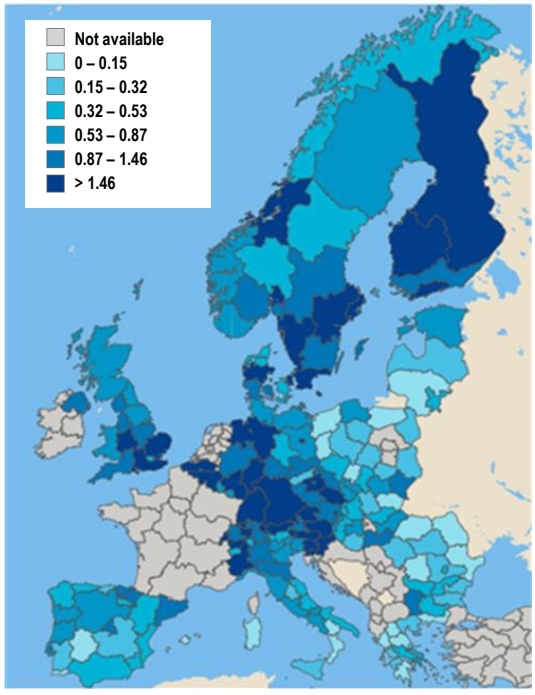
Figure 2.23. R&D expenditures (all economy) as share of the GDP in benchmark regions

OECD regional percentiles



Source: OECD Regional Statistics Database

Figure 2.24. R&D expenditure by the private sector as a % of GDP in selected OECD regions (2017)

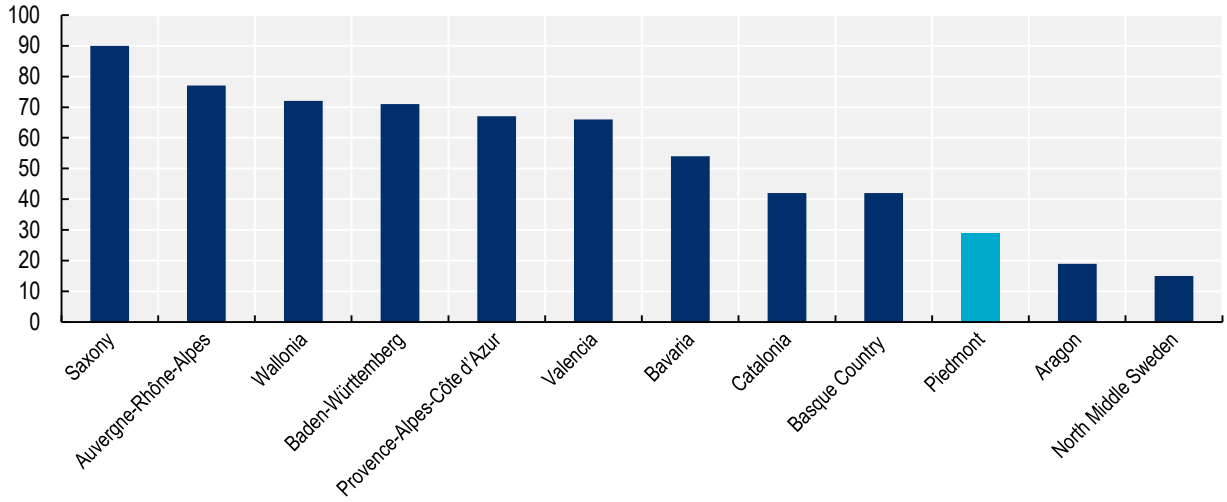


Source: OECD Regional Statistics Database

Meanwhile, there is room for improvement in R&D investment and employment by the public sector in Piedmont. Piedmont stands in the bottom 40% of OECD regions in terms of R&D investment as a share of GDP made by the government (0.08%) and in the bottom 30% OECD regions in terms of R&D investment as a share of GDP made by universities and other higher education institutions (0.28%). For instance, Saxony has an R&D share by universities and other higher education institutions that is 2.7 times higher than that of Piedmont (Figure 2.25).

Figure 2.25. R&D investment by universities and other education institutions as a % of GDP

OECD regional percentiles

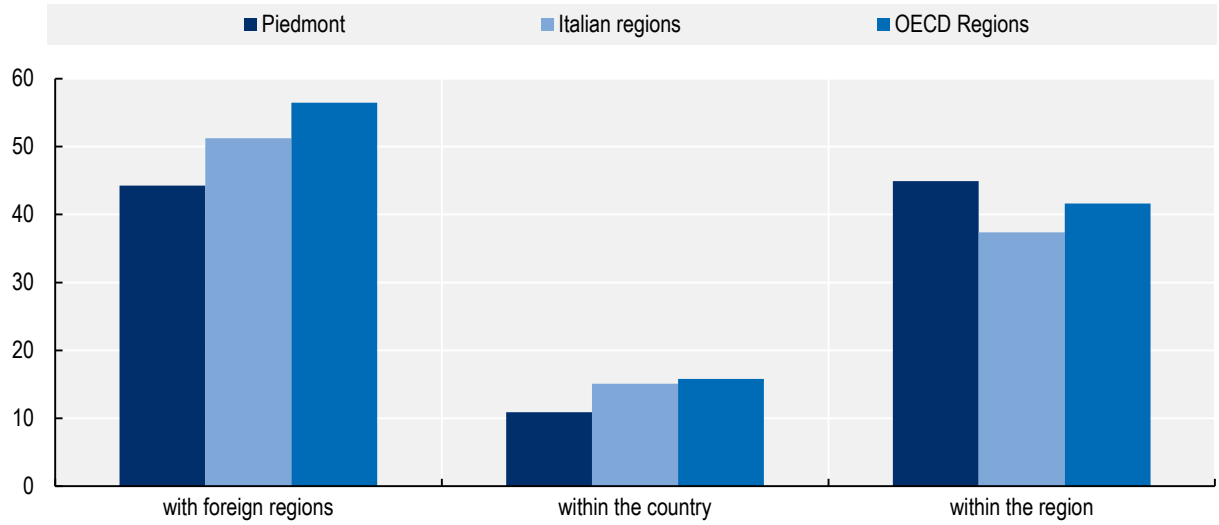


Source: OECD Regional Statistics Database

Patent applications are increasing. R&D investments, in particular those made by the business sector, seem to pay off in terms of output, as measured in patent applications per capita. While the regional value is still below the OECD regional average, it is increasing over time and Piedmont is in the top 54% of OECD regions. In terms of patent applications per capita (under the Patent Cooperation Treaty PCT – The International Patent System)[16], Piedmont showed 85 applications per million inhabitants in 2015, comparable to what was seen in Trento (Italy), Provence-Alpes-Côte d'Azur (France), Catalonia (Spain), British Columbia and Quebec (Canada). Most of applications come from the business sector (89%), while university and other governmental institutions are much lower (respectively 1.4% and 1.7% of all applications).

Data on patent applications show a considerable amount of collaboration in R&D. From 2011 to 2015, Piedmont's share of PCT co-patent applications was 70.2%, compared to the Italian regional average of 67.9% and OECD regional average of 73.8% (Figure 2.26). When compared to the OECD regions, Piedmont shows a high share of co-patenting within the region (almost 45% of all co-patenting applications). This is not matched by cross-border or international co-patenting cooperation. Among OECD regions, cross-border co-patenting averages 56.5%, while in Piedmont it is the case in only 44.3% of co-patent applications. This may be explained both by the presence of many large, international and leading firms in Piedmont not perceiving a need to co-patent across borders, as well as by the archipelago of small firms that may find it difficult to access international collaboration.

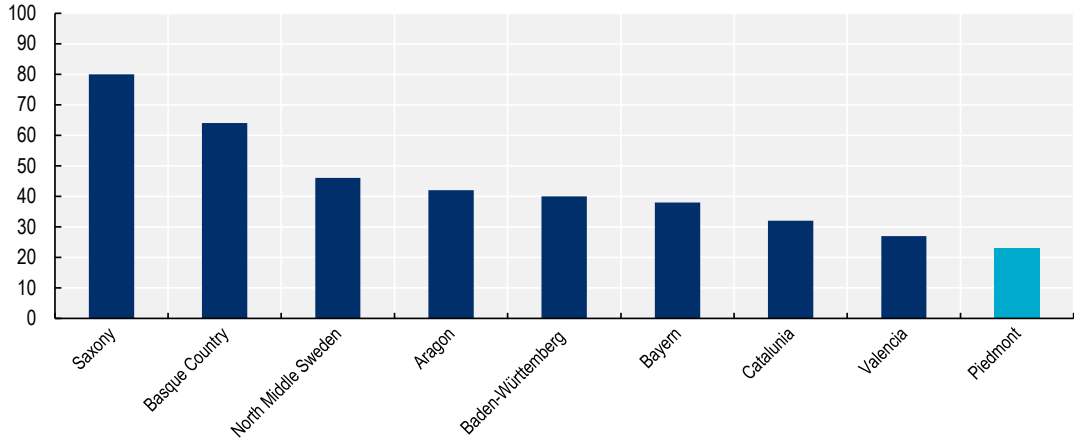
Figure 2.26. Shares of co-patenting with foreign regions, within the country, within the region



Note: Average values for the period 2011-2015.
Source: OECD elaboration on OECD Regional Statistics Database.

SMEs face more difficulties in collaborating in innovation. Just the 17% of Piedmontese SMEs are collaborating in innovation. This represents the lowest figure among benchmark regions and corroborates the hypothesis of difficulties for smaller firms to access innovation. This calls for action targeted at fostering shared innovation among SMEs (Figure 2.27).[17]

Figure 2.27. SMEs collaborating in innovation in benchmark regions, OECD percentiles (2017)



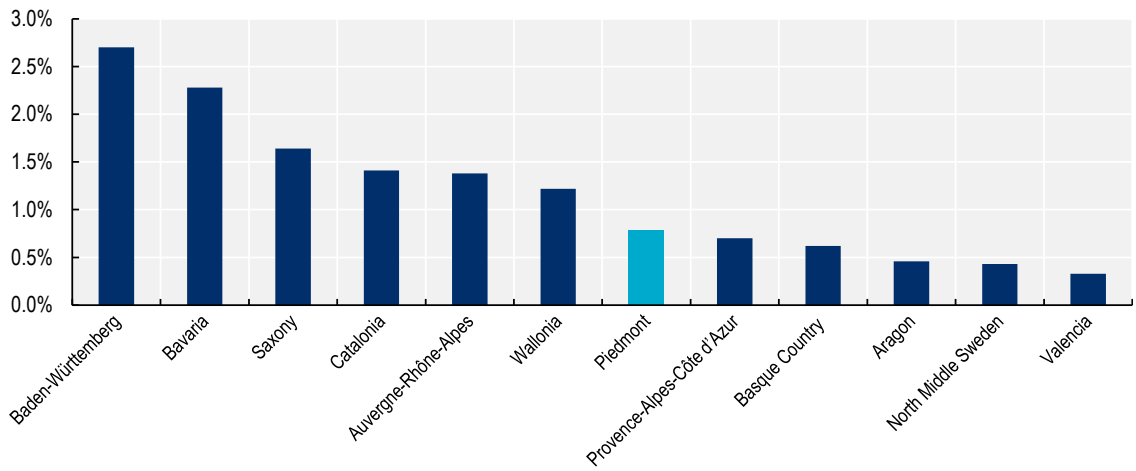
Source: OECD elaboration from Regional Innovation Scoreboard

Major challenges for innovation in Piedmont are related to the employment of high-skilled workers, particularly those with tertiary education (Figure 2.20). The share of Piedmont's labour force with tertiary education (International Standard Classification of Education – 5 to 8) is low, placing the region in the bottom 10% of OECD regions. The low employment of skilled labour is also linked to the sectoral structure of the region. Piedmont specialises in some sectors that demand high-skill work (such as professional services, ICT, finance), but it is less oriented towards high-tech and knowledge-intensive activities than

other the OECD regions: it is in the bottom 21% of OECD regions in the share of employment in knowledge-intensive services, and it is in the bottom 43% of employment in high-technology manufacturing. The comparison with benchmark regions (Figure 2.28, Figure 2.29) confirms the weakness of Piedmont. Additionally, the share of R&D personnel employed by higher education institutes is 0.45% of total employment, as measured by the Higher Education Sector Rate. The share of government sector employment is even lower (0.8%).

Figure 2.28. Employment shares in hi-tech manufacturing, benchmark regions

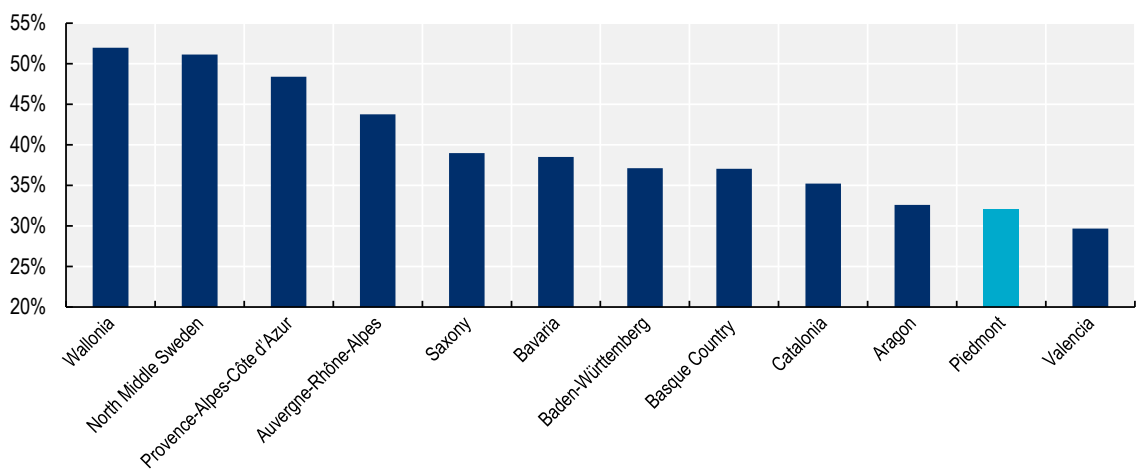
% employment shares



Source: OECD elaboration on OECD Regional Innovation Diffusion Database.

Figure 2.29. Employment shares in Knowledge-Intensive Business Sectors, benchmark regions

% employment shares



Source: OECD elaboration on OECD Regional Innovation Diffusion Database.

Taken together, the various innovation indicators explored (i.e. expenditure, personnel, patents, demand for skills) highlight an innovation potential that needs to be enhanced and promoted. Innovation performed by the business sector is strong. However, it can be very concentrated in few, and generally large,

companies, leaving a large share of smaller companies behind. This calls for actions aimed at fostering innovation-led development and will likely require further investment in R&D and skills. It would be important to do so in such a way as to maximise the returns of R&D and technology adoption by promoting high-tech and high-skilled sectors, and broadening innovation diffusion across sectors and regional value chains, with a particular focus on SMEs. The promotion of innovation should also consider how the results of R&D investments can translate into increasing demand for labour. This is particularly necessary given the risks linked with job automation and the structural changes that can be associated with a transition to greener industry in terms of R&D, innovation and skill-profiles needed.

COVID-19 is magnifying Piedmont's existing economic trends

The COVID-19 pandemic has caused an unprecedented health, economic and social crisis in a world that was already grappling with significant megatrends, such as deep changes in technology, automation, global value chains, urbanisation and demographic change. The aggregate GDP of the OECD area decreased by 4.8% in 2020 (from 2019 levels) as a result of measures taken by countries to combat the COVID-19 pandemic. While an economic recovery of 5.3% is expected in 2021 and 3.8% in 2022 among OECD countries, 2022 output is projected to be below pre-pandemic forecasts in many countries, raising the risk of long-lasting or even permanent impact (OECD, 2021[24]). Moreover, the impact is highly differentiated across territories (OECD, 2020[25]). The intensity of the pandemic, the containment measures implemented to slow its spread and the sectoral composition of the economy magnified the effects on national and regional economies.

The economic effects of COVID-19 have been asymmetric not only across territories, but also across sectors and firms (OECD, 2020[25]). The sectors that are more exposed to international demand and value chains have suffered the most from the supply and demand shocks that hit the global economy (Box 2.3). Likewise, some sectors, such as tourism, transport, retail and food service activities, have been affected more by the measures taken to contain the virus. The economic impact is affecting large businesses and SMEs. Yet, compared to larger companies, SMEs are more vulnerable to the impact, face higher risks, and are less resilient (OECD, 2020[26]). SMEs that are able to continue their activities are likely to be more vulnerable to social distancing measures than larger firms (e.g. ease in switching to teleworking, adapting working spaces, etc.).

Box 2.3. How the economic crisis arising from the COVID-19 pandemic affects firms

The economic effects of the COVID-19 pandemic are hurting firms on the aggregate supply and the demand sides.

On the supply side, firms have experienced a reduction in the supply of labour due to COVID-19 containment measures. This particularly affected the sectors less amenable to remote working, such as manufacturing. Additionally, international supply chains were interrupted, leading to shortages of raw materials, parts and intermediate goods, especially from areas most severely affected by COVID-19 cases and containment measures.

On the demand side, the drop in demand (arising from a suspension of activities because of containment measures and general uncertainty) and in revenue affects the ability of firms to function, and/or causes severe liquidity shortages. Consumers experience income loss and heightened uncertainty, which in turn reduces spending and consumption. These effects are self-reinforcing because workers are laid off and firms are not able to pay salaries. Reduced demand will in turn affect the supply side, with negative multiplicative effects.

Finally, the uncertainty and volatility that is associated with the novel coronavirus may continue to affect financial markets and risks further reducing confidence and credit.

Source: (OECD, 2020[26])

COVID-19 has affected Italy more than many other European countries, particularly in the early months of the pandemic (early March 2020). The economic effects of the pandemic and the very stringent lockdown measures were magnified by the country's openness to trade and its specialisation in sectors heavily affected by the pandemic, such as tourism. Italian GDP is estimated to have fallen by 8.9% in 2020, and a slow recovery is forecasted for 2021 (+4.1%) and 2022 and (+4%) (OECD, 2021[27]). The unemployment rate is also forecasted to increase from 9.4% in 2020, to 11% in 2021, and 10.9% in 2022 (OECD, 2021[24]).

Piedmont has been one of the most affected regions in the OECD. The suspension of economic activities undertaken by the Italian government to contain the COVID-19 virus is estimated to have affected 29.1% of total employment in the region, a larger share than the average of OECD regions (27.8%) (OECD, 2020[16]). GDP in Piedmont is projected to fall by 8% in 2020 (Conte et al., 2020[28]). The regional economy's high trade-openness had been one of the most relevant drivers of the fall of GDP: exports, (accounting for 35% of regional GDP) have been estimated to drop by 12.2% in 2020 (IRES Piemonte, 2021[29]; OECD, 2021[30]). In Italy and in Piedmont, almost all sectors reduced their output in 2020, with the exception of ICT. The impact of the pandemic is compounded by the fact that it hit at a moment when Piedmont's economy was weakening (Bank of Italy, 2020, p. 5[7]). This increases the likelihood that the economic costs will affect the regional economy in the coming years. As reported by *Istituto di Ricerche Economico Sociali del Piemonte* (IRES Piemonte) (2021[29]), GDP is recovering in 2021 (+5%) and the 2022-2024 outlook is for a slow recovery (+2.7 yearly average growth rate of GDP). However, this expected growth rate will not be sufficient to compensate for the region's economic losses in 2020 (Table 2.6).

Table 2.6. Piedmont growth prospects

Average yearly growth rates

	2000-2007	2008-2014	2015-2018	2019	2020	2021	2022-2024
GDP	1.0	-1.8	1.6	-0.2	-9.4	5.0	2.7
Household consumption	0.9	-0.9	1.6	0.3	-12.1	4.1	3.7
Public consumption	1.9	-0.7	0.3	-1.1	0.7	3.2	-0.6
Investments	0.3	-32	3.3	2.3	-10.8	12.5	6.8

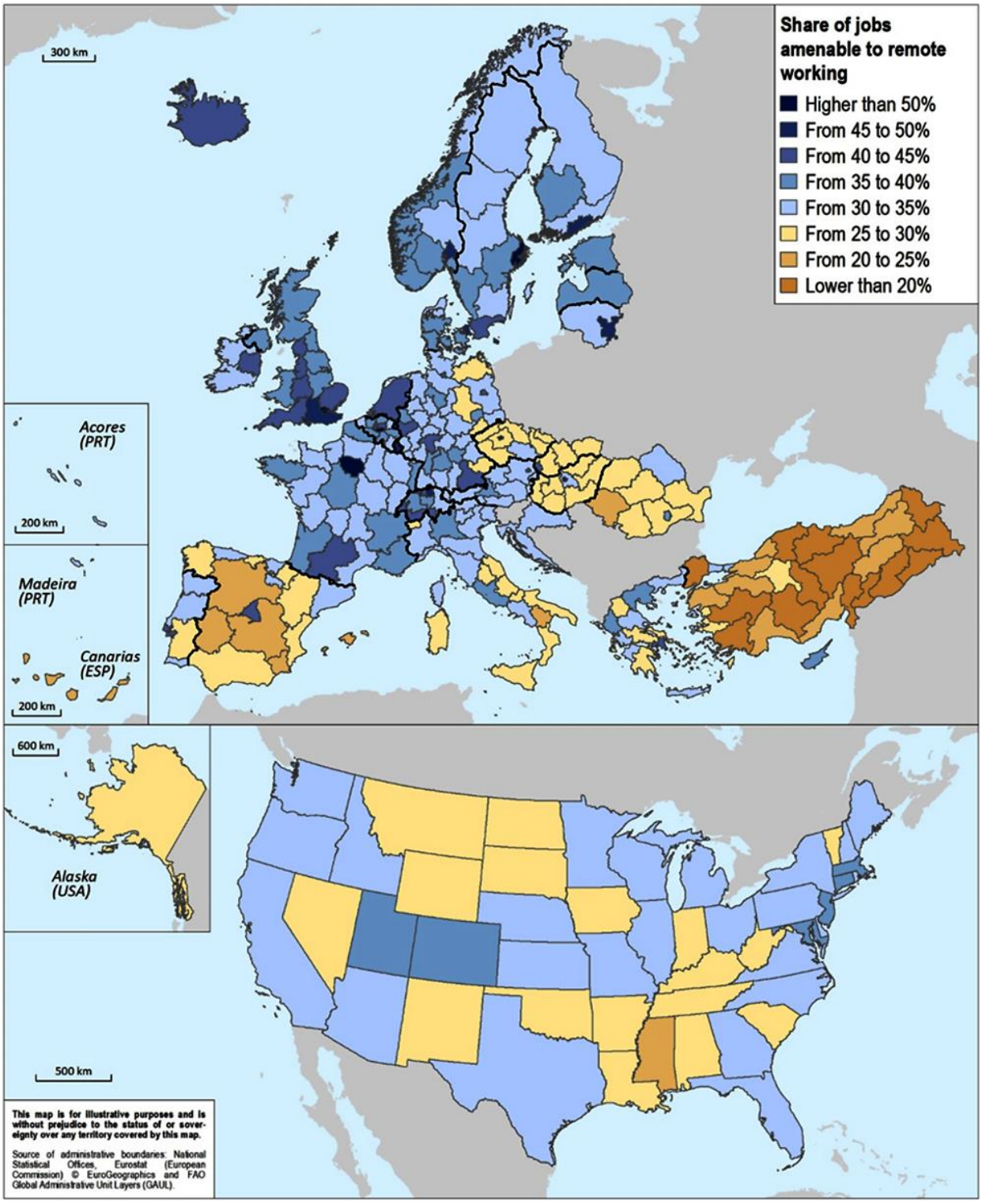
Source: (IRES Piemonte, 2020[31])

The ability to unlock investments in the region will be crucial to effective innovation-led development in Piedmont, and COVID-19 is challenging this ability. The vulnerabilities of the regional economic structure, and in particular those associated with having a high percentage of SMEs forming the backbone of a region's business environment, risk being accentuated in Piedmont as a result of COVID-19. First, two-thirds of workers are employed in firms with less than 50 employees. Small manufacturing firms, in particular, had already shown long-term patterns of employment reduction. Second, SMEs are generally more vulnerable to shocks (like the drop in the aggregate demand due to COVID-19) than large firms, particularly in terms of their dependence on debt for financing their activities. The COVID-19 economic shock can cause a shortage of liquidity and insolvency to SMEs, which in turn increases the death rate of firms (Kalemli-Ozcan et al., 2020[32]).

The pandemic shows how crucial digitalisation is for people, firms and institutions to access services and markets. The ability to telework often supported business continuity during the 2020 COVID-19 containment measures, for many in Piedmont and around the world. At the aggregate level, the increase of jobs easily performed remotely reduces job losses. The higher the capacity for remote working, the smaller the lockdown costs, the lower the vulnerability of firms in the short run, the higher their resilience in the medium and long run. In Piedmont, 32.1% of jobs were estimated to be adaptable to remote working based on the tasks required and whether they could be performed remotely (OECD, 2020[33]). This is in line with the OECD average of 31.47% (Figure 2.30). The provision of fast digital infrastructure is a key enabling factor. Piedmont lags behind, being in the bottom 33% OECD regions in terms of share of population with broadband access, whereas, for instance, all German regions stand in the top 25% (OECD, 2021[34]).

Figure 2.30. Share of jobs amenable to remote working in selected OECD and European countries

Percent values, 2018, NUTS-1 or NUTS-2 (TL2) regions

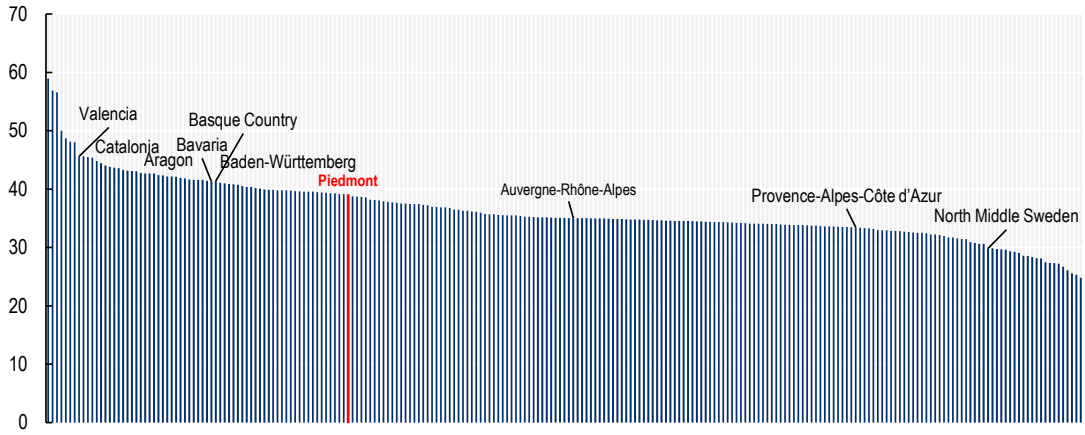


Source: (OECD, 2020[35]).

The economic sectors most affected by containment measures face the highest risk in the short-term. The capacity for remote working, and its relative costs, are highly differentiated among sectors and firms. Some sectors, for instance those involving direct contact, travelling, physical presence, etc. were more likely to be suspended to contain the diffusion of the virus. The OECD estimates that in Piedmont around 29% of jobs were at risk from containment measures, putting it in the top 50% of regions (OECD, 2020[16]). SMEs may face greater difficulties and higher costs when adapting to digitalisation needs for remote working, e-commerce and other digitalised business activities. The digital divide between "champion" firms and lagging enterprises may increase, and could be further exacerbated by inequalities in access to digital infrastructure and services among urban areas and rural and inner areas. Additionally, teleworking capacity varies across workers: high-skill workers are able to switch to remote working more fluidly, while low-skill workers are generally employed in jobs that cannot be performed by telework, and can face higher health, economic and social impact consequences as a result of the virus.

The combination of COVID-19 and technological change is magnifying the risks of tension in the job market in terms of quantity and quality of jobs, and will likely magnify the polarisation of firms and jobs. The automation of industrial processes and jobs was already challenging regions in industrial transition such as Piedmont, with new jobs generated by automation, for example, and old jobs destroyed, thus changing the profile of skills demanded. The COVID-19 pandemic is accelerating this and could result in a poorer job market structure for regions already affected by job polarisation, unemployment and skill mismatch (OECD, 2020[16]). Negative forces might dampen labour force participation and employment levels, as well as further accentuate any mismatch between the supply of and demand for work, employability of youth, and re-employment (reskilling) of the workforce. Within the OECD area, there are a few regions that face relatively low risks from both COVID-19 and automation, located mostly in Belgium, Canada, and the Netherlands, and the Scandinavian countries. There is a cluster of regions, mainly in Eastern Europe, France, part of Germany, Greece and southern Italy that face relatively low risks of job losses from COVID-19 and high risks of automation, while other regions, mainly in Australia, the UK, and the US that face high risks from COVID-19 and low risks from automation. Finally, some regions, mainly in northern Italy, southern Germany, and Spain, are facing relatively high levels of risk from both COVID-19 and automation. Piedmont shows a considerable amount of combined risk: within a regional comparison, Piedmont ranks in the top 30% regions in terms of combined risks of automation of works and COVID-19 (Figure 2.31). Among benchmark regions, those with higher industrial shares (e.g. the German regions) as well as those that are service-oriented (e.g. the Spanish regions) face higher risks, while areas with a more diversified structure show a lower combined risk.

Figure 2.31. Combined risk from automation of jobs and COVID-19 in OECD regions



Source: Authors own elaboration from OECD estimates (OECD, 2020[16])

The COVID-19 crisis also offers some opportunities for Piedmont's economy. Improved physical and digital accessibility to services can contribute to the regional resilience of firms and to citizens' well-being. The expansion of teleworking, e-commerce and other digital-related changes in firms has been a driver of higher productivity and market expansion. Additionally, innovation in public services, fostered by the crisis, represents another important aspect. For instance, COVID-19 accelerated the digitalisation of public administration and public services delivery (OECD, 2020[36]). These innovations might also enhance Piedmont's rich environment of ICT and high-tech firms.

A second opportunity is embedded in the transition towards a greener and circular economy. While a higher demand for "greener" products may bring potential risks, for example to the region's traditional automotive industry, demand favouring electric vehicles, and green business investments are likely to continue to grow. This could activate a regional value chain that already shows considerable potential (OECD, 2020[37]), and offer strong prospects for job creation.

In order to boost the potential and activate regional value chains and jobs, it will be crucial to invest in the new skills associated with a green transition. This will be necessary in the context of existing jobs that require reskilling so they may evolve, and new jobs that attract youth just entering the workforce, as well as workers previously in carbon-intensive sectors. Skill gaps are particularly noticeable in "green" sectors such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services and manufacturing (OECD, 2020[33]). Regional-level investment in skills (soft infrastructure) can generate a win-win outcome in technological transition (job losses in traditional manufacturing) and the low-carbon transition (job gains in the green sectors). Being a region in industrial transition, Piedmont had already started to experience what other regions are experiencing now with automation and digitalisation-related job changes. This gives the region a competitive advantage in managing the regional challenges and changes associated with the COVID-19 crisis. Piedmont can also learn from the experience of other regions in industrial transition.

The economic and technological changes arising from COVID-19 are also affecting territorial attractiveness. The deceleration of globalisation processes and the shifts (and disruptions) in global value chains may change where firms chose to locate. Local supply chains may be favoured over global supply chains. Within this context, the availability of local public goods (e.g. digital and physical infrastructure), and effective and quality institutions (e.g. schools and universities), which are the building blocks of innovation ecosystems, can represent a strategic asset for investment and firm attraction.

Changing geographic preferences associated with the COVID-19 pandemic could also mitigate geographic concentration and the urban-rural divide that affects Piedmont and the related economic and demographic imbalances (e.g. population decline and ageing in rural and mountainous areas). The rise of teleworking and digital access offer more households the chance to choose where they live – if in large urban areas, smaller communities, or rural areas with natural amenities and more affordable housing. Small cities and rural areas are potentially very attractive in a post-pandemic "new normal" scenario. This may activate virtuous circles for a balanced territorial development within the region. Investment in the drivers of territorial attractiveness such as digital connectivity and public service provision is key to optimising this opportunity.

Conclusion

The industrial specialisation that shapes the region has allowed Piedmont to reach high levels of economic output and income. At the same time, it can represent a driver for long-term stagnation and erosion of regional competitiveness, as shown by the slowdown in productivity growth. The reduction of the weight of manufacturing in the regional economy has affected activities and value chains that characterised the regional productive system. Now Piedmont risks being caught in a middle-income development trap, stuck between rising competition both from low-income regions (because of higher production costs in

'traditional' activities) and from high-income regions, which can more easily attract investments in more innovative activities. Worsening job market figures, with rising general and youth unemployment, reinforce the concerns surrounding Piedmont's economic health. Within this framework, innovation can be a tool to foster regional competitiveness in terms of its firms as well as its workers. Piedmont shows a high potential for innovation-led growth, as demonstrated by the investments made by the private sector. Yet it will need to ensure that smaller firms are able to access innovation production, collaboration and diffusion, and that the public can increase the type of resources that drive innovation, or the elements that contribute to it (e.g. education and skills training).

The ability to further unlock public and private sector investment in innovation will be crucial to effective innovation-led development in Piedmont, especially in light of the COVID-19 framework, which has affected Piedmont and Italy more than other countries. The pandemic has shown the extent to which investment in digitalisation and innovation is important for firms and people. This gives the region the opportunity to re-think its place-based assets, in order to better scale-up its economic system and boost firm productivity, increase the region's attractiveness for investments and promote high-quality job creation.

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Notes

[1] Economic data for the OECD regions are drawn from several sources. For reasons of data availability, when possible the comparison is made with the average of the OECD area as a whole. In other cases, the comparison is made with the average of the OECD regions.

[2] The Territorial Level 2 (TL2) regions represent the first administrative tier of subnational government. For Italy, this definition corresponds to the *Regioni* and the *Provincia Autonoma di Trento* and *Provincia Autonomia di Bolzano/Bozen*, which have the same legislative powers as regions. For further details, please see https://www.oecd.org/regional/regional-statistics/territorial-grid.pdf.

[3] The Functional Urban Area of Turin comprises the city of Turin and the 87 municipalities in its commuting zone. For the definition and description of FUAs, as well as the list of municipalities included in each FUA, please refer to https://www.oecd.org/regional/regional-statistics/functional-urban-areas.htm.

[4] OECD LAU (Local Administrative Unit) level 3.

[5] GDP per capita in Bavaria was 24% higher than the OECD average in 2007 and 41% higher than the OECD average in 2018. GDP per capita in Baden-Württemberg was 25% higher than the OECD average

in 2007 and 36% higher in 2018. GDP per capita in Saxony was 22% below the OECD average in 2007 and 9% below the OECD average in 2018.

[6] GDP per capita in Wallonia was 20% below the OECD average in 2007 and 17% in 2018.

[7] Within the OECD area, the highest values in terms of participation and employment rates are found in Japan, Iceland, Netherlands, New Zealand, Sweden, and Switzerland.

[8] The following indicates the values of the participation rates and employment rates in the top performing Italian regions: Bolzano-Bozen (76.3%, 74.1%), Emilia-Romagna (74.6%, 70.4%), Aosta Valley (73.2%, 68.3%), Lombardia (72.5%, 68.4%),Trento (72.2%, 68.5%)

[9] Early leavers from education and training refers to a person aged 18 to 24 who has completed at most lower secondary education and is not involved in further education or training.

[10] Among secondary school students, 52.4% enrolled at a university in Piedmont versus the national average of 50.3% in 2016 (Source: Italian Statistical Bureau).

[11] Middle-skill jobs are defined as occupations in the middle of the occupation-wage distribution (OECD, 2020[10]). Skill-levels are defined by using the International Standard Classification of Occupations (ISCO) used by the OECD. Accordingly, occupations are distinguished as high-skill (or high-occupation), middle-skill (or middle-occupation) and low-skill (or low-occupation) based on by their average wage, regardless of the formal education, training, or labour market experience they require (OECD, 2017[13]). The median middle-skill workers is a person without a tertiary degree and likely to work in manufacturing.

[12] In 1995-2015 in the OECD area, the share of middle-skill jobs in transport manufacturing dropped by 9.5%, while the share of high-skilled jobs increased by 9% (OECD, 2017[13]).

[13] High-skill jobs include jobs classified under the ISCO-88 major groups: 1 (legislators, senior officials, and managers); 2 (professionals); and 3 (technicians and associate professionals). Middle-skill occupations include jobs classified under the ISCO-88 major groups 4 (clerks); 6 (skilled agricultural workers); 7 (craft and related trade workers); and 8 (plant and machine operators and assemblers). Low-skill occupations include jobs classified under the ISCO-88 major groups 5 (service workers and shop and market sales workers); and 9 (elementary occupations) (OECD, 2020[16]).

[14] For a full comparison with the OECD regions, data refer to year 2016.

[15] Source: OECD elaboration from Italian Statistical Bureau permanent census of industry

[16] Data collected from the OECD REGPAT Database, which presents patent data that have been linked to regions according to the addresses of the applicants and inventors. For more information on the database, see: www.oecd.org/dataoecd/22/19/40794372.pdf.

[17] No data are available for the French and Belgian regions.

3 Reconsidering innovation policy and reinforcing innovation policy governance in Piedmont, Italy

A fresh look at innovation and innovation policy in Piedmont, Italy could help boost the region's innovation capacity and process of industrial transition. This chapter evaluates the current approach to innovation in Piedmont and identifies challenges, including a lack of institutional thickness that can stymie the full development of an innovation ecosystem. It begins with an overview of Piedmont's regional innovation system and current policy, identifying points to consider for the next policy. It then focuses on mechanisms to update and broaden Piedmont's approach to innovation. From there, it explores how to generate a more integrated regional innovation system. The chapter also examines ways to reinforce the multi-level governance of innovation policy, and ends with a series of recommendations for action.

In Brief

Piedmont's next innovation policy can be used to develop a dynamic regional innovation ecosystem

- Piedmont, a moderate innovator+, faces several economic weaknesses, including productivity declines, low skill levels, and limited entrepreneurialism. Innovation policy can help address these while supporting the region's industrial transition. Doing so effectively means transforming Piedmont's current innovation environment into an innovation ecosystem.
- Regions with the best performing regional innovation systems are those that enjoy both organisational and institutional thickness. Currently, Piedmont's organisational thickness is strong. It has a rich and diverse organisational fabric that contributes to innovation through research, education and other relevant activities, and actors that recognise the importance of innovation for the region's development. It also outperforms Italian averages with respect to private sector R&D expenditures, and European averages in terms of small and medium-sized enterprises (SMEs) innovating in-house. Yet, its institutional thickness is not strong. There is a limited culture of innovation and cooperation among institutions, which may be holding back the growth of innovation activities.
- Piedmont dedicated more than twice as much of its EU funding to research and innovation in the 2014-2020 programming period than to other EU priority areas. Its approach to innovation focuses on a strong cluster model that prioritises research and development (R&D) innovation, the promotion of cross-disciplinary technologies and products, and on the region's largest existing business and research concentrations. Greater diversity, achieved by supporting other forms of (non-R&D) innovation and small and micro enterprises, and expanding innovation networks could boost innovation, and economic opportunities in the region.
- Piedmont's SMEs, and particularly its smaller firms, may be missing out on value-added from the value-chains to which they belong. Small size and limited innovation levels may be holding them back. However, the way that large firms manage the relationship with small suppliers may also be playing a role. Productivity among SMEs also needs to improve, and boosting their capacity for functional upgrading could be one way to accomplish this.
- Greater integration among innovation actors and innovation activities, as well as expanded innovation networks, would make a difference in Piedmont's innovation environment. This calls for developing, over time, an effective toolbox of coordination mechanisms so that actors understand each other's roles and work together to advance innovation and innovation policy objectives. Doing so could help address one of the most significant challenges confronting the region's innovation system.
- Framework conditions are the largest obstacle in the multi-level governance system supporting Piedmont's innovation policy. Regulatory/administrative requirements – and especially those associated directly and indirectly with the financing system – are perceived as most onerous. To implement its future innovation policy, Piedmont will need to make it easier – to the extent that it can – for its firms to meet European Union (EU) fund requirements while supporting greater agility within the frameworks.

Introduction

Innovation and innovation-based activities have steadily grown as a focus for place-based regional development policy and investment. This is regardless of whether the region is predominantly urban or rural, advanced, falling behind, or in a process of industrial transition. Regional development policy is likely to continue to focus increasingly on innovation as countries and regions concentrate on building resilience post-COVID-19, including through investment in Industry 4.0, greater digitalisation, the environment (green investment) and a just transition to carbon neutrality. The expectation is that place-based innovation policies, particularly those grounded in smart specialisation strategies (S3), can promote economic development and tackle new and pressing social and environmental problems, or grand challenges (Larrue, 2021[1]). At the same time, policy makers acknowledge the complexities of innovation-driven regional development, which include fostering a dynamic and effective innovation ecosystem, and ensuring that governance systems inside and outside the ecosystem are well structured.

Piedmont, together with other regions in European Member States, is redesigning its S3 for the 2021-2027 Programming Period. As part of this, it is taking a careful look at its approach to innovation policy and its cluster model to make innovation a bigger contributor to the region's development. As Chapter 1 highlighted, there are a number of structural barriers to development in Piedmont, such as marked territorial inequalities, the risk of falling into a middle-income trap, and a polarised productive structure with large and medium firms on one side and small and micro firms on the other. In addition, Piedmont must grapple with several economic weaknesses, including productivity declines, low skill levels, and limited amounts of entrepreneurialism. Innovation and innovation diffusion could help address these challenges, particularly the last three, while contributing to Piedmont's process of industrial transition. Success will depend on Piedmont's ability to refine its current innovation policy. It will also need to reinforce certain aspects of its governance system inside and outside the innovation policy environment. A broader definition of innovation will be important, so will be monitoring and learning from policy experience (i.e. knowledge sharing), and introducing new mechanisms to advance innovation, such as innovative public procurement (Marques, P., 2020[2]). The result could be a positive shift from today's innovation environment to a dynamic innovation ecosystem.

Moving from an innovation environment to an innovation ecosystem will depend on transforming the innovation environment. Transforming it from one where actors act in the same space but relatively separate from one another (despite a common goal), to a space where actors act as part of an integrated community or network and are each a unique but essential and interdependent performer in a complex system. This chapter focuses precisely on these matters. It first considers the current regional innovation system (RIS) and innovation policy in Piedmont. It then spends time examining what would be necessary to innovate innovation policy and shift from an innovation environment to a true innovation ecosystem. Finally, it looks at the multi-level governance system that supports innovation policy design and implementation, focusing on aspects that are either constraints or need to be reinforced. The chapter concludes with a series of recommendations as the Piedmont regional government reconsiders its innovation policy and the policy's governance.

An overview of innovation in Piedmont

Piedmont is a moderate innovator+ that performs within the top 40 of EU Member State regions in a number of areas[1] (Hollanders and Es-Sadki, 2021[3]). It ranks among the top 20 regions for only one of these – "Employment in knowledge-intensive activities as percentage of total employment SME's" – where it scored 19. To put this into context, of the benchmark regions only cities that form part of Baden-Württemberg and Bayern scored better than Piedmont.[2] With regard to the indicator "R&D expenditure in the business sector as a percentage of gross domestic product (GDP)", several German cities in the Baden-Württemberg, Bavaria and Saxony regions scored better than Piedmont (39), as well as the

Wallonia region in Belgium and Auvergne-Rhône-Alpes region in France. Regarding "SMEs introducing business process innovations as percentage of SMEs", of the selected benchmark regions only cities that form part of Baden-Württemberg, Bayern and Sachsen scored better than Piedmont (37). There clearly is innovation occurring in Piedmont. The question is what may be holding innovation back, and what can be done to more fully unleash the region's innovation potential.

Piedmont's regional innovation system

In general, RIS can be organised along two dimensions: organisational thickness (i.e. the number of organisations that exist in a region) and institutional thickness (i.e. the existence of formal and informal institutions that promote coordination among actors and facilitate the exchange of knowledge). Regions with the best performing RIS tend to have a large number of organisations that produce and exploit knowledge, and an ability to link these organisations in an integrated manner (Table 3.1) (Trippl, M., B. Asheim, J. Miörner, 2016[4]). Based on this framework, Piedmont falls into the bottom left quadrant of Table 3.1.

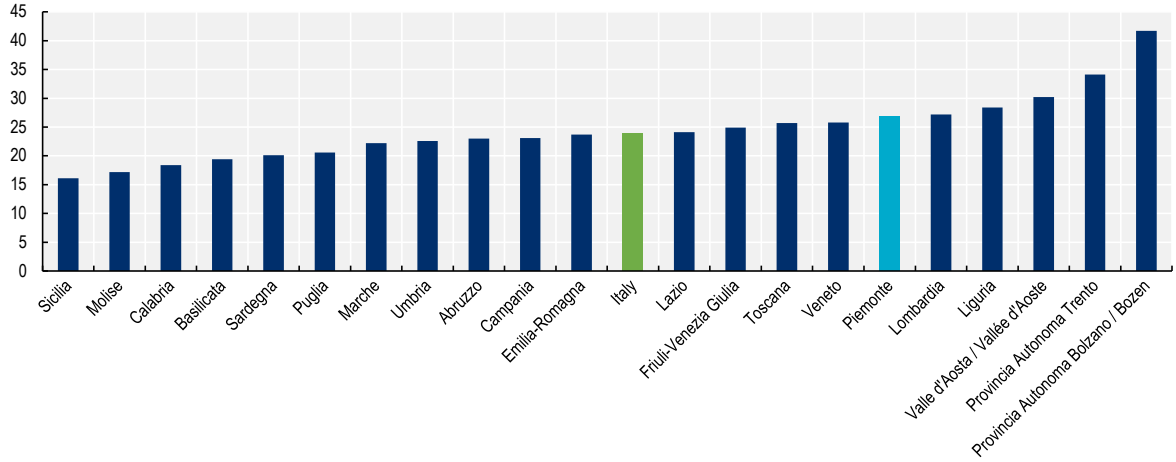
Table 3.1. Organisational and institutional thickness in regional innovation systems

	Organisational thickness	Organisational thinness
Institutional thickness	Metropolitan/city regions in Northern and Western Europe	Industrial districts in the "Third Italy" (i.e. north eastern and central areas); Nordic peripheral regions
Institutional thinness	Larger cities in Southern and Eastern Europe; old industrial areas in Western Europe	Southern and Eastern European peripheral regions

Source: (Trippl, M., B. Asheim, J. Miörner, 2016[4])

Piedmont is a region with organisational thickness, having a rich and diverse organisational fabric that directly or indirectly contributes to innovation through research, education and other relevant activities. Its large, innovative firms and SMEs (Delponte, L., E. Sirtori, 2018[5]; OECD, 2020[6]) outperform the Italian average in terms of private sector R&D expenditures as well as the European average in "product/process innovation" and "SMEs innovating in-house" (European Commission, 2019[7]). Its universities have high quality research departments and strong training programmes. In addition, there are well-developed cluster management organisations and other public and private institutional actors, including the private bank foundations. Yet, it suffers from institutional thinness – where a limited culture of innovation and cooperation among institutions, combined with a need for stronger institutional capacity, including government capacity, may stymie innovation activities. This is evidenced in a general perception that cluster activities and relationships among actors (e.g. among the various universities, and universities and start-up incubators) could and ought to be more integrated (OECD, 2020[6]). In addition, key private-sector actors (e.g. the bank foundations) tend to shy away from working with public institutions to promote innovation given real or perceived red tape, which could slow project implementation (OECD, 2020[6]). The regional government is aware of this and is taking steps to build dialogue and exchange opportunities with the bank foundations, for example, to build coordination and identify synergies, as a first step towards more structured collaboration in the future. The lack of interpersonal trust has been cited as a major reason for the limited cooperation among Piedmont's RIS actors (OECD, 2020[6]). A 2020 survey shows that only about 30% of people in Piedmont say that most people can be trusted (Figure 3.1). This is higher than the Italian average, but still low. A lack of trust has important consequences for innovation and innovation support. If small business owners and managers do not trust one another or others, including the government, this not only undermines their ability to approach each other for a cooperative opportunity, it can also undermine efforts by public sector organisations to reach these firms and help them build their innovation capabilities (OECD, 2018[8]; Murtin, F., et al, 2018[9]).

Figure 3.1. Percentage of people in each Italian region that say most people can be trusted



Source: (I.Stat, 2020[10])

The lack of coordination among Piedmont's RIS actors is also compounded by low innovation capabilities among micro and small firms. This can indicate they do not value innovation, and thus do not actively pursue collaborating on innovation projects with other institutions (Marques, P., 2020[2]). Encouraging regional innovation actors, such as the cluster management organisations or the *Istituti Tecnici Superiori* (ITS), to develop outreach programmes for training micro and small firms in areas such as digitalisation or management skills (see Chapter 4) would be valuable. This could facilitate engagement with such companies and, in doing so, build trust, which is particularly important as an informal contributor to institutional thickness. At the same time, it is important to note that, according to the European Innovation Scoreboard 2021, Piedmont is currently considered a "bottom high performer" with regard to the indicator "Innovative SMEs collaborating with others as percentage of SMEs", scoring above the European and Italian averages (Hollanders and Es-Sadki, 2021[3]). This represents a strong improvement vis-à-vis 2019 when Piedmont scored well below the European average and just below the Italian one (European Commission, 2021[11]).

Piedmont's innovation policy in the 2014-2020 EU programming period

Piedmont's current innovation policy is rooted in its innovation antecedents and is strongly guided by European Union Cohesion Policy programming and funding. This is true not only for Piedmont but also for many other Italian and European regions.

To meet the requirements of the 2014-2020 European Programming Period, Piedmont developed an S3 – in accordance with the EU's smart specialisation strategy concept (Box 3.1) – to prioritise and guide innovation investment financed through European Structural and Investment Funds (ESIF)[3]. It built this strategy and its innovation policy around a strong innovation cluster and cluster organisation model[4] and promoted cross-disciplinary technologies and products in six areas of specialisation: aerospace, automotive, mechatronics, green chemistry/cleantech, "made-in" (agri-food and textiles), health and well-being. There are also two transversal guidelines or guiding directions: "smart" and "resource efficiency". These are considered transformation trajectories, and should support the six prioritised specialisations, for example by increasing the use of digital modalities to improve agricultural production and to make use of the circular economy. In general, the strategy reflects and supports the largest existing business and research concentrations in the region – mechatronics and industrial production, as well as agriculture and

food ("made in"). Other specialisation areas, such as green chemistry/cleantech (or biotechnology in general), health and well-being, have a smaller existing basis on which to build activity.

Box 3.1. What is a smart specialisation strategy?

Smart specialisation is a concept designed by the European Commission to encourage regions to identify their strongest assets in research, innovation and entrepreneurship so they can then select priority investment channels and build their regional comparative advantage around them. The objective of an S3 is to help regions diversify their economic base – their industrial specialisations – in fields with the greatest socio-economic potential for their region. The concept emphasises the role of entrepreneurial knowledge to identify regional priorities, giving rise to the entrepreneurial discovery process[5]. The 2021-2027 EU Cohesion Policy programming period dedicates the majority of its budget to promoting a Smarter Europe. This is one of the five thematic objectives of the new programming period and emphasises innovative and smart economic transformation.

European regions have to update their S3 and ensure that it meets seven "enabling conditions", as follows:

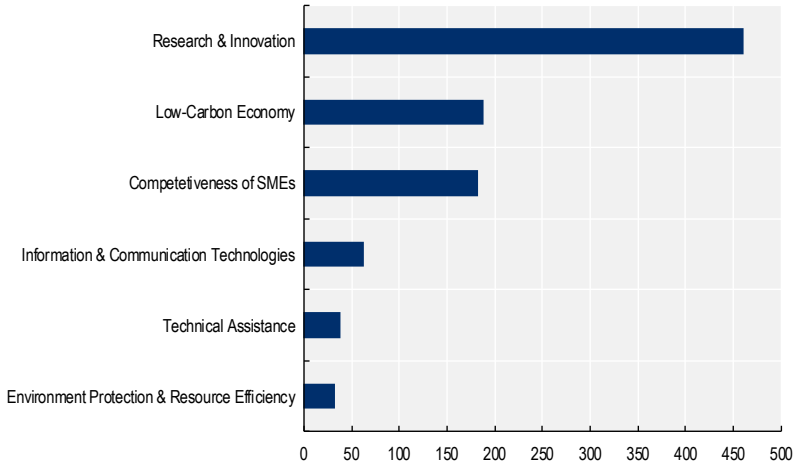
1. Up-to-date analysis of bottlenecks for innovation diffusion, including digitalisation
2. Existence of competent regional / national institution or body, responsible for the management of the smart specialisation strategy
3. Monitoring and evaluation tools to measure performance towards the objectives of the strategy
4. Effective functioning of entrepreneurial discovery process
5. Actions necessary to improve national or regional research and innovation systems
6. Actions to manage industrial transition
7. Measures for international collaboration

Source: (Interreg Europe, 2020[12])

In the 2014-2020 EU programming period, Piedmont heavily prioritised investment in research and innovation (R&I), as evidenced by its allocation of ESIF. It dedicated more than twice as much of its European Regional Development Fund (ERDF) to R&I in the six specialisation areas than to other EU priority areas (e.g. low-carbon economy, SME competitiveness, information and communication technology (ICT), etc.) (Figure 3.2). This prioritisation aligns with Piedmont's S3 objectives of supporting smart and resource-efficient industrial modernisation. It also signals an S3 strategy and innovation policy focused on R&D-driven projects – a rather traditional approach to innovation and its definition. While this is a clear choice, it may be at the expense of supporting other forms of innovation, particularly non-R&D innovations that could be more adapted to potential innovators in Piedmont, such as micro and small enterprises. A recent study by *Istituto di Ricerche Economico Sociali del Piemonte* (IRES Piemonte) (2020[13]) also came to the same conclusion. Lost innovation (and economic) opportunities arising in other important areas, such as advancing toward a low-carbon economy and building SME competitiveness, may also be a consequence of this strategic direction. As Piedmont considers its next generation S3 strategy and innovation policy, it may wish to rethink this prioritisation approach. Doing so could help it identify and build on additional innovation opportunities and investment complementarities.

Figure 3.2. Total budget by ERDF theme: Piedmont

EUR billion



Source: (European Commission, 2021[14])

Looking forward

As it reconsiders its S3, and especially its regional innovation policy, Piedmont will need to emphasise shifting the innovation space from an innovation environment to an innovation ecosystem, the latter term referring to a wider and more integrated set of actors and sectors, as well as to broader and more dynamic frameworks, structures and processes involved in fostering the various forms of innovation. This can mean building institutional thickness – reinforcing (or building) the ability of formal and information institutions and mechanisms to promote coordination and facilitate knowledge exchange within the innovation space. Doing so could help overcome a number of challenges for Piedmont's RIS, including a narrow approach and limited space for innovation to occur (i.e. in terms of the types of innovation that is supported), limited system integration, and framework barriers embedded in the governance system. Structuring a policy that promotes expanding the system's networks, encourages the formation of new networks, and fills the real or perceived leadership and coordination vacuum will be important. Piedmont has a dynamic and diverse group of organisations that recognise the importance of innovation for the region's development, and support it as a lever for industrial transition. These organisations – and the RIS – would benefit from greater coordination, from more diverse networks and from a more integrated approach to managing the innovation environment. To advance in this direction, public authorities should be prepared to articulate, promote and support a more strategic view of innovation activities. Equally important will be to use the policy to grow private sector productivity, particularly in micro and small firms, and to stimulate job creation. Finally, and perhaps most critically, it will be crucial to broaden the innovation space. This can mean expanding the definition of innovation that supports the emergence of related sectors of economic activity to help advance structural economic change and employment growth, while at the same time addressing broader social and environmental challenges. Of course, the region should continue to nurture and reinforce its well-developed organisational thickness, a current strength of its RIS.

Piedmont made two very clear decisions with respect to its 2014-2020 S3 and innovation policy: first, it would focus efforts on R&I, and second it would depend to a large degree on its cluster organisations to advance the innovation policy. This approach, combined with the need to rely heavily on EU funding in order to implement its innovation policy, has resulted in some systemic challenges that can be grouped into three broad categories: i) a rather narrow approach to innovation which can exclude many smaller and less innovative firms from the innovation environment, ii) limited system integration, and iii) significant

framework constraints in the multi-level governance system supporting innovation policy. In their own ways, each of these challenges may be contributing to Piedmont's institutional thinness in the innovation space. This is compounded by limited regional and local experimentation in innovation policy. Piedmont may want to orient its upcoming S3 and innovation policy in such a way that they help Piedmont address – and ideally overcome – the challenges identified and transform the innovation environment into an innovation ecosystem.

Updating Piedmont's innovation policy: broadening the definition and approach to innovation

Innovation activities and financing in Piedmont focus on technological innovation (R&D), particularly among the cluster management organisations. This works well within the space created and for those who participate in it. However, there is less room, and financing, for other, potentially more creative, or more innovative approaches to innovation, or approaches that are more inclusive of the diversity of the region's enterprise fabric. For example, less emphasis is placed on promoting innovation in management, marketing, or product development processes in micro-firms and small enterprises. There is no doubt that R&D-based innovation is important, and it is a critical component of any region's S3. Yet, regions also can promote innovation that is based on a sector's experience (doing-using-interacting), is incremental (e.g. improvements in process or product engineering), improves production capacity, or builds stronger management practices, for example (Foray, Morgan and Radosevic, 2018[15]). The Autonomous Community of Extremadura in Spain offers a relevant example (Box 3.2). In Piedmont, little is done to "mainstream" social innovation activities, and more attention could focus on innovation in the public sector. Doing so could create greater inclusiveness, support meeting larger societal goals (e.g. addressing climate change), and also generate greater citizen satisfaction with public and administrative services. Piedmont may want to consider broadening its definition of innovation, or the types of innovation and locations for innovation that the government actively supports through its next innovation policy and Regional Programme for the 2021-2027 EU Cohesion Policy funding period.

Box 3.2. Process and product innovation in Extremadura, Spain: *La Torta del Casar*

Extremadura, Spain's smart specialisation strategy is structured around five sectors: agro-industry, energy, tourism, health and ICT. It is a region well-known for speciality food products, including its unique cheese, *La Torta del Casar.* To further improve and develop the production of this cheese – and to advance other S3 Pillars, the Local Action Group for Rural Development of the Tajo-Salor-Almonte *comarca*, brought together farmers, shepherds and other actors to identify weaknesses in the production system and design solutions to overcome these. This led to the creation of the Farmers School of XXI and the Shepherding School, which partner with farmers and shepherds and provide training in farming techniques including in the use of ICT and other technological advances that can support production. In addition, cheese producers are exploring and testing how to improve their production processes. For example, they are investigating the use of seawater in the cheese's salting process, rather than brine, to give the cheese different characteristics. The region is also developing tourism around the cheese – launching a *ruta de la Torta del Casar*.

Source: (European Commission, 2017[16]; Avuelapluma, 2014[17]; European Commission, 2016[18])

The current innovation environment, which centres around Piedmont's cluster organisations, does not necessarily foster economic diversification or the active expansion of networks. In general, there is a limited number of cluster activities designed to help existing firms find new product and service lines, and/or to encourage the emergence of related or – perhaps more innovative – unrelated economic activities. There are exceptions to this, particularly among Piedmont's more cross-sectoral cluster organisations (e.g. mechatronics, green chemistry/cleantech). Yet, the narrow specialisation of most of Piedmont's clusters

may be working against diversification. While this may not have been the initial intention, it has evolved to be the case and affects not only cross-sector specialisation, but integration potential, as well (OECD, 2020[19]; OECD, 2020[6]; Marques, P., 2020[2]). This lack of diversification and integration is reinforced by an apparent "exclusivity" to cluster membership, evidenced in two ways. First, cluster membership levels may not represent the broader business base of the specific industrial activity. This indicates a tendency to concentrate activities on a number of "insider" organisations (Marques, P., 2020[2]). Second, approximately 30% of ERDF funds are reserved for cluster members wishing to apply for innovation funding opportunities through ERDF.[6] This might be considered an incentive to join a cluster, though it does not seem to work as such. Behind this may be the complexity and bureaucracy that is associated with accessing EU funds, putting off small firms that may need them and large firms that can access other lines of credit. It could also be due to a lack of interest or ability in joining a cluster organisation. This could be particularly true for micro and small firms. They may not recognise the value added in joining, they may feel that the heavy emphasis on R&D and technology-driven R&D is outside of their scope of activity, or they may not have the capacity or resources to do so (OECD, 2020[19]). Chapter 4 explores, in depth, Piedmont's clusters and cluster organisations, and their place in the region's innovation policy.

Promoting more than technological innovation

Advancing R&I should continue, and Piedmont's clusters are active and essential players for accomplishing this. Yet, innovation is a much broader concept, and there is a need to work with it as such in Piedmont. Ensuring that a future innovation policy provides guidance on what a broader approach to innovation means, how to realise it, who should be involved, and what its objectives are, will be important to encourage and legitimise the shift in perspective.

Traditionally, innovation is associated with science, R&D. This view has biased the formulation of innovation policies and institutions in many regions by focusing on a "linear" or "supply side" approach, whereby research is seen as generating R&D and inventions and then is transformed into innovations introduced by firms in markets (Howells and Bessant, 2012[20]). It has influenced innovation policy design and created new knowledge and more radical, disruptive, and novel innovations. Yet, its application should be balanced with efforts to adapt existing knowledge and technologies, and more generally, create and build basic innovation capabilities (OECD, 2018[21]). While more novel or radical innovations are important, they are not necessarily everyday occurrences. The "linear" view misses the fact that incremental innovation and upgrading are important characteristics of the innovation system. Thus, a broader view of innovation (Box 3.3), one that includes incremental innovation and upgrading, is needed to improve innovation policies. This may be particularly beneficial in Piedmont. Broadening innovation policy is not about defunding R&D and the instruments that support it. Rather, it means balancing the composition of innovation activities, for example by aligning budget allocations with the actual and evolving capabilities of the region's private sector (OECD, 2020[22]).

Box 3.3. Types of innovation activity to consider supporting through an innovation policy

A well-balanced innovation policy for Piedmont should incorporate different types of innovation, including those that depart from current technologies and practices. Some forms to consider include:

- **Technological innovation**: refers to developing technologically new or substantially changed goods or services, or to the use of a technologically new or substantially changed process.
- **Social innovation**: refers to the design and implementation of new solutions that imply conceptual, process, product or organisational change, and which aim to improve the welfare and well-being of individuals and communities. The aim of social innovation is to meet social demands traditionally not addressed by either the market or existing institutions and generally, but not exclusively, directed towards vulnerable groups in society. For instance, social innovations can aim at encouraging a more participative society where empowerment and learning are sources and outcomes of well-being. An example of social innovation includes the creation of a community-managed development bank that provides credit for initiatives aimed at solving local service delivery gaps.
- **Business model innovation**: seeks to change to an organisation's value proposition and to its underlying operating model by changing the rationale of how an organisation creates, delivers and captures value in economic, social, cultural or other contexts. Business model innovations in existing firms can include: a firm ceasing its previous activities and entering into new types of products and markets that require new business processes; or a firm changing the business model for its existing products, for example by switching to a digital model with new business processes for production and delivery.
- **Policy innovation**: aims to find novel processes, tools and practices used for policy design, development and implementation that result in better problem solving of complex issues. These can include innovative methods of engaging the public in the design of policy and services (for example through participatory budgeting), and evaluating the efficacy of policies, services and funding.
- **Public sector innovation**: refers to the design and implementation by a public sector organisation of new or significantly improved processes, methods or services – from data analytics to prototyping and design thinking – aimed at improving its operations or outcomes. Many of such innovations create services that are more user-focused, better defined and better targeted to user demand. Such innovations can alter the supply of services by improving their characteristics, and demand for services. Public sector innovation differs from policy innovation in that it generally encapsulates a wider range of measures to enable and accelerate innovation within government.

Source: (OECD, 2020[22]; OECD/Eurostat/European Union, 1997[23]; OECD, 2020[24]; OECD/Eurostat, 2018[25]; OECD, 2016[26]; Marques, Morgan and Richardson, 2017[27])

The regional government could also use its influence – and policy – to support innovation among targeted populations and/or targeted territories within the region (e.g. youth in rural areas). Early evidence in a study of innovation in OECD rural regions is indicating that innovation capacity is high for young, start-up entrepreneurs. Yet, their numbers and activities are dropping in rural areas. Young entrepreneurs in rural areas, towns and suburbs are 30% less likely to start a business than their urban counterparts. This becomes problematic, particularly for regions that have a significant amount of rural territory, since innovation can improve income, productivity and employment in rural areas more so than in dense ones (Marshalian, M., 2021[28]). Ensuring that the upcoming policy emphasises, even more strongly, training and

education can help. Developing specific incentives for education institutes in rural areas to work with youth interested in entrepreneurship could be part of policy programming.

In addition to broadening the definition, or type, of innovation that it supports, and targeted populations, Piedmont may also want to consider paying particular attention to mainstreaming social innovation and developing public sector innovation in its upcoming innovation policy.

"Mainstreaming" social innovation by integrating it into the innovation policy

Piedmont boasts a fairly well-developed social innovation ecosystem, with a longstanding tradition of community-based organisations and the emergence of new organisations and funding agencies. It has a strong third sector, and a growing social economy. There are about 40 000 organisations with a social purpose in Piedmont, of which about 4 000 are for-profit companies that pursue social goals. In addition, Piedmont has a relatively well-established network of institutions that support social entrepreneurs and impact investing. For example, Torino Social Impact functions as a platform that fosters high-tech social entrepreneurship in the Turin metropolitan area (European Commission, 2019[29]). Though the third sector has been characterised as rather risk-averse and closed to outsiders (OECD, 2020[19]), its existence is nonetheless a strength. By providing financial incentives it could become better mobilised and encouraged to open up to new ideas (Marques, P., 2020[2]).

Actively mainstreaming social innovation into Piedmont's innovation mix would both broaden the approach to innovation, and could help the region address some of its more persistent structural challenges, especially if combined with more traditional innovation instruments. Many initiatives launched by social economy organisations[7] and by civil society have proven to be innovative in dealing with socio-economic and environmental problems, while contributing to economic development (OECD, n.d.[30]). For example, a non-profit organisation in Luxembourg provides donated digital devices, such as smartphones, to refugees and other marginalised groups. This material support is combined with educational services. The recipients of digital devices learn how to fix the donated equipment through refurbishing workshops and ICT skill classes. These are delivered in different languages to reach a wider audience. The project considers digitalisation to be an enabling factor for integration, while also having a positive environmental impact through the re-use of ICT equipment. The WASCO Cooperative in Slovakia seeks to reduce long-term unemployment of Roma people in deindustrialised areas. The cooperative provides Roma people and other vulnerable groups with work in laundry and ironing services. The employment is accompanied by training in order to help the beneficiaries develop their skills and experience. In the longer-term, the cooperative aims to help participants to move on to employment elsewhere through tailored guidance on searching for and securing a job (European Commission, 2020[31]). Using social enterprises to advance education for disadvantaged groups, to address a chronic low-skill level shortage certain segments of the population, or to design and deliver training for micro and small firms in management, digitalisation or new-market prospecting are all are forms of social innovation that can contribute to an innovation policy that supports both R&D and non-R&D driven innovation.

Integrating social innovation into Piedmont's overall innovation policy would require identifying ways to overcome one of its principle challenges – the lack of funding in the third sector. One way to address this would be to launch project calls open to any social enterprise or non-profit organisation, ideally in partnership with a social enterprise or an organisation already funding social innovation, such as SocialFare, private foundations (e.g. the bank foundations), or ImpactHub Turin. Social enterprises already providing services to micro and small firms could also seek support from SME associations in order to increase the number of possible funders (Marques, P., 2020[2]). Skills for social innovation, including social enterprise financing, would also need to be built. These activities could be integrated into the curricula of the ITS, and could also include placement schemes for graduates. Skills-development activities or initiatives similar to those that support SMEs could be created for the social enterprise sector to help improve its skill base. Higher education institutes, such as Santa Clara University (United States) have

developed specific education material and foment collaboration between students, social entrepreneurs, corporate partners and faculty to incubate and scale development projects in areas such as clean energy, mobile technologies and sustainable livelihood development (Fichter, Geier and Tiemann, 2016[22]). Scaling-up the third sector to further advance social innovation can also require encouraging cooperation and collaboration among social enterprises, since there is evidence that mergers are a common growth strategy for such organisations (Marques, P., 2020[2]). Fostering networks between social enterprises and other types of organisations would be important to disseminate ideas, diffuse social innovation knowledge could promote growth among social enterprises. In addition, strong coordination with small business associations and other relevant organisations, in order to ensure broad stakeholder buy-in and improve coordination within the overall innovation system.

Reinforcing innovation in the public sector as part of innovation policy

Public sector innovation should not be ignored in the upcoming innovation policy. There are two dimensions to this. The first centres on the need to ensure that innovation policy addresses societal challenges (Coenen, L., and K. Morgan, 2020[32]). This is particularly important given that innovation itself can contribute to these challenges, for example by reinforcing inequalities, disrupting the labour market, and generating further environmental degradation. The debates surrounding the direction of innovation, mission-oriented innovation and inclusive innovation – be it innovation generated by marginalised or under-represented groups or innovation that generates more inclusive growth (Heeks et al., 2013[33]) – illustrate the growing concern (Box 3.4). The EU Green Deal, the growth in national, regional and local policies and investments targeting or incorporating green infrastructure, the circular economy, climate transition and the call for greater regional resilience post COVID-19, indicate that these concepts will become even more relevant in the future. Piedmont has already made some progress in these areas and is preparing to advance further, as outlined in its Agenda 2030 and Unified Strategy Document (*Documento Strategico Unitario – DSU)*[8]. Yet, these approaches to innovation can be very challenging to the government departments, institutions and individuals tasked with designing and implementing innovation policies. There may be a lack of capability, expertise or technical knowledge to design appropriate social or environmental programming. Building innovation within the public sector can help address these shortcomings, as can encouraging stronger partnerships between the public sector, the private sector and civil society (Mazzucato, 2018[34]). It can also mean building the capacity and comfort level within the public sector to be more open to exploration, experimentation, and learning-by-doing (Mazzucato, 2018[34]).

Box 3.4. Inclusive and mission-oriented innovation

The debate about inclusive and mission oriented innovation is a response to the conventional views of innovation that understand development to refer mainly to economic growth, thereby excluding its social and economic dimensions.

Inclusive innovation views development in terms of active inclusion of those groups that are currently marginalised. Depending on the issue at stake, this can refer to women, youth, the disabled, ethnic minorities, 'the poor', etc. Innovation initiatives can be inclusive in terms of the process by which they are achieved, and inclusive in terms of the problems and the solutions that they address.

Mission-oriented innovation is closely related to inclusive innovation. It stresses the importance of directionality. The policy debate about the directionality of growth and innovation should involve a wide array of public and private stakeholders, each contributing to a set of questions, including:

- What are the key challenges facing society?
- How can concrete missions help solve those challenges?
- How can the missions be best designed to enable participation across different actors and levels?

As such, innovation missions should have societal relevance, for example in the ability to improve the living environment, health outcomes or contribute to poverty reduction. This implies that missions should be defined broadly enough to engage the public and attract cross-sectoral investment and participation, and yet remain targeted enough to involve industry and achieve measurable success.

Source: (Mazzucato, 2018[34]; Heeks et al., 2013[33])

Generating more innovative approaches to innovation policy could help Piedmont address the current challenge of a narrow approach to innovation policy implementation (e.g. through cluster management organisations which themselves frequently take a narrow approach) and broaden the basis for strategic action (Marques, P., 2020[2]). This may be more easily said than done given public sector dynamics, particularly a need to respond to internal (e.g. election cycles) and external pressures (e.g. interest groups), and overcome the inertia that can settle over large public organisations. The INFUSE project in Cardiff, Wales (United Kingdom) offers an example of how to address this challenge. The project is based on experimentation, on improving the skills of public sector employees and on building monitoring mechanisms that help policy makers learn from experience. It could be a useful reference as Piedmont works to solve structural issues such as lack of skills, or low productivity among small and micro firms.

There is a second dimension to public sector innovation that merits consideration as Piedmont rethinks its approach to innovation policy. An OECD/Bloomberg Philanthropies study on innovation capacities, innovation goals and innovation strategies at the city-government level[9] points to evidence that cities with higher public sector innovation capacity tend to rate higher in terms of city satisfaction among residents, and exhibit stronger outcomes in a number of OECD well-being dimensions (e.g. safety and education). Furthermore, the cities themselves indicate that innovation contributes to improving service delivery and internal efficiency (OECD, 2019[35]). Encouraging cities within Piedmont to develop their own innovation strategies, and supporting their design and implementation through the region's innovation policy could contribute to further building the attractiveness of the region for investment and households that may be considering moving to the area, and contribute to addressing some of the demographic challenges.

Finally, Piedmont could also make better use of potentially underused policy levers – introducing more innovative working methods into public sector practices, for example using innovative public procurement to encourage innovation in micro and small firms. Redirecting procurement funds to achieve specific goals,

such as increasing innovation capabilities within targeted firms, or encouraging economic diversification is one of the most efficient ways to ensure that public funds are mobilised to achieve strategic development goals (Uyarra et al., 2020[36]). Public procurement allows the state to become a lead buyer by demanding a certain type of good and service that pushes suppliers to innovate and develop new capabilities. It can also be used to support technological development at a stage when firms might struggle to attract private funding, a problem that is salient in Piedmont (OECD, 2020[19]). It can also serve to enforce or diffuse product standards, which facilitates adoption and diffusion of new technologies and raises quality standards (Marques, P., 2020[2]).

Public procurement is a challenging process, since it demands a skill set in the public sector that is not always available. Innovative public procurement must include some level of technical sophistication, both in the writing of calls and in their evaluation, rather than a simple method of selecting the cheapest bid. It also poses challenges regarding transparency and the avoidance of conflict of interest, since this type of procurement is usually preceded by conversations between the public sector and private firms, with a view to preparing the potential suppliers for the bid's technical requirements (Uyarra et al., 2020[36]). Innovative public procurement is equally challenging from a technological point of view, especially when the goal is to deal with problems that are not clearly understood, when the technology that is being bought is not yet mature and therefore requires further development, or when there is no consensus as to which solution is the best to deal with a problem. An example of the latter are strategies to address climate change, and the debates that exist about how to reduce CO_2 emissions. Though a holistic take on this matter might suggest that governments need to implement a variety of initiatives in coordination, the reality is that each has a set of potential risks and rewards, and governments tend to favour some over the others. Nonetheless, considering its potential, innovative public procurement is a line of action that Piedmont should pursue, and for which it could rely on support from the European Union. This was the case in Galicia, Spain (Box 3.5), which undertook innovative public procurement in the health sector. This is particularly relevant to Piedmont as it prepares to build the Health City in Turin (European Commission, 2020[37]).

Box 3.5. Public Procurement in Galicia, Spain

The region of Galicia in Spain is a good example of the potential of innovative public procurement (IPP). After the economic crisis of 2009, under worsening financial conditions, the Galician government needed to search for new processes and partnerships to ensure its ageing population received adequate care. A health innovation platform was created to find solutions to these challenges.

By leveraging financial resources from the European Technology Fund 2007-20013, the health innovation platform launched two projects in 2011, worth EUR 90 million, with the aim of developing services for elderly care among local firms. It required that firms follow international health standards, so that these innovations could later be sold to other health service providers. Before launching the public procurement calls, the platform reached out to local suppliers to learn about their innovation ideas for elderly care. This allowed the public sector to refine the technical specifications of the calls and to prepare a document that gave the private sector advanced warning of what was going to be required, and give them sufficient time to prepare proposals.

At the early stage, a large proportion of contracts were awarded to SMEs, and more than half the contracts involved Galician firms. Of these, a significant number later received contracts from other regional governments. The IPP initiative allowed the regional government to strengthen the innovation ecosystem in the area of health, and to support innovation initiatives in other sectors.

The success of the IPP initiative also generated interest from universities and other public authorities and encouraged the creation of new formal and informal networks.

Source: (Marques, P., 2020[2]; Uyarra et al., 2020[36])

Initiatives that can improve the effectiveness of innovation policy are likely to require a more innovative public sector, one capable of training staff to monitor the implementation of innovation tools, and able to adopt complex (but potentially very beneficial) implementation instruments, such as innovative public procurement. Piedmont's public sector has accumulated a significant level of knowledge and experience, which should be fully utilised and also expanded.

Promoting the region's unique competences and knowledge sources to attract investment

A further policy consideration is to attract investment partners by strongly promoting the region based on its unique competences and knowledge resources. Currently, these include Piedmont's specialisation in a number of innovative manufacturing sectors (e.g. mechatronics), and in health and life sciences, supported for example by the upcoming City of Health (Delponte, L., E. Sirtori, 2018[5]). This could encourage foreign firms to invest in Piedmont based on an interest in engaging with local firms, thereby increasing the likelihood that foreign direct investment (FDI) has a larger impact on local innovation. Success, however, rests with the region's ability to clearly demonstrate its strengths, using data and data-based evidence, and identify which organisations (firms, universities and others) offer the highest innovation capacities (Marques, P., 2020[2]).

Adopting a strategic approach will be necessary to optimise resources. This means targeting FDI attraction efforts to those sectors or economic areas where Piedmont has demonstrated unique knowledge resources. Such an effort could be supported by a technological diagnostic of the region (Balland et al., 2018[38]), which could help firms, particularly SMEs incorporate innovation into their development strategies. This could help the region identify current specialisations and use those with a high degree of complexity to build networks across them. This may require specific incentives, particularly since the

funding disbursed through clusters is already focused on building greater coordination and collaboration. However, the government could use funding opportunities to foster networks and greater collaboration in areas of complex specialisation among firms that are not active in clusters, or in areas where collaboration is limited, such as cross-sector collaboration, collaboration among universities and third-sector parties or with micro and smaller firms (Marques, P., 2020[2]).

Spending time to identify new, related sectors, currently not in the region but in which there is potential to generate investment could also help attract investment. Chapter 4 of this report presents the Complexity/Relatedness Matrix, which is a framework that can contribute to identifying technological opportunities for the region based on the relatedness density and knowledge complexity of individual technologies. It can also be used to advance economic diversification efforts. Stakeholder consultation should support the identification of new areas in a process similar to the entrepreneurial discovery process. By mapping its technological strengths, the region could use them to target foreign investors interested in the region's unique knowledge resources and guide its efforts to attract FDI to these strengths (Marques, P., 2020[2]).

Better supporting innovation among the "S" in SMEs to boost productivity and innovation capabilities

As highlighted in Chapter 2, Piedmont suffers from decreasing productivity and many SMEs struggle with weak performance. Raising productivity levels is a strategic development challenge facing Piedmont, and will be key to its successful industrial transition. Given that SMEs form a significant proportion of the region's enterprise fabric, supporting greater productivity, including through innovation, should be a cornerstone – not only of Piedmont's approach to regional development – but also to its innovation policy. Special attention will need to be given to small and micro enterprises.

Piedmont's SMEs, and particularly its small firms, appear to only be capturing a limited amount of value-added from the value chains to which they belong (OECD, 2020[19]). There are a number of factors behind this. Their small size and lack of innovation are two. Yet another factor is SMEs' limited opportunity to move up the value chain for higher reward given how large firms manage the relationship with small-firm suppliers. Cluster members are generally better integrated in local and international value chains (OECD, 2020[19]), one indicator of their better relative performance compared to non-cluster member firms (Marques, P., 2020[2]). To address this issue, cluster membership would need to increase.

Piedmont's firms, including micro-enterprises, could substantially improve productivity by adopting knowledge or technologies that have already been generated. They could also benefit from building managerial and organisational practices in local businesses to manage and accumulate knowledge and organise the business routines needed for innovation. For example, target setting, or quality management and monitoring, are key activities to manage innovation projects across different sectors. During the COVID-19 pandemic, many businesses were forced to reconsider and adapt how they did business, for example, by embracing e-commerce and adjusting their businesses to incorporate e-commerce models (e.g. click and collect) (OECD, 2020[19]). Innovation policy in Piedmont needs clearer support for building productivity through non-R&D focused innovation, and for building the capacity of small, and even micro enterprises to recognise innovation opportunities rather than discard them as irrelevant to their businesses.

Using innovation policy to strengthen value chains

Attention to value chains is also important for building productivity among the smaller firms. How multinational or large firms govern interactions within their value chains strongly affects the business strategies of supplier firms, including with respect to technological development and innovation (Gereffi, Humphrey and Sturgeon, 2005[39]; Marques, P., 2020[2]). When large firms do not or no longer push innovative behaviour from their suppliers it can generate a disincentive on the part of smaller, supplier firms to innovate or generate new knowledge. The result can be limited upgrading. Upgrading occurs when

a firm in a supply chain begins to provide a wider range of goods and services (product and process upgrading) or when it starts supplying higher value-added services (functional upgrading), such as engineering or design, or developing its own brand (Marques, P., 2020[2]). While product and process upgrading can result from a lead firm demanding that suppliers take on more responsibilities, functional upgrading, often considered the more desirable form, happens in a more limited fashion, as it depends on firms acquiring unique knowledge resources. This can lead some SMEs to downgrade their value chain position, for instance by supplying a more limited range of goods and services that carry less risk (Blažek, 2015[40]; Marques, P., 2020[2]).

In recent years, the automotive sector, a stalwart of Piedmont's industrial fabric, has focused on cost-cutting and making supply chains leaner, which means that suppliers have not been actively encouraged to innovate or focus on developing unique knowledge skills. This may explain why it appears that Piedmont's micro and small firms may be appropriating only a small share of the value in the value chains to which they belong: they are choosing to remain in a lower tier and avoid taking on too much risk (OECD, 2020[19]). This may be coherent as a strategy for an individual company. Yet, if too many firms adopt such a strategy, it could negatively affect aggregate productivity within a region or a country. Innovation policy in Piedmont should fully consider the region's value chains, their composition, strengths and weaknesses, in order to help firms in industries that have been targeted for support to overcome the challenges.

One approach to the value chain challenge as it affects productivity is to encourage the development of mutually beneficial relationships between multi-nationals and the region's SMEs. When a region has unique knowledge resources, multi-nationals are more likely to invest in order to engage with local firms or universities, rather than to exploit lower factor costs, such as labour (Crescenzi, Pietrobelli and Rabellotti, 2013[41]; Marques, P., 2020[2]). Flipped around, this concept indicates that when a smaller firm already has the ability to access, integrate and exploit knowledge, it is more likely to benefit from engagement with large multi-national firms. *Centro Estero Internazionalizzazione Piemonte* (CEIP), Piedmont's agency dedicated to internationalisation, could play a strong role in bringing the parties together and working with clusters to nurture such relationships. Success, however, may depend on mechanisms to encourage stronger coordination and collaboration between CEIP and innovation actors, such as the cluster management organisations (OECD, 2020[19]).

Raising innovation capabilities within small (and micro) firms

It will be important not only to improve innovation capabilities among micro and small firms that are already innovating, but also among those that are not. Piedmont's cluster management organisations are a strong lever for this, and their role is extensively explored in Chapter 4. At the same time, networks among smaller firms should be nurtured. This could be done through a series of coordinated activities that help build qualified expertise (human capital) within the firms, and also by increasing the skills of individuals who are already employed. For example, the government could incorporate into its policy programming university-student placement schemes in which the government works with small firms to identify skills needs and matches them with recent university graduates who want practical work experience. Placement schemes could come with fiscal or other incentives to encourage firms to participate in them. This would extend Piedmont's apprenticeship programme, already in place with large firms (OECD, 2019[42]). The United Kingdom's Knowledge Transfer Partnership (KTP) is an example of such a programme, as is the Danish innovation pilot in rural districts (Box 3.6). Aspects of these placement or apprenticeship programmes could be adapted to Piedmont's context, for example, by permitting only SMEs (with a special emphasis on micro-firms) to participate. This would be reasonable given Piedmont's existing apprenticeship programme with large firms.

Box 3.6. University-student placement schemes in Denmark and the United Kingdom

The UK's Knowledge Transfer Partnership

Knowledge Transfer Partnerships (KTPs) are programmes partly funded by the government of the United Kingdom that help firms gain access to knowledge, expertise and resources available in universities. Core to the KTPs are tripartite agreements among a business (or a non-profit organisation), a university and a student. The placement of the student can last between 12 and 36 months, and is subsidised by the state. The KTP initiative, which has existed for over 40 years, involves graduates working on projects identified as central to a company's future commercial development. Whereas an SME has to cover one-third of the costs related to the placement, a large firm has to cover half. The KTPs also involve training for the students before their placement. This helps the student implement the specific projects, drawing on the expertise of the academics involved in the KTPs, and facilitating knowledge transfer, under the supervision of, and with input from, company staff.

The Danish Innovation Pilot in Rural Districts

The Innovation Pilot in rural districts is an initiative launched by Denmark's Innovation Fund. It allows firms located in rural areas with an idea for a particular innovation (e.g. the development of new products, services, or production methods) to apply for funding to hire a university graduate for up to two years. The graduate, whose education profile must differ significantly from the education profiles of the company's staff, must play a key role in creating and developing the innovation project. In addition, the participating firms are required to grant the graduates a certain level of autonomy in managing the innovation project to ensure it benefits both parties involved.

Source: (Jones-Evans, n.d.[43]; Innovation Fund Denmark, n.d.[44])

Piedmont could prioritise innovation funding for projects that promote cross-sector activity and economic diversification, such as digitalisation tools for agro-food companies, or biotechnology solutions for the chemical industry. The overall aim is to ensure the new innovation policy includes guidance or support for helping (smaller) private sector firms attract qualified candidates with tertiary education, and to help foster a closer relationship between universities and the private sector in the innovation space (Marques, P., 2020[2]).

Piedmont's future innovation policy could also support placing researchers in firms for a given period of time (e.g. six months) in order to identify the firm's innovation strengthens and needs. In Spain, the Basque Country's technological centre Tecnalia, has implemented such an approach. Here, a firm hosts a researcher from a technological centre that is tasked with identifying latent opportunities for innovation within the company. The company might not be aware of the opportunity or might not know how to capitalise on it. Piedmont could consider piloting this model with university researchers or others in research institutes. The placement could be subsidised by the public sector with the requirement that the main technological breakthroughs or solutions not be protected by strong intellectual property rights but rather be disseminated to other companies that could also benefit from them.

Better supporting cross-regional collaboration would also be important in the next innovation policy (and S3), both to build innovation among SMEs and to increase institutional thickness. To boost cross-regional collaboration in S3, the European Commission announced a EUR 500 million Interregional Innovative Investment programme. Piedmont could take advantage of this funding opportunity by coordinating with regions that have a similar industrial structure. Such coordination could encourage Piedmont's SMEs to work together in order to ensure that the value-added generated in the value chain(s) is more evenly distributed among them, and avoid arms-length behaviour by multi-nationals. Cross-regional S3

cooperation could also support further internationalisation of local firms. There are two broad, common constraints faced by SMEs, including those in Piedmont, when they seek to internationalise: financial support and general business advice on finding appropriate international partners, marketing strategies, market prospecting, networking, etc. (Abel-Koch et al., 2018[45]). Piedmont could begin to address the first by expanding lines of credit provided by Finpiemonte for internationalisation activities. For the second, the CEIP could further develop or be further encouraged to develop its innovation-related advisory services. Alternatively, a one-stop-shop for all business activities related to innovation could be established. Collaborating with Agenzia ICE, the Italian trade and investment agency, could be valuable in order to create vertical (national and regional) synergies in activities undertaken, benefit from cross-border collaboration (e.g. with other Italian regions) that might arise from networking, access to external partners, clients, etc.

Making the most of Piedmont's Istituti Tecnici Superiori to address a skill deficit

In 2010, the national government introduced a policy of *Istituti Tecnici Superiori* (ITS) to restart vocational education in Italy, which was strong until the 1970s, and then was abandoned in favour of tertiary education. By law, according to the 2010 policy, at least 50% of ITS teachers must come from the private sector, and the training includes student placements. Within this national framework, Piedmont successfully introduced a regional ITS system of seven ITS centres that focus on the six technological areas within the national framework[10] and roughly correspond to Piedmont's S3 and cluster specialisations, with the goal of better integrating skills training and innovation. The seventh is focused on tourism. The ITS are considered pivotal for dealing with the structural problem of low skills and skills mismatches. The latter is achieved primarily by involving firms in the design and delivery of courses, to make sure that skills are well-aligned with industry needs (Marques, P., 2020[2]). ITS are undeniably successful at student placement. Most ITS administrators report at least 80% of students employed within one year after finishing their degrees, with some reporting up to 98% (prior to the COVID-19 pandemic) (OECD, 2020[19]). Yet, Piedmont is grappling with a skill deficit, and the number of students completing ITS-offered training is insufficient to reduce it. In addition, the ITS focuses on youth entering the job market, but this misses the opportunity to also provide reskilling or life-long learning for workers already in the workforce. Furthermore, the ITS do not themselves promote an integrated or multi-disciplinary approach to studies, which limits the development of a "reflex" to multi-disciplinary or cross-sector problem solving when the students finish their studies and enter the workforce.

ITS administrators work hard to attract more students. This has paid off as the number of students enrolled in ITS programmes continues to grow. Yet, the total number of graduates remains relatively low. Optimising what the ITS can offer in terms of skills and training could help address the low skill level of Piedmont's youth who are not enrolled in a university, which is considered a structural problem (OECD, 2020[19]). Doing so would mean overcoming at least three constraints. First, there is a constraint in terms of enrolment. This is due, at least in part, to a general public bias against vocational education training (VET), and a preference to ensure students enrol in a university. While there may be many, individual reasons for such a bias, in general there appears to be a lack of knowledge and understanding about the nature and value of VET. This limits the ability of ITS to attract quality students. Second, the ITS face a financial constraint: their budgets are renewed annually. The lack of multi-annual budget visibility makes it very difficult for them to plan for even the medium-term, and it is considered a fundamental constraint by ITS administrators (OECD, 2020[19]). Finally, the ITS focus on youth, and training young people to enter the job market. This is a crucial contribution to the region, but does not address the lack of skills in the existing workforce. Adding a focus on life-long learning, continuous training and reskilling for established workers could help boost the skill level of Piedmont's current labour force.

Making the most out of the ITS

In the next innovation policy, strengthening the ITS, and helping them grow, will be important. Identifying ways to stabilise their funding would be a first step. ITS are financed by grants from the Ministry of Education, the European Social Fund (ESF) and some private sector financing. While more funds are always welcome in education, it may be less of a question of increasing the financing levels, and more a question of finding ways to establish multi-annual budgets. Even if they had two years of budget visibility, this could already make a large difference. If this is not possible to do for all seven ITS at once, it may be possible to pilot a new budgeting approach with one or two to determine the impact. More effective budgeting practices alone will not attract more students, however. There will need to be an effort placed on changing perceptions regarding the value of VET and the employment opportunities for those who graduate from these training programmes. Investing in a targeted communication campaign designed by – or with input from – the ITS, students and teachers, and supported by the regional government would be valuable. The ITS could also work with social enterprises to attract "difficult-to-reach" and/or often marginalised or disadvantaged groups. Finally, it will be important to encourage ITS to collaborate with each other. This would serve at least three purposes. First, it could prompt ITS to share resources that can alleviate financing shortfalls. Second, it could show students how the different industries or fields are linked, thus helping to build greater integration within the innovation space in the future. Finally, it can also contribute to fostering a culture of collaboration and trust among students, which over time could hopefully spill over into the regional fabric, and building trust within the region in the process.

ITS are already contributing to improving the skill level in Piedmont, but they could do more, particularly by training people who are already in the labour force. Thus, ITS could offer life-long learning courses to help workers refresh existing skills or acquire news ones in key areas, such as digitalisation and industry 4.0, for example. Given the region's challenges with its unemployment rates, and the additional strain on employment (and the economy) arising from the COVID-19 pandemic, the region could consider working with the ITS to offer courses to individuals who have lost their jobs due to the crisis. Ideally, this can help workers prepare to re-enter the labour market with upgraded skills that would make it easier to find employment, and help firms by making it easier to find employees with work experience and relevant skills.

Generating a more integrated regional innovation system: from innovation environment to innovation ecosystem

Piedmont's current innovation environment is characterised by significant number of organisations, including private firms, public sector entities, public-private agencies, such as the seven clusters (*Poli di innovazione*), private foundations, and others. These organisations operate in a region with a long tradition of manufacturing and which has a history of pioneering key Italian industries, despite the current context of economic stagnation. The most well-known example is the automobile company FIAT, headquartered in the Turin area. Yet, the region is also the birthplace of the Italian chemical industry in Novara, and home to Olivetti, born in the city of Ivrea. In the 1950s, Olivetti was the largest typewriter company in the world, and it pioneered the production of electronic calculators as well. This explains why Piedmont continues to host several high-performing economic sectors, including in the production of intermediate outputs, such as advanced packaging or medical devices (Delponte, L., E. Sirtori, 2018[5]). While Piedmont has a rich innovation environment, measured in terms of the number of organisations that exist and the scope of their activities, there is a relatively weak innovation ecosystem. This means that the activities of these organisations are undertaken in parallel to each other, notwithstanding a few important exceptions, rather than in an integrated or coordinated fashion. The lack of coordination among these actors is likely affecting their ability to have a greater impact on the region (Marques, P., 2020[2]).

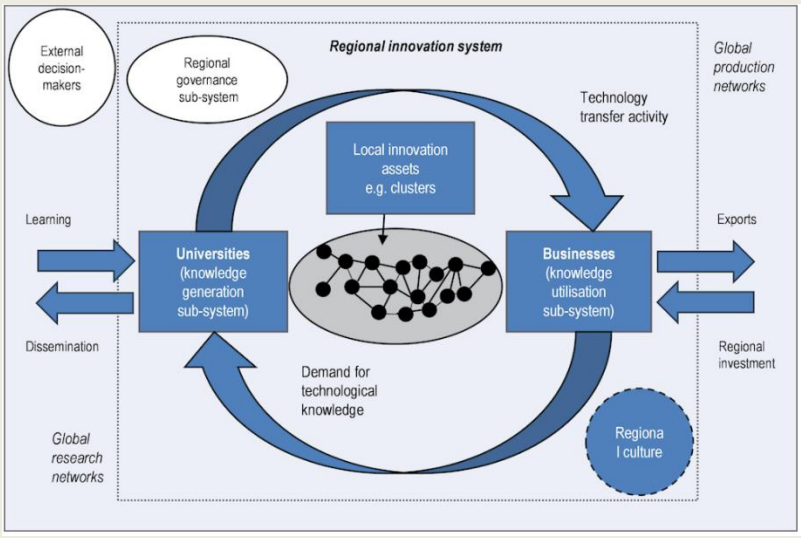
One challenge for Piedmont's next innovation policy is to generate greater integration within the innovation space – to move from an innovation environment to an innovation ecosystem (Box 3.7). Doing so will mean

expanding its approach to policy implementation, and reinforcing coordination mechanisms among innovation actors. Piedmont's current innovation policy relies heavily on cluster organisations for its implementation. The way in which these organisations have been functioning in the 2014-2020 EU Programming Period presents an obstacle for the development of an innovation ecosystem and for generating institutional thickness. They have been narrowly focused in their areas of specialisation and limited in terms of their reach, particularly in terms of their membership and the support services they provide. Overcoming this may require encouraging a more integrated perspective of the specialisation areas, adopting a broader definition to what constitutes innovation within their specialisations, identifying complementarities and encouraging ways for cluster management organisations to work together, and ensuring that they expand their membership base (see Chapter 4). In addition, it could also mean reinforcing the role of other innovation actors as contributors to the innovation ecosystem. Innovation stakeholders in the region have expressed a desire for greater integration, which is a strong step towards building stronger networks within – and beyond – each cluster (OECD, 2020[19]) and generating greater institutional thickness.

Box 3.7. Regional innovation systems: innovation environments or ecosystems

A regional innovation system (RIS) is a complex combination of multi-level considerations (global, national, regional and local) and the interests and objectives of very different actors (public sector, private sector, investors, firms, academia, higher education institutes, civil society organisations, etc.). Evaluating an RIS means mapping the system and its actors, understanding interactions and relationships, and identifying how policy measures can improve these interactions with the recognition that it is a dynamic and not static process. The RIS concept assumes that regional innovation performance increases through more knowledge intensive interactions among partners (Figure 3.3). Each component of an RIS serves a function in advancing innovation in a region. The system works as an environment when its components are less integrated (i.e. there is less of a network) – where each actor fulfils a particular role in its unique space, but does not contribute to the system as a whole. The more networked (i.e. integrated and dynamic) the components of the system are, the more it works as an ecosystem.

Figure 3.3. Regional innovation ecosystems



Source: (Benneworth and Dassen, 2011[46]; Cooke, 2005[47])

A future innovation policy that actively supports a more networked, integrated approach could also help overcome critical obstacles to innovation in the region, such as financing for start-ups and for technology-based firms. The lack of financing for these firms is perceived as an innovation barrier (OECD, 2020[19]) and may contribute to a competitive rather than cooperative, partnership-based approach among actors.

Linking innovation actors and activities

Innovation stakeholders in Piedmont, particularly cluster managers and the regional government, recognise that innovation actors and activities lack integration. Piedmont's cluster organisations do not actively seek to expand their networks. The result is an innovation environment that is rich and dense in its actors, generating its organisational thickness, but also highly fragmented, which contributes to the institutional thinness. This indicates that the necessary scale and critical mass (e.g. in human or financial resources) remain elusive as actors and initiatives focus on individual or unique objectives. System fragmentation can dilute resources and limit the capacity of the region to achieve innovation objectives. This is not an argument for a top-down, or highly controlled, approach to policy implementation – doing so can stifle creativity and innovation. Rather, it is a call for developing a toolbox of effective coordination mechanisms to ensure that actors and actions throughout the ecosystem work together rather than against each other, and contribute not only to their own organisational objectives but also to those established in the innovation policy and beyond.

Creating a single entry point to the regional innovation ecosystem

Creating a single entry point for regional innovation support, for example a website that provides an overview of all innovation support and financing activities offered in the region, can contribute to ensuring that the innovation ecosystem operates in a harmonious way. In Piedmont, the Torino Tech Map platform fills this need, but only for Turin and not for the entire region. The platform localises and describes all of the actors in Turin's high-tech start-up innovation ecosystem, including, investors, incubators, accelerators, training institutions, co-working spaces, associations and innovative start-ups. In addition, it offers training resources for start-ups and additional services such as dissemination of relevant, innovation-dedicated events (Comitato Torino Finanza, n.d.[48]). Another example is Scotland's Highlands and Islands Enterprise (north and west Scotland's economic and community development agency), which launched its "Innovate your Business" portal as a "go-to" place for businesses seeking specialist support and advice about their business ideas and potential opportunities (Scotland Highlands and Islands Enterprise, 2019[49]).

There are two courses of action that could be taken with respect to a single point of entry portal. First, expanding the Torino Tech Map platform in order to cover the region is one option. While one could create a new portal for the rest of the region, this would serve to increase the system's fragmentation rather than reduce it. Here, the Silicon Europe platform could serve as an example. Ten European clusters that represent over 2 000 firms collaborate to promote the network and its members internationally, facilitate the transfer of knowledge and technologies between the cluster members and promote available R&D results for better commercial use (Silicon Europe Alliance, n.d.[50]). Another example comes from the Noord-Brabant Region in the Netherlands. The Brainport Eindhoven platform provides information about the associated universities and firms, and lists job vacancies. It also presents the particular societal challenges it seeks to address through collaboration between government, civil society, the private sector and academia, and provides information on the attractiveness of the region, both in terms of professional opportunities and quality of life (Brainport Eindhoven, n.d.[51]). The second course of action is to establish a portal for the region that distinguishes between start-ups/entrepreneurs and interested investors and risk capital players. Such a portal could offer an overview of all existing innovation support and services available regardless of whether the actor is a tech start-up or not. It could also provide a free digital business diagnostic as a means to encourage businesses incentivised to make use of existing support offers. The diagnostic tool could lead to tailor-made suggestions for further advice or training and provide relevant links (OECD, 2020[52]).

Creating regional innovation platforms around existing strategic themes

Innovation platforms can bring together different stakeholders to identify solutions to common problems or to achieve common goals. They ensure that different interests are taken into account, and various groups contribute to finding solutions. Innovation platforms are particularly useful at a regional and local level because they provide a space for learning and exchange on complex themes. They can be used to explore strategies that can boost productivity, manage natural resources, improve value chains, and adapt to climate change. Some innovation platforms focus on single issues, others deal with multiple topics (OECD, 2020[22]).

In Piedmont, a thematically-oriented regional innovation platform could be designed to connect different stakeholders (e.g. universities, the private sector, and public institutions) and enable a continuous dialogue among them. There are already examples of such platforms being used in other Italian regions, for instance the Open Innovation Platform of the Lombardy Region, the Emilia-Romagna Open Innovation platform, and Open Innovation Campania. The experience of Tampere in Finland is also relevant. The region became a Nokia-led global ICT hub from the 1990s to the early 2010s. With the closure of Nokia's research facility, Tampere needed to modify its innovation model to retain the highly skilled workforce in the region and to maintain its image as a dynamic and innovative place. With the aim of transitioning from its regional cluster policy, based on the dominance of a large company, into an entrepreneurial ecosystem of innovative technological start-ups, Tampere's Open Innovation Platform (OIP) was launched (OECD, 2020[22]). This initiative funds and supports a variety of platforms that stimulate students, firms, and citizens to interact, experiment and co-create new businesses, innovations and services. This support aims to lead to processes that can survive without public funding or which can be co-financed on a PPP-basis. Stakeholders include municipal governments, research organisations, development agencies, firms, public administration organisations and higher education institutions (HEIs). This initiative was launched in 2013, and by 2015 it had 500 people active with programmes and projects, 180 companies and organisations involved. One platform generated more than 100 start-ups and attracted EUR 18 million in funding for start-ups and innovators (Interreg Europe, n.d.[53]). At the same time, the ad hoc and bottom-up approach of the initiatives, such as Tampere's OIP, may not always be compatible with national or international funding mechanisms that support innovation practices. Depending on the regional ecosystem, the OIP approach could be adopted to stimulate bottom-up innovation within existing economic or industry clusters. It could also operate in parallel to them, allowing for innovation in areas that are not currently covered by the different clusters. Facilitating the participation of individual citizens and community organisations in the OIPs can also facilitate inclusive innovation that aims to meet more social and environmental needs.

In order to promote greater diversification and integration, these platforms should be based on broader transversal themes already relevant and present in the region, rather than on specific industrial sectors. At the same time, they need to be future oriented, i.e. based on identified future societal, technological, and business trajectories. Thematic platforms oriented around the circular economy, design and digitalisation, and sustainable mobility would fulfil these two criteria for Piedmont, as they combine actors with various expertise from different industries already based in the region. There is certainly a role for Piedmont's innovation clusters in these innovation platforms, and cluster organisations could be responsible for coordinating or leading them. However, the platform should connect many actors beyond cluster organisation members, including those that may appear to be unrelated to the platform's theme. This could result in unorthodox combinations of knowledge, competencies, and other resources coming together to generate new regional combinations of knowledge. The membership of an innovation platform may change over time as needs arise, and the platform may invite new members to join. For example, a platform focusing on agriculture may invite a company with expertise in water to join if this emerges as a key issue in farm production. It is important to take a long-term perspective when considering innovation platforms, as engaging actors and developing relationships requires time and investment, as well as policy support.

Filling a leadership void with a regional innovation coordination body

Effective coordination of the different organisations and individuals contributing to innovation in Piedmont is considered among the most fundamental of challenges in the region's innovation system (OECD, 2020[19]). This means ensuring the coordination of activities among existing public organisations (e.g. clusters, CEIP, Finpiemonte, etc.), and managing collaborative initiatives among the wide array of innovation stakeholders (e.g. universities, private bank foundations, business associations and others). It is fundamental for an integrated regional innovation system, and should be one of the objectives for regional innovation policy in Piedmont (OECD, 2020[19]).

Innovation ecosystem coordination is usually undertaken by an innovation ecosystem leader (Dedehayir, Mäkinen and Roland Ortt, 2018[54]). The role of an innovation ecosystem leader is primarily to engage in governance-related actions, including to shape the role of other actors and coordinate their interactions (Dedehayir, Mäkinen and Roland Ortt, 2018[54]). This role is currently vacant in Piedmont's regional innovation ecosystem. Some experts attribute this void to the labour force reductions at Fiat (now Stellantis), which leaves it unable to play the leadership role it has in the past, particularly vis-à-vis other firms and public sector bodies such as universities. In addition, Fiat itself may be limiting its role in promoting innovation, for example by not incorporating an innovation dimension into its local procurement strategy. If this is the case, it can limit the incentive for suppliers to develop more complex innovation capabilities. The innovation cluster organisations have not been able to fill the horizontal coordination vacuum left by Fiat. Individually they are too small and narrowly focused to catalyse and accelerate the performance of the entire innovation ecosystem. While taking on this leadership role has not been part of the mandate of cluster organisations, given their importance in implementing Piedmont's innovation policy, proactively stepping in, at least partially, could have been valuable. To move innovation performance to the next level through the upcoming policy, Piedmont will need to give additional thought to the mechanisms that could coordinate and integrate innovation activities among the region's extensive set of innovation actors (e.g. firms and other private sector actors, the public sector, universities, non-profit organisations, social organisations, etc.) (Marques, P., 2020[2]), as well as the resources necessary to sustain such mechanisms and innovation performance itself.

A regional coordination body that is not associated with a specific industrial sector may provide stronger and more sustained leadership within the ecosystem and an individual firm, regardless of its size. It could function as a coordination hub for the activities of existing public organisations (including cluster organisations, CEIP, Finpiemonte, etc.), and manage collaborations with the universities, private bank foundations, business representatives and other stakeholders. In addition, such a body could support policy implementation across the different productive sectors and with different types or categories of firms and actors. Overall, such a body can serve a number of purposes, including to:

- Bridge the strategic aims of the innovation policy and the practical activities of innovation actors, including clusters, and private sector entities.
- Advise regional decision makers on innovation policy design, implementation and performance measurement.
- Actively support the regional-level implementation of national level innovation-supporting policies.

There are a number of forms that this type of coordination mechanism can take, ranging from a broad coordination body, such as a regional development agency (RDA), to a regional innovation agency (RIA), to something "lighter in touch", for example a regional innovation council. These are not mutually exclusive options, and one model is not necessarily better than another. Regardless of the model, however, the activities undertaken by the ecosystem leader should include building relationship-specific assets and inter-organisational trust while forging partnerships, including with new actors that join the innovation ecosystem.

Consider establishing a regional development agency

Currently, regional development agencies (RDAs) are growing in popularity and can play a strong role in supporting policy implementation. However, establishing an RDA requires a clear political mandate, strong government support, sufficient resources (including time), and well aligned interests across government sectors. The focus of an RDA frequently includes innovation but is broader and can encompass regional development planning and implementation, urbanism and transport planning, competitiveness and enterprise growth, SME and business support, etc. RDAs are a good option to link distinct sector policies, such as innovation, with overall regional development policy and objectives. They can also be useful for supporting cross-sector policy coordination and implementation for regional development. However, given the more immediate need for effective coordination of Piedmont's innovation ecosystem and very real resource constraints, it may be better, for the moment, to consider the merits of a regional innovation agency or a regional council for science, technology and innovation.

Consider establishing a regional innovation agency

Regional innovation agencies (RIA) can be particularly effective innovation policy implementation mechanisms given their proximity to innovation actors, which gives them a good understanding of specific local situations. They can also be brokers, promoting and reinforcing regional partnerships and social capital among actors. In addition, because RIAs generally work alongside, rather than within, traditional regional government departments, they enjoy a degree of autonomy. Unlike an RDA, an RIA focuses exclusively on delivering innovation policy. Yet, similar to RDAs, they require political commitment, adequate resources and highly qualified staff (Prota, F., A. Fiore, and M.J. Grisorio, 2012[55]).

In France, Picardie's RIA and Transfers Languedoc-Roussillon (Transfers LR) in Occitanie can serve as examples. The former, a RIA created in 2007, works to reinforce the ability of Picardie's businesses to detect and develop innovative approaches that can be integrated into their activities, in collaboration with other innovation support actors. Funded by the EU, and by the national and regional governments, the agency intervenes at all stages of an innovation project. This includes helping firms apply for EU funding. One of the agency's main activities relates to the coordination of the Regional Innovation Network that convenes advisors and practitioners from a wide variety of organisations specialised in the field of business development and innovation and offers assistance for the creation of technology partnerships for innovation (European Commission, n.d.[56]). Transfers LR, in France's Occitanie region, provides the same services as Picardie's RIA, but also evaluates innovation projects and supports firms by conducting feasibility studies and market surveys (European Commission, n.d.[57]).

RIAs are often closely linked to the regional authority and are generally mandated to:

- Develop an innovation-friendly environment, particularly by creating operational networks between universities, research laboratories, technology centres and the productive sector
- Improve the region's knowledge base and support knowledge dissemination
- Assist in enterprise growth and encourage start-ups and spin-offs via innovation projects

There is no standard RIA model. They can differ depending on the region, the country, the institutional context, degrees of decentralisation, the region's sectoral specialisations and the presence of innovation actors (e.g. firms, clusters, universities, etc.). This said, as exemplified by the two French RIA's mentioned above, they share the common purpose of reinforcing the governance of a region's innovation ecosystem to ensure that innovation policy is effectively delivered. Furthermore, there is evidence that RIAs can help enhance regional innovation performance (Prota, F., A. Fiore, and M.J. Grisorio, 2012[55]).

When considering an RIA it is important to keep the following in mind (Morisson and Doussineau, 2019[58]):

- The private and public sectors must share the same vision for the RIA
- Establishing the RIA within the appropriate level of governance

- The RIA must have the legitimacy, credibility and capacity to mobilise the region's most important innovation actors within the private sector, public sector, academia and civil society, and manage political motivations
- The RIA should be able to monitor not only its RIS but also stay abreast of what is happening in successful RIS around the world, facilitating the identification of internal weaknesses and practical solutions on how to address them
- The RIA must have the mandate and capacity to coordinate many quadruple helices simultaneously, at varying levels of decision-making capacity, and in a wide range of areas, from identifying strategic priorities to implementing and evaluating policy

In theory, an RIA in Piedmont could help address problems of institutional thinness by generating and coordinating arrangements that reinforce the innovation network, bringing together the private sector, the public sector, higher education institutions, bank foundations and/or civil society, fostering cross-sector relationships, and building new relationships among existing actors. It could also serve to constantly monitor or scan the RIS for weaknesses, and identify how to address these and by whom before the risk to the system becomes too great. It would also be important that an RIA be tasked with the diversification of regional economic structures by encouraging the development of new sectors of economic activity that could add value to the regional economy and generate jobs.

As such, an RIA's value added would lie in various areas: in its ability to contribute to policy initiatives that encourage cross-sector cooperation, in expanding innovation stakeholder networks and cooperation, and in facilitating the emergence of new sectors of economic activity.

A new institution does not necessarily need to be founded. An RIA could be created within an existing body. One option would be to create a coordination body within Finpiemonte, for example, as it already has experience working with local firms and stakeholders in the innovation space. Doing so could mean expanding its mandate to include coordination of the innovation ecosystem, of course providing it with the resources (human, financial and infrastructure, if necessary) to do so. By expanding the scope and scale of Finepiemonte's activities (or those of another public institution), the risk of "agencification" is lower (Marques, P., 2020[2]).

Notwithstanding the above, creating an RIA or assigning similar tasks to an existing regional institution, might not be realistic due to financial, administrative or political constraints. In this case, the creation of an advisory innovation council could be a practical alternative.

Consider establishing a regional innovation council or council for science, technology, and innovation

Innovation councils can be national, regional, or even local, and help catalyse and coordinate regional innovation ecosystems. They are frequently structured as advisory bodies to government, composed of representatives from the public and private sector, investors, academia, researchers, and civil society. They can provide strategic guidance on the territory's science, technology, research and innovation needs to improve economic performance and competitiveness, and might also contribute to policy design, propose potential actions for policy implementation, and help establish relevant networks. This is the case with Spain's national Council of Science, Technology and Innovation Policy, and two different regional innovation councils in Greece. The national council in Spain focuses on improving the coordination of research and innovation policies between the national government and Spain's Autonomous Communities. It is responsible for developing the country's science and technology strategy and for prompting joint activities between the national and regional administrations in order to maintain a coherent scientific policy (European Commission, n.d.[59]). In Greece, the Innovation Council of Ipeiros is comprised of representatives from the regional and municipal governments, academia and different chambers of commerce, among other actors. It helps draft the Regional Strategy for Research and Innovation and

establishing a network of cooperation among the different relevant public and private stakeholders (European Commission, n.d.[60]). The innovation council of Thessalia region is also a relevant example, in particular with regard to its institutional structure. It is comprised of representatives from the public sector, academics and the private sector. To support the Council's work it created different thematic working groups on topics such as logistics, health services and the primary sector (European Commission, 2014[61]). There are also several examples of metropolitan areas that have created an advisory body to support local innovation. One example is the Amsterdam Economic Board, which convenes representatives from the Amsterdam municipal government, CEOs of major companies located in the metropolitan area, and deans of HEIs to identify and promote innovation opportunities and set (social) innovation targets, for example in the field of sustainable procurement (European Commission, n.d.[62]). Depending on how innovation councils are set up, they can give innovation stakeholders the chance to come together, identify common strategic goals, shape policy direction, and exchange knowledge, as well as contribute to impact evaluation, as is the case with the San Diego Innovation Council (San Diego Innovation Council, 2021[63]). There are many examples of national and regional innovation councils, however, very few cities have created similar advisory bodies.

When considering coordination mechanisms for innovation policy and the RIS overall, it is important to keep the objective of such mechanisms in mind. Merely establishing one or more coordination bodies does not guarantee the efficient coordination of innovation policy and innovation activities, nor should coordination bodies be considered a panacea. Too many bodies, for example, can add to the RIS complexity and amplify the fragmentation rather than reduce it. In sum, while an RDA might be more effective in linking innovation policies with regional development through its broader mandate than an RIA. Indeed, both require resources, strong cross-sector agreement and multi-stakeholder agreement, and a clear political mandate.

A regional innovation council for Piedmont may be just as relevant and effective. While these councils rely on institutional support in order to operate, for example with a technical secretariat, funding, and infrastructure, it could be a less resource-intensive and still effective coordination option for Piedmont. The value-added of a regional innovation council lies in its potential to provide strategic guidance, participation, advice and promotion of innovation in Piedmont. It can also provide strategic guidance on how innovation can contribute to dealing with grand societal challenges, such as global warming (Fagerberg and Hutschenreiter, 2020[64]).

In the medium to longer term, Piedmont may also wish to consider developing a suite of coordination mechanisms, as is the case in Spain's Basque Country (Box 3.8). Regardless of the model chosen, the effectiveness of the body will depend on having a clear mandate, adequate resources and a set of responsibilities clearly distinguished from those of the innovation clusters and other public agencies, including the regional government.

Box 3.8. Innovation policy coordination in the Basque Country, Spain

Similar to Piedmont, the Basque Country's regional government not only implements policies gear towards other administrative levels (mainly national and European), but also designs, finances and implements its own policies. Consequently, the Basque innovation system includes diverse actors of very different natures, which act as developers, implementers and beneficiaries of the regional innovation policy.

The region has established several coordination mechanisms to manage innovation complexity. Its main horizontal coordination mechanisms are:

- **The 2030 Science, Technology, and Innovation Plan**, which provides the smart specialisation strategy for the region. The plan tries to overcome a lack of coordination between regional government departments, which is one of the weaknesses of the Basque region. The plan is intended to coordinate the policies within different STI domains: (i) science policy, managed by the Department of Education; (ii) technology and R&D policy (including research policy in the energy domain), managed by the Department of Industry and its corresponding agency (i.e. the Society of Industrial Promotion and Restructuring); and (iii) research policy in the health domain, managed by the Department of Health. The Basque Innovation Agency (Innobasque) designed and implements the plan.
- **The Basque Innovation Agency (*Innobasque*)**, whose mission is to foster, in collaboration with other stakeholders, the development of innovation practices and policies. It assists the Basque government in the design, implementation and evaluation of science, technology and innovation policies. For this purpose, it observes and evaluates the Basque science, technology and innovation ecosystem and provides suggestions for its policies and instruments, it also provides training for public sector agents on how to create a more innovation-favourable environment. In particular, it focusses on contributing to increase the number of innovative organisations in the Basque Country, particularly SMEs.
- **The Basque Council for Science and Technology** (*Consejo Vasco de Ciencia y Tecnología*), which is a multi-level mechanism within the region. Its main mission is to ensure the necessary inter-departmental coordination from the definition and design of regional innovation policy to its implementation, including the distribution of the budget. The Council includes: a) representatives from the regional government and the three provincial councils, b) representatives from two of the main innovation-related regional agencies (Innobasque, the Basque Innovation Agency and Ikerbasque, the Basque Science Foundation), and c) representatives of the three Basque universities. Recently, the two technological corporations, Tecnalia and IK4, and four representative companies of private investment in R&D were added. The Council has a Scientific Advisory Committee, which functions as an advisory body to the Basque Council for Science, Technology and Innovation. This Committee is composed of ten professionals of recognised standing in the field of science, technology, research and innovation, who are designated by the President of the Basque Government.
- **The Society of Industrial Promotion and Restructuring** (*Sociedad para la Promoción y Reconversión Industrial, SPRI*). SPRI supports industrial and industrially related companies and research institutes to: (i) improve their innovation capacities, (ii) generate process innovations, and (iii) adopt organisational innovations. It provides tools for companies to obtain financing, apply new technologies, and adopt an international focus. SPRI is also charged with attracting and facilitating foreign investment. Currently, it helps Basque companies in eight strategic areas, including cybersecurity, internationalisation, entrepreneurship, and technology and to attract investment.

The example of the Basque country shows that a variety of coordination mechanisms may be necessary for managing the complexity of innovation policy.

Source: (Morgan, 2016[65]; OECD, 2011[66]; Morisson and Doussineau, 2019[58]; European Commission, n.d.[67])

Reinforcing the governance of innovation policy in Piedmont

Over the past 20 years, the increasing importance of EU regional policy, its instruments and financing resources have progressively strengthened the role of regional governments in shaping their region's development (Bellandi and Caloffi, 2016[68]), including through enterprise and innovation policy. At the same time, this has generated a need for even more effective multi-level governance systems to manage the complex, and mutually dependent relationships among multiple levels of government. In the Italian case, this matrix includes the EU, the national government, regional governments, provinces, metropolitan cities, and local authorities[11]. The previous section highlighted the primary governance challenge found within Piedmont's innovation ecosystem: the need for more effective coordination among actors and institutions. Consideration also needs to be given to how the region's multi-level governance system supports or advances decision-making with respect to Piedmont's S3 and innovation policy, their design and implementation.

When considering a multi-level governance system, in this case for innovation policy, there are three main areas to look at: the framework conditions (the structural and generally fixed parameters for action), the institutions (institutional context), and the governance practices, which when combined shape how policy decisions are made and implemented. In Piedmont, the largest challenges lie in the framework conditions surrounding innovation policy design and implementation. Challenges in the institutional context stem from national and regional concerns regarding quality of governance (QoG). Finally, perhaps among the most urgent practice to consider is the monitoring and evaluation of outcomes associated with innovation policy and initiatives. These various challenges are not insurmountable, but they can be difficult for the regional government to address on its own. At the same time, it is important for the government to identify the limitations and opportunities regarding where it can act to generate change and what it can influence.

Working within the established framework conditions

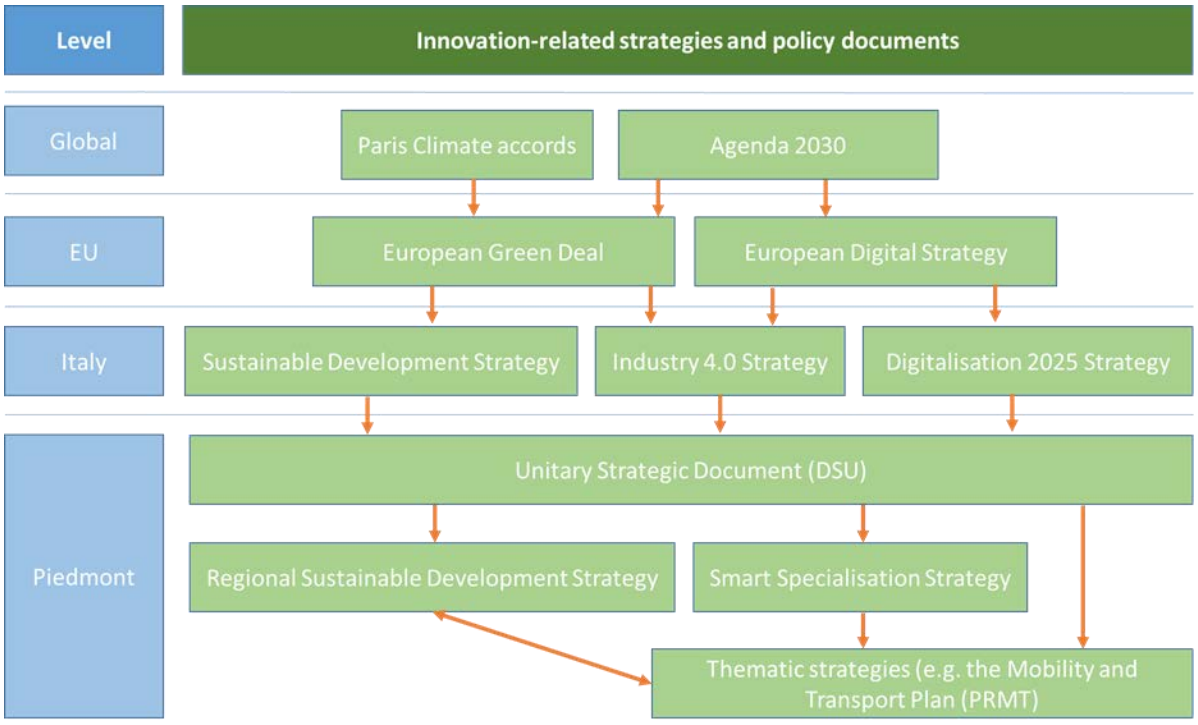
Piedmont's innovation system is governed by a series of externally established agreements, as well as strategic, regulatory and financing frameworks (e.g. the 2030 Agenda for Sustainable Development, the Paris Climate Accord, EU and national regulations and innovation financing mechanisms). Even though many of these fall outside the control of Piedmont's regional authorities, they condition its actions.

Working within multi-level strategic frameworks

Strategic frameworks represent both a strength and a governance challenge for Piedmont, which the regional government can influence with its upcoming S3 and innovation policy.

Each level of government in Italy, plus the EU, directly or indirectly contributes to Piedmont's innovation policy. Piedmont's innovation activities coexist with, and to a degree are embedded in, the Agenda 2030, European initiatives, and in national programmes managed by the Italian government (Figure 3.4). The 2030 Agenda for Sustainable Development and its 17 corresponding Sustainable Development Goals (SDGs) provide the umbrella for action at the global, European, national and regional levels. At the European level, the European Green Deal and the European Digital Strategy shape national and regional innovation strategies. Nationally, and regionally, Piedmont aims to meet similar but also uniquely Italian or Piemontese objectives. This places a complex set of demands on innovation policy, requiring effective multi-level governance. The strategic and framework documents are useful for coordinating the governance of innovation policy.

Figure 3.4. Overview of main global, national and regional innovation-related strategies and policy documents in Piedmont, 2021



Source: OECD elaboration

Piedmont's innovation policy is firmly linked to EU Cohesion Policy and the EU's S3 concept. This has the advantage of ensuring the policy benefits from Cohesion Policy financing. However, it has the disadvantage of placing the region's innovation activity within a relatively tight regulatory framework that can affect action and limit the activity of actors in the innovation space (see below). Both, the region's S3 and innovation policy should also help advance national level strategic objectives found in a variety of innovation-relevant strategies and plans, such as the National Sustainable Development Strategy, the National Plan for Industry 4.0 (*Industria 4.0)* and the upcoming Digital Innovation Strategy 2025. Piedmont does not lack in strategic frameworks to guide innovation, and these documents, for the most part, appear to be well aligned and complementary, at least on paper.

The strength of Piedmont's strategic frameworks as support to innovation policy lies in the regional government's initiatives to ensure that the multiple EU, national and regional strategic initiatives, including innovation policy, are linked to one another, and to articulate these links in an effort to identify strategic and cross-sector synergies. This is well developed in Piedmont's Unified Strategy Document (*Documento Strategico Unitario – DSU)*. The DSU outlines the region's development ambitions for the EU 2021-2027 Programming Period. It establishes the priority lines of intervention for development, and sets the strategic parameters within which the European funding resources will be used in the 2021-2027 Programming Period. It also, very importantly, highlights the synergies among the various strategic documents guiding the region's development initiatives financed by the EU (Box 3.9). It would be important to ensure that the type of dialogue between government actors that supported the DSU's development becomes an on-going cross-sector conversation.

Box 3.9. Linking different EU funding streams in a coherent regional strategy: the Unitary Strategic Document of Piedmont

The Unitary Strategic Document (DSU*)* is a programming document for the region of Piedmont for the EU funding period 2021-2027. The document lays out the regional planning and development vision and objectives, including territorial, economic and social development, and how different regional development tools can help achieve the region's development objectives. These tools include different regional strategies, such as the Regional Strategy for Sustainable Development, the regional Smart Specialisation Strategy (RIS3) and the regional Smart Mobility Plan. It also includes an assessment of how to make best use of the different EU financing streams for Piedmont. These include the Cohesion Fund Operational Programmes, notably the ERDF, the ESF and the European agricultural fund for rural development (EAFRD), and the Next Generation EU – COVID 19 recovery package. Furthermore, the document also describes how regional objectives are aligned with and embedded in national, European, and international policy and development visions, in particular the European Green Deal and the 2030 Sustainable Development Agenda.

The DSU is, therefore, an extraordinary programming document providing coherence and synergy between different strategies and instruments available for strategic regional planning and development. It offers not only a development vision for a smart, sustainable, and inclusive regional development, but also a pathway to achieving the vision through concrete actions that maximise synergies and minimise trade-offs between policy objectives and instruments.

Source: (Regione Piemonte, 2020[69]).

The challenge Piedmont faces with respect to strategic frameworks and innovation policy is to ensure its own regional innovation policy, which reflects the region's priorities, needs and capacities, is effectively carried out. The region's DSU, its S3 and its innovation policy are all fundamental to establishing objectives and providing guidance on how they can be met. However, they are also still "on paper" and moving from planning to implementation is a big step. The institutional context, in this case, becomes critical, and will be explored later in this section.

There is another strategic framework consideration for Piedmont: the need to ensure that its vision for innovation – the role that innovation can play in regional development, and the role of actors in helping achieve its ambitions – within the region is well communicated. This is a challenge in Piedmont where actors, including public agencies such as CEIP and Finpiemonte, operate without a clear strategic view of their place within the innovation ecosystem, and how their organisation fits within the broader picture of the region's development activities (OECD, 2020[19]; Marques, P., 2020[2]). This leads to an inability on the part of critical players to articulate a wider view of future strategic directions for innovation and development policy in the region, and how, as stakeholders, they can contribute to such directions. Instead, they tend to focus on how to improve current actions rather than how they can make substantial contributions to innovation and development policy. There are two aspects to this challenge. The first is within the innovation ecosystem. Often, innovation initiatives are designed as individual activities rather than a suite of related and complementary projects. This can generate effective projects that nevertheless lack building critical mass and capitalising on potential synergies (Interreg Europe, 2020[12]). This is why effective leadership and coordination within the innovation ecosystem are critical. The second aspect is within the overall regional governance system, where agreeing on common, as well as sector objectives can reinforce the regional development policy approach. The DSU can help meet this latter challenge. However, it will be important that the upcoming S3 and innovation policy address the former and break down the "silos" of activity among the various innovation actors. The regional innovation coordination body introduced in the

previous section – an RDA, RIA or Regional innovation Council – could be particularly valuable in this respect, as well.

Working within EU and national regulations

The very close ties between Piedmont's innovation policy and EU Cohesion Policy places the region's innovation activity within a tight regulatory framework. This can limit the activity of the actors involved, including the regional government, in the innovation space.

European-level regulations and requirements for programming and funding are frequently found to be unclear, excessive and can generate a heavy administrative burden. In addition, European regulations are often incorporated into national legislation, adding another layer of complexity, reducing the room to manoeuvre with respect to regional policy implementation and potentially increasing red tape. This can increase the administrative burden for the regional government as it administers Cohesion Policy and other funds to support innovation, as well as imply higher transaction costs for any intermediate body supporting implementation or the beneficiaries receiving the funds (OECD, 2020[70]).

The impact of the regulatory environment on the governance of innovation policy in Piedmont is two-fold. First, it can affect the regional government's ability to ensure that resources are optimised as it implements its innovation policy. An excessive amount of legislation and guidance or the proliferation of multiple conditions coupled with weak capacities can lead to inefficient investment, be it for innovation or any other policy area. The implication is that all levels of government need to work together to find the right balance between systems that are sufficiently rigorous to detect and prevent irregularities in EU financed initiatives, and not too demanding or complex for administrations to manage (OECD, 2020[70]; Ferry and Polverari, 2018[71]). Second, the complexity and bureaucracy associated with EU financing opportunities, such as ERDF or ESF, makes interacting with the system difficult and can exclude smaller (or micro) firms that do not have the capacity to engage with the bureaucracy. At the same time, it can also exclude large players that do not need to seize such funding opportunities, and perceive the cost of engaging with the system to be higher than the benefit it may generate. The result is that valuable actors and potential partners, such as private foundations, prefer to advance innovation and innovation projects on their own or together, but not with public sector actors. For example, Compagnia di SanPaolo and Fondazione CRT, in a partnership the Intesa SanPaolo Innovation Centre, recently attracted the US-based TechStars Foundation to Turin. This foundation specialises in funding start-ups and high-tech entrepreneurs (OECD, 2020[19]; Marques, P., 2020[2]). Regulations and the types of projects that can be financed by "outside" or private sector actors also limit their ability to fully participate in and integrate into the current innovation environment.

These regulatory-based challenges can be particularly problematic in Piedmont as there is a need to increase the engagement of micro and small firms with the innovation policy and in the innovation environment, and project financing can be a powerful incentive. In addition, in order to create a dynamic innovation ecosystem, it will be important to better incorporate large players – be they firms, investors or other financiers. Excluding them or limiting their capacity to engage, for example through restrictive project financing rules, is a disincentive and ultimately counterproductive for all actors concerned.

Framework challenges associated with regulations may be difficult for the regional government to address on its own. The European Commission has proposed several reforms to reduce the administrative burden in the 2021-2027 period. These include establishing one single rulebook, introducing the Common Provisions Framework, and having fewer rules and lighter control procedures for beneficiaries (OECD, 2020[70]). At the same time, consideration must be given to national and regional level regulations and practices. To influence the process, the regional government should consider mapping the EU, national and regional rules and regulations that affect innovation policy implementation, to determine where the burden originates and if it has the ability to streamline procedures.

Working within Cohesion Policy and other investment funding parameters

Potentially the greatest framework challenge within the multi-level governance system of innovation policy in Piedmont is the financing and investment mechanism. Throughout Europe, spending on innovation-related activities has increased, and dramatically. In the 1988-1994 programming period, such activities accounted for about 8% of regional policy expenditures. In the 2014-2020 period, they reached about one-third of total expenditures (Morgan, 2016[72]), and it is expected to be even greater in the 2021-2027 period. Much of this investment relies on EU Cohesion Policy funds[12], particularly on the ERDF, and to a lesser degree on the ESF. Overall, Italy received EUR 44.7 billion in ESIF funding in the 2014-2020 period, of which close to EUR 1.4 billion (a little over 3%) was allocated to Piedmont. This included some innovation-related EU funding from the EAFRD. While not all of this money was spent on innovation objectives, a large share was (Table 3.2).

Table 3.2. Allocated ESIF Budget for Italy and Piedmont by Fund: 2014-2020

Share of EU financing, in EUR

Funds	Piedmont (EU)	Italy Country Budget (EU)
ERDF	482 922 370	21 542 042 052
ESF	436 145 000	10 265 946 183
EAFRD	465 238 000	10 444 380 767
Youth Employment Initiative (YEI)	-	1 880 204 992
European Maritime and Fisheries Fund	-	537 262 559
Total	**1 384 305 370**	**44 669 836 553**

Note: The EU Youth Unemployment Initiative (YEI) and the European Maritime and Fisheries Fund (EMFF) are managed at national level only.
Source: (European Commission, 2021[73])

In the 2021-2027 EU Programming Period, the ERDF Programme for Piedmont will have an allocation of EUR 1.5 billion. The ERDF co-funding rate will be EUR 600 million (40%) and the national co-funding rate (which includes the regional share) will be EUR 900 million (60%). The allocation of funds for innovation – Policy Objective 1: "A Smarter Europe" will cover not only R&D but also digitalisation, SME development support, and skills. This is a shift from the 2014-2020 period, when these four dimensions were separate Priority Axes, and skills did not fall within the ERDF funding remit. In addition to the ERDF programme, the ESF programme will have a total allocation of EUR 1.3 billion. This brings Piedmont's total allocation of Cohesion Policy co-funded programmes for the 2021-2027 period to a total of EUR 1.8 billion.

The heavy reliance on EU funds as a source of financing for innovation activities can limit the region's ability to pursue its own, more territorially specific, innovation priorities. Indeed, in order to benefit from EU funding, the Regional Programme and other innovation initiatives must fit within the framework of the Programming Agreement between Italy and the European Union, the negotiated objectives, and the financing arrangements. Whether this is the case depends on how adept the regional government is in aligning its regional innovation objectives and priority investment areas with those negotiated between the European Union and the Italian government. In addition to the administrative burden associated with EU financial mechanisms, the heavy reliance on EU funds can limit innovation activity among smaller actors. Many may not be able to meet the co-financing requirements necessary to access EU Funds, thereby limiting their entry into the innovation space. It can also dissuade the Managing Authorities for Regional Programmes to accept more innovative projects, as they frequently wish to minimise the possibility of financial corrections and audits (OECD, 2020[70]). In addition, regulations associated with accessing the funds could limit the possibility of tapping into other financing opportunities.

Piedmont uses non-EU funds as indirect support to implement innovation policy. For example, some SMEs may benefit from specific SME support schemes that are financed jointly through the regional budget and ERDF or ESF via a credit guarantee fund (i.e. from Confidi and Tranched Cover), and in doing so advance

innovation-related businesses or projects (OECD, 2020[74]). Another example are the ITS, which are partially financed through the national education budget and which the region receives as a grant, partially through ESF, and partially from the private sector. The combination of these financing streams presents a set of challenges for the ITS and indirectly for advancing innovation policy. First, they are reported to be insufficient. Second, national-level grants are allocated on an annual basis, which makes longer-term planning, which is crucial for growing ITS activities, very difficult, as discussed earlier.

While increasing own-source revenues (i.e. revenue generated by the region through taxes, fees and user charges) to support innovation financing would be ideal, this can frequently be difficult and may not be realistic at the moment. Thus, it would be important to focus on optimising existing financing streams. There are also other EU financing opportunities relevant to innovation such as HORIZON 2020 and COSME, for example, which, perhaps so far have not been maximised by the region. Mobilising EU funds that are not part of the Cohesion Policy funds is an area that the next version of Piedmont's innovation policy should explore further. One such source will certainly be the Next Generation EU COVID-19 recovery package, and specifically the funds associated with the Recovery and Resilience Facility. This temporary instrument was designed to boost the post-COVID-19 recovery. It is the largest stimulus package ever financed through the EU budget, and includes support for research and innovation with a focus on fair climate and digital transitions.

Undoubtedly, increasing public financing and investment for innovation in Piedmont will always be welcome. However, given the framework conditions, it may be more of a matter of optimising existing resources, making the most of the variety of EU and national financing sources, and – to the extent possible – using existing public and private financing opportunities in a more agile way. Identifying and optimising different types of funds and financing opportunities would be extremely valuable. The DSU can support this by highlighting complementarities and synergies across strategic frameworks and policies, each associated with financing. To the extent possible, loosening restrictions on the types of regionally sponsored projects in which the bank foundations or the private sector can participate would also help. Developing a public investment strategy, be it for innovation policy or more broadly for Piedmont's regional development could also be valuable. If specifically for innovation, it could help coordinate innovation investment planning and implementation processes across financing streams, ensuring greater coherence and helping identify complementarities. Given the number of strategies and plans Piedmont is working with and within, it may be just as effective to use the upcoming S3 and innovation policy for this purpose. One way to do so would be to ensure that these documents clearly articulate desired investment outcomes for innovation policy.

Reinforcing the institutional context and institutions to deliver innovation policy

Evidence indicates that institutional context and capacity are among the major barriers to effective S3 implementation (Interreg Europe, 2020[12]). The institutional context in Italy may be particularly challenging, especially with respect to QoG, as measured by the quality of government index.[13] According to the latest European QoG survey, between 2010 and 2021, Italy as a whole saw a drop in its QoG. Between 2010 and 2017, Piedmont was one of the country's regions to experience a significant QoG decline. It reversed this between 2017 and 2021, when Piedmont was among the top three regions in terms of improving their QoG (Charron, Lapuente and Bauhr, 2021[75]). While the regional government can do little to affect QoG at the national level, it could consider how its service delivery capacity, on which QoG measurement depends, is affecting innovation outcomes in the short and medium terms. There are two aspects to the institutional dimension of governance that merit particular attention in Piedmont: administrative capacity and ensuring active multi-stakeholder participation.

Administrative capacity among small municipalities and small enterprises

The administrative capacity of the authorities that design and implement innovation policy and manage its investment process can affect overall policy effectiveness. Generally, QoG contributes to better investment outcomes, which themselves depend on effective administrative capacity. Effective administrative capacity refers to good coordination, institutional stability, appropriate expertise, and effective policy or service planning and implementation (OECD, 2020[70]).

Smaller municipalities in Piedmont face shortages of staff and expertise in designing and implementing innovation initiatives at the local level, and limited technical expertise of staff has been acknowledged (OECD, 2020[19]). This affects the ability of smaller municipalities to be more innovative and engage with innovative mechanisms, such as using public procurement as a lever for innovation policy, for example. In addition, Piedmont also struggles with low capacity of small and micro companies to make use of EU funds. Several stakeholders agree that there are few training activities for small and micro companies to keep abreast of the latest developments with regard to legislation, regulations, procedures, and processes (OECD, 2020[19]). At the same time, the resource capacity (e.g. staff, finances, time) of small and micro firms to take part in training programmes — if and when they are actually offered —is also low. A strong understanding of training needs, and the development of well-targeted, hands-on learning, as well as peer-exchange opportunities sponsored by the regional government could be valuable. Developing such capacity-building initiatives will depend on the region's ability to engage with small municipalities, and micro and small beneficiaries of EU funds to identify their capacity gaps.

Boosting multi-stakeholder participation in the innovation and innovation policy process

Piedmont successfully identified its innovation policy priorities through an inclusive and evidence-based process grounded in the engagement of key innovation stakeholders, including regional universities, business associations, cluster organisations and other innovation intermediaries. These actors participated in the region's entrepreneurial discovery process, which the region used to define the priorities of its innovation and smart specialisation policy for the period 2014-2020 (Regione Piemonte, 2020[69]). The region is using similar consultative processes as it sets its next S3 and innovation policy. However, like many regions, Piedmont struggles to keep stakeholders engaged throughout the process, including refining priority areas, identifying implementation tools, and defining innovation governance and monitoring mechanisms (OECD, 2020[19]).

Effective stakeholder engagement is tricky, it requires time and willingness on the part of the stakeholder, an understanding as to why they are being engaged, as well as capacity and the ability to access the engagement process. In addition, too much engagement, or engagement that is poorly managed, can result in engagement fatigue and be counterproductive. The same applies for engagement processes that are not effectively linked to decision-making processes.

Developing an engagement strategy for innovation stakeholders is one option to be explored. Such documents can align conceptual understanding and definitions with respect to engagement (OECD, 2020[76]), clarify expectations, identify necessary resources and provide guidance for using and communicating the results from an engagement process. They can also build engagement capacity among civil servants and non-government stakeholders.

Engaging stakeholders on their own terms is also important. Online mechanisms and decision tools can be a particularly attractive alternative to traditional engagement methods, especially in the context of the COVID-19 crisis. The practical deployment of information and communication technologies has led to the rise – and increased the speed – of customised Internet platforms, such as social media, chat rooms, online fora, or e-voting. Such mechanisms can be used during the policy design stage, but also to guide policy implementation and monitoring (Fellnhofer, 2017[77]). ICT tools can be used by the region of Piedmont to help stakeholders better understand what the regional government does, including in innovation policy activities. They can also be used to actively involve and engage stakeholders, for example

through electronic participation, which can facilitate reaching out to a wider audience and be more cost-effective than traditional engagement practices (OECD, 2015[78]). Finally, ICT tools can also support inclusive stakeholder interaction. Although evidence on bottom-up civil society engagement efforts is still sparse in the context of smart specialisation (Uyarra et al., 2020[36]), more place-based policy efforts could be targeted to civil society engagement. Such policy efforts hold promise, since an engaged civil society with strong social capital can partly compensate for a region's weak institutional capacity (Rodríguez-Pose, 2013[79]).

Enhancing evidence bases and performance measurement practices for more successful innovation policy

Understanding what is happening in the innovation ecosystem, and the impact the ecosystem is having on a region's development is part of the multi-level governance system supporting innovation policy. To this end, Piedmont's next S3 and innovation policy should be supported by monitoring and evaluation mechanisms that include indicators and specific targets, which can be used to assess policy results and make policy adjustments when necessary

Building evidence bases for innovation policy

Building quantitative and qualitative evidence regarding the region's innovation capabilities, entrepreneurial activities and competitiveness can help regional policy makers better understand their innovation ecosystem and make the most of innovation opportunities. It also helps to match innovation needs – of the region and of the individual innovation actors – to innovation capacities and could be used to attract investment. The emphasis, however, should be placed on attracting investments that match the region's unique knowledge skills, to ensure that FDI is – or becomes – locally embedded. To do this, the region must be very clear on what its unique knowledge skills are and monitor their evolution. Public sector innovation labs that promote bottom-up and more experimental policy approaches are one mechanism that national, regional and local governments use to address this issue. In Piedmont, the Torino City Lab, launched two years ago, is a good resource (Torino City Lab, n.d.[80]). Its strong focus on innovative urban solutions may leave room for the regional government to partner with it in order to expand the model into other sectors and geographic areas. Another option is to support the development of an innovation lab at a regional level, potentially in partnership with the Torino City Lab.

Measuring innovation – frequently an elusive task – is another crucial element of a successful S3 and innovation policy. It may require, however, updating methodologies and indicators. Available measurements largely reflect the industrial era rather than the knowledge-based and digitalised economy. This can leave policy makers struggling to capture the impact of innovative efforts (e.g. the digital transformation). Strengthening monitoring and evaluation capacities and practices implies, among other things: improving consultation with stakeholders to develop goals and design programmes; more stringent collection of data (including the use of non-traditional sources of information); involving representatives from civil society, academia and the private sector in monitoring and evaluation processes; developing clear and publicly accessible monitoring dashboards; and linking investment planning and budget decision-making processes to monitoring outcomes. Regarding the collection and use of data for monitoring and evaluation purposes, it would be beneficial to improve data collection on the amount of public and private investment already in play, where it is channelled and its impact. This could shed light on how investment in R&D in the region benefits innovation and innovation policy, what is working, and where adjustments are needed. This would allow the regional government to further ensure that appropriate conditions are in place for private innovation investment, including FDI.

For Piedmont, it might be useful to identify a dedicated team that would be responsible for innovation monitoring and evaluation within the public administration. Furthermore, making use of analytical and informative tools, including big data, web semantics, etc. would help Piedmont gather and analyse different kinds of data faster. They also promote continuous policy learning, as is emphasised by the monitoring system in Catalonia, Spain (Box 3.10).

Box 3.10. Monitoring the S3 in Catalonia, Spain

The region of Catalonia, Spain, developed the RIS3CAT monitoring system to gain insight into how initiatives undertaken under the rubric of its S3 contribute to the strategic objectives shared by diverse innovation actors. The monitoring system is based on a governance structure that articulates the various initiatives, reinforces synergies and maximises collective impact. It also establishes a common system of indicators and monitoring mechanisms to support decision making by RIS actors. This monitoring system focuses on promoting learning, rather than on achieving objectives. The system itself is dynamic, evolving with the implementation of the strategy. It is also participatory: actors establish the objectives and indicators associated with their projects, provide the relevant qualitative and quantitative information that is useful in adapting the strategy, and determine the smart specialisation process supporting research and innovation in Catalonia. The emphasis on learning supports the continuous adaptation of the region's S3 as well as its implementation mechanisms in order to more rapidly respond to identified challenges and opportunities. It also enables the regional authorities to measure and evaluate the strategy's results and impact.

The RIS3CAT is supported by an interactive web tool – RIS3-MCAT – used to visualise the development of the sectorial and technological specialisation of the region's research and innovation financed by European funds. The platform functions as a data visualisation tool that integrates and interrelates open data from science and innovation projects, making this data interoperable with the aim of:

- Assessing the impact of European funds on the specialisation of the research and innovation ecosystem in Catalonia.
- Identifying opportunities to maximise the collective impact of research and innovation in Catalonia through synergies and the coordination of efforts.
- Providing new evidence to assist decision-making by stakeholders in the research and innovation ecosystem of Catalonia, encourage new collaboration dynamics and inspire new public policies.
- Raising the profile of organisations in Catalonia that participate in European research and innovation networks.
- Understanding how European funds contribute to Sustainable Development Goals (SDGs).

The platform maps the relations between organisations in the R&D+I system in Catalonia, as well as with international partners, and detects the structure and evolution of innovative networks and communities in the various areas of specialisation. For example, the region has used the tool to monitor the potential of its circular bio-economy.

Source: (Generalitat de Catalunya, n.d.[81]; Generalitat de Catalunya, 2021[82])

Reinforcing outcomes-based performance measurement at the regional level

Performance monitoring of policies associated with EU Cohesion Policy funds is particularly challenging. First, is the general and almost universal tendency by actors to perceive performance measurement as a control or compliance tool. Monitoring should ideally be designed as a learning tool, allowing policy makers and all organisations in Piedmont's RIS to assess the quality of their initiatives and adapt whenever necessary (Morgan, K., and C. Sabel, 2019[83]; Marques, P., 2020[2]). Second, is a general resistance to additional reporting by those who must also report to meet EU performance requirements. While EU funds have robust evaluation mechanisms, these focus on measuring investment project and investment outputs. They identify what activities or investments produce with respect to specific, agreed-upon funding objectives and commitments associated with innovation. They are not generally designed to capture the outcome, i.e. the expected or desired change arising from the innovation investment or policy intervention.

This limits their ability to offer insight into an action's broader success and may not help policy and decision-makers identify where to invest more or better (OECD, 2020[76]).

In Italy, strategic programming for ESIF in the 2014-2020 period, and now for Cohesion Policy funds in 2021-2027, falls under the direct responsibility of the Department for Cohesion Policies, which is part of the Presidency of the Council of Ministers. Operational responsibility for programming, coordinating, implementing and monitoring rests with the national Agency of Territorial Cohesion (OECD, 2020[6]). This matters because while the design and implementation of regional innovation policy is in the hands of the regional government, responsibility for its monitoring and evaluation is a national-level exercise, dissociating the policy design aspect from the objective setting and monitoring. While this may be coherent in the context of EU Cohesion Policy fund control, verification and audit, it leaves little room or incentive for the region itself to monitor the impact its policies are having within its territory. This can lead to the question of whether the regional government is expected to consider the impact of its policy beyond the objectives of Structural/Cohesion Policy funds.

While there is a recognised need by regional stakeholders to monitor innovation policy (and S3) results (OECD, 2020[19]), Piedmont is not alone in its limited approach to doing so. A recent study on selected S3s in the 2014-2020 programming period has shown that, throughout Europe, the practice of policy monitoring and evaluation continues to lag behind. The survey finds that most strategies have only been partially evaluated, if at all, which in turn limits learning and the development of an updated strategy that is based on S3 policy outcomes and impact (JRC, 2021[84]). Improving monitoring and evaluation practices is challenging, however, as regions often face limitations with regard to their financial and human resources, as well as gaps in technical knowledge of key staff with regard to defining performance indicators and setting quantitative objectives and targets.

Despite the challenges, it would be valuable for the region to complement its next innovation policy with an outcomes-oriented monitoring and evaluation system. This will require a very clear articulation of objectives that also have measurable components, and an even greater openness to transparency and accountability by regional government, and other pivotal actors that must provide data and information.

Conclusion and recommendations

The importance of S3 – and within these regional innovation policies – as drivers of regional development is likely only to increase. To make the most of the opportunities afforded by S3 and regional innovation, policy makers will need to embrace the complexity of innovation – from the innovation process itself, to its diversity of actors, to the environment in which it occurs.

Piedmont, as a moderate innovator+, and region in industrial transition with a strong history of innovation should seize the chance offered by designing and implementing a new S3 and innovation policy to transform what is currently an innovation environment into a dynamic and productive innovation ecosystem. The region has a number of innovation-related strengths, which should be reinforced. These include its organisational thickness (i.e. the number of organisations engaged in innovation-activities in the region) and the commitment of pivotal actors, such as its education institutions, incubators, and the private sector, to innovation. Its strengths, however, will need to be balanced by greater institutional thickness, and by innovating the current approach to innovation. This can include using a broader definition (or typology) for the kind of innovation the policy emphasises, attracting new players and building the capacities of existing ones, particularly micro and small enterprises, as well as investors. There are a number of ways to go about this. Balancing the current emphasis on R&D-driven innovation with process, product, and business-model innovation is one. Mainstreaming social innovation and by also giving greater consideration to public sector innovation are others. Greater support to SMEs currently outside of the innovation space will be important in this next policy period, as will finding a way to make the region even more attractive for innovation-related investment. Ensuring that the future innovation policy actively supports a more coordinated, networked and integrated approach to innovation will be an important step towards creating an innovation ecosystem and unleashing the innovation potential of the region.

Recommendations for action in innovation policy and its governance for Piedmont

1. Recommendations for broadening the definition (type) and approach to innovation within the new innovation policy

- **Actively support innovation in management, marketing, processes, business-models**, etc. in addition to technological/R&D-driven innovation.
- **Mainstream social innovation**, for example by:
  - launching project calls that are open to any social enterprise or non-profit organisation;
  - supporting partnerships between social enterprises and institutions funding social innovation;
  - building social innovation skills, including through the ITS or other higher education institutes;
  - encouraging cooperation and collaboration among social enterprises;
  - fostering networks between social enterprises and other organisations;
  - support coordination with small business associations.
- **Develop public sector innovation**, for example by:
  - building public sector capacity, skills for and comfort with exploration, experimentation and learning-by-doing, including using performance monitoring mechanisms;
  - encouraging cities in the region to develop innovation strategies; target innovation activities to certain demographic groups (e.g. youth) and in specific areas (e.g. rural communities);
  - making better use of existing public policy levers to advance an innovation agenda, for example through public procurement.
- **Attract new investment partners,** for example by:
  - promoting the region's unique assets and knowledge, e.g. by concentrating efforts on sectors or areas unique to Piedmont, based on a technological diagnostic of the region;
  - fostering networks and more collaboration in areas of complex specialisation, especially among firms currently not in clusters or where collaboration is limited;
  - identifying new, related sectors where there is potential to attract and generate investment.
- **Support innovation among micro and small firms** currently not active in the innovation space, for example by:
  - strengthening value chain relationships between multi-nationals and Piedmont's SMEs;
  - boosting the role of *Centro Estero Internazionalizzazione Piemonte* (CEIP) in building and nurturing relationships between small Piedmont firms and large multi-nationals and helping it develop innovation-related advisory services;
  - incorporating university-student and researcher placement schemes in innovation policy programming initiatives;
  - prioritising funding for projects that promote cross-sector activity and/or economic diversification among smaller firms;
  - further encouraging cross-regional collaboration, particularly among SMEs; expanding credit lines by Finpiemonte for internationalisation activities;
  - developing a one-stop-shop for innovation-related business activities.

- **Address a skill deficit by optimising what the ITS offer**, for example by:
  - stabilising ITS funding by piloting multi-annual budgets;
  - developing a targeted communication campaign to improve the image of VET;
  - partnering with social enterprises to attract "difficult to reach" or marginalised groups;
  - encouraging ITS to collaborate with each other;
  - expanding training to those already in the labour force.

2. Recommendations for moving from an innovation environment to an innovation ecosystem

- **Better link innovation actors and activities**, including by:
  - creating a single point of entry for regional innovation support in the form of a website/single point of entry portal for all actors, or one that distinguishes between start-ups/entrepreneurs and potential investors;
  - creating an innovation platform based on broad, future-oriented transversal themes present in the region (e.g. circular economy, sustainable mobility) that also connects actors beyond cluster members.
- **Improving coordination in the innovation space to fill a leadership void**, for example by:
  - introducing a coordination and/or advisory body that brings together representatives from the public sector, the private sector, academia and civil society, in the form of a regional innovation council;
  - in the medium to longer term consider a regional innovation agency or a suite of coordination mechanisms that address different aspects of the innovation space.

3. Reinforcing the governance of innovation policy in Piedmont

- **Continue and reinforce the good practice of identifying and strengthening links among global, EU, national, and regional strategic documents**, including by:
  - ensuring ongoing consultation and dialogue with government actors at all levels regarding innovation and regional development priorities;
  - more clearly communicating the region's innovation vision to regional innovation actors.
- **Begin to address concerns of administrative burden and excessive red tape,** for example by:
  - mapping EU, national and regional rules and regulations related to innovation policy and programming implementation to identify where procedures can be streamlined, and communicating these efforts to stakeholders.
- **Optimise existing streams of investment financing for innovation**, for example by:
  - loosening restrictions on the types of regionally sponsored projects in which non-government, non-cluster actors can participate;
  - introducing a public investment strategy component in the new innovation policy, ensuring that they also articulate the desired investment outcomes associated with the innovation policy.
- **Build the administrative capacity of municipal governments and micro and small firms** to be more innovative an engage with innovative/innovation mechanisms (e.g. innovative public procurement), including by developing well targeted, hands on learning and peer-exchange opportunities.
- **Enhance evidence bases and performance measurement practices** by:

- building quantitative and qualitative evidence regarding the region's innovation capabilities; developing an innovation lab for the region;
- more actively monitoring and evaluating innovation in the region to capture the impact of innovation efforts; improving innovation-related data collection;
- building an outcomes-based performance measurement system for the new innovation policy, independent of the monitoring undertaken for EU programming.

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Notes

[1] "R&D expenditure in the business sector as a percentage of GDP" (39 out of 40); "SMEs introducing business process innovations as percentage of SMEs" (37 out of 40); and "Employment in knowledge-intensive activities as percentage of total employment SME's" (19 out of 40).

[2] The Regional Innovation Scoreboard 2021 includes data on all Belgian, French, Spanish and Swedish benchmark regions. No aggregate data is included for the German benchmark regions of Baden-Württemberg, Bavaria and Saxony. These are represented by individual cities (NUTS 2 level). As such, it might be that, on the aggregate level, one or more of these three regions performs better on the selected indicators than Piedmont.

[3] European Structural and Investment Funds (ESIF) were adjusted for the 2021-2027 programming period and are now called Cohesion Policy Funds.

[4] Chapter 4 of this report explores Piedmont's cluster model in detail.

[5] The entrepreneurial discovery process is a bottom-up process of interaction among a region's universities, the public sector, private sector and civil society organisations (quadruple helix) with entrepreneurial knowledge (Interreg Europe, 2020[12]).

[6] The remaining 70% is allocated to technology platforms; IR2 – targeting large beneficiaries; SCUP targeting start-ups with high potential; IFRA-P and V-IR targeting research and technology infrastructure and SME access to them.

[7] A 'social economy organisation' refers to associations, cooperatives, mutual organisation and foundations with activities grounded in solidarity, the primacy of people over capital, and democratic and participative governance (https://www.oecd.org/cfe/leed/social-economy/).

[8] The DSU outlines the region's development ambitions, highlighting synergies among various EU strategic documents and regional policies, and helps define investment priorities for the EU 2021-2027 Programming Period.

[9] Innovation capacity is defined as the human, financial and institutional resources and skills that can generate, implement and advance cutting-edge, inclusive, long-term and bottom-up problem solving. The resources and skills could include data analytics, resident engagement, human-centred design or other iterative design methods, behavioural economics, and inter-sectoral and inter-jurisdictional collaboration.

Innovation goals are short- and long-term aspirational outcomes for residents, businesses and the community. Innovation strategies set the course towards achieving innovation goals (OECD, 2019[83]).

[10] The six nationally established areas are: sustainable mobility; new technologies for life; new technologies for "Made in Italy" products; innovative technologies for cultural heritage and tourism; ICT; energy efficiency.

[11] Provinces, metropolitan cities, and municipalities play a role in innovation policy, but to a lesser extent than the regions. The statutory autonomy of provinces, metropolitan cities, and municipalities, was recognised in 1990 and enshrined in the Constitution in 2001. However, Law 56/2014 "Reordering the Territorial Organisation of the Country" reinforced the role of regions and municipalities, limited the role of provinces and conferred more responsibilities to metropolitan cities. Provinces lost their status as elective bodies and became territorial bodies for wide areas (*ente territoriali di area vasta*), now responsible primarily for local planning and zoning, local police and fire services, and transport regulation (e.g. motor vehicle registration, maintenance of local roads, etc.). Metropolitan cities were recognised as government entities in charge of formerly provincial responsibilities. Smaller municipalities were encouraged to merge with larger ones to reduce fragmentation at the local municipal level (OECD/UCLG, 2019[88]). Metropolitan cities and municipalities support innovation locally, though the capabilities for project design and implementation in smaller municipalities are often limited (OECD, 2020[7]).

[12] What was known as the European Structural and Investment Fund (ESIF) in the 2014-2020 programming period is now called the Cohesion Policy Fund in the 2021-2027 programming period.

[13] This index measures quality of governance (QoG) by asking a representative sample of the population in each European region for an evaluation of public services such as schools and police, and for their perception of corruption (Charron, Lapuente and Bauhr, 2021[75]). The argument sustaining this methodology is that quality of public services tends to be highly correlated with other measures of QoG, including levels of corruption, transparency, etc. As such, the authors claim that the measurement of the perception of the quality of public services can function as an indicator for QoG in general.

4 Towards a revised cluster policy for Piedmont, Italy

Despite its strong innovation clusters, Piedmont faces important policy challenges to economic development, including low labour productivity and human capital. This chapter examines how Piedmont's cluster model and governance can be upgraded to respond to global megatrends and their impact on Piedmont's emerging industries and competitiveness. The chapter starts with a description of the current cluster model in Piedmont and why it needs a rethink. The chapter then proceeds with suggesting a revised cluster model based on three pillars of strong industrial innovation clusters: i) reinforcing the role of clusters as drivers of the regional innovation system, (ii) strengthening cluster collaboration across borders, and (iii) using clusters to support regional vision-setting for future technological and industry development, including advancing social and environmental innovation practices. Addressing these pillars, the chapter discusses how to better integrate the themes of entrepreneurship, digital transformation, innovation diffusion, and up- and re-skilling in cluster programmes.

In Brief

Piedmont's clusters could become strong partners for a green, digital and inclusive industrial transition

- **Piedmont's seven innovation clusters successfully support innovation and economic growth in innovation-oriented firms**. They facilitate access to public funding from the region to innovative firms, including small and medium-sized enterprises (SMEs), for collaborative research and development (R&D) projects. They also play an important role as knowledge brokers by bringing together innovative SMEs, universities and large firms in the region.
- **The region's innovation clusters are less successful in preparing companies not at the forefront of innovation to manage the large-scale challenges,** such as industrial transition, digitalisation and moving to a net-zero carbon economy. There are several reasons behind this. First, many innovation actors perceive the cluster's role to be limited to facilitating access to Cohesion Policy funds. Second, cluster membership has remained stagnant for the past five years, with some exceptions (e.g. the Agrifood cluster). Finally, clusters seem to reinforce incumbents but do not always encourage the industrial diversification of local firms into new and related activities. Without overcoming these challenges, clusters risk being unable to sustain their current role and face a threat of decline.
- **It is imperative to upgrade the role and capacity of clusters as central innovation actors**. The region should use the next iteration of its cluster policy and cluster model to help clusters better respond to changing industry needs and meet regional innovation and development objectives. A revised cluster policy should ensure that entrepreneurship, digital transformation, innovation diffusion, and up- and re-skilling are well integrated into cluster programmes.
- **A revised model based on three critical pillars – or focus areas – could drive an upgraded cluster policy that concentrates on innovation, innovation diffusion and productivity growth**. First, making use of clusters as drivers of the regional innovation ecosystem would help Piedmont strengthen cross-sectoral linkages between firms. By favouring collaboration among firms and knowledge spillovers, these linkages play a central role in industrial transformation, the development of emerging industries and innovation. Next, cluster internationalisation is a key driver of transformation and growth for firms and the ecosystem in which they operate. Finally, by providing intelligence to the region, clusters help future-proof innovation policies in important regional development areas, such as the transition to a net-zero carbon economy, the digital transformation and inclusive territorial development.

Introduction

Since the 1990s, researchers have emphasised the importance of economic clusters and cluster (management) organisations in economic and innovation development. For the purpose of this chapter, the former is considered to be a regional ecosystem of related industries (e.g. a group of firms, related economic actors and institutions) that is "located near each other and have reached a sufficient scale to develop specialised expertise, services, resources, suppliers and skills" (European Union, 2021[1]). It is generally referred to as an economic or an innovation cluster. The latter term refers to an entity that supports the strengthening of collaboration, networking and learning in economic clusters and provides innovation support by offering or channelling specialised and customised business support services to stimulate innovation activities (European Union, 2021[1]). Many studies have asserted that economic (or innovation) clusters generate benefits for their associated enterprises, for example easier and affordable access to means of production, distribution channels, human resources, or knowledge and innovation (Audretsch and Feldman, 1996[2]) (Delgado, Porter and Stern, 2014[3]) (Litzel, 2017[4]). Innovation clusters can also strengthen a country's or region's international competitiveness through stronger external linkages and better integration in global value chains (Bathelt, 2001[5]). To properly provide these benefits, cluster management organisations need the right competences, sufficient visibility, and the trust of local and regional innovation actors (OECD, 2018[6]).

Recent OECD work highlights the importance of clusters as an "innovation governance tool" for policy makers (OECD, 2019[7]). Across OECD regions, policy makers turn to innovation clusters to support local industrial modernisation and smart specialisation strategies, which emphasise strong interactions among different public and private innovation actors (OECD, 2020[8]). Clusters can support innovation governance by bringing together the interests of relevant innovation stakeholders, such as higher education institutions, large and small companies, the public sector, innovation intermediaries, etc. Cluster structures, often supported through a cluster initiative (such as a cluster organisation)[1], can facilitate communication between firms and public institutions to define policies and actions that support regional competitiveness (OECD, 2009[9]). This is particularly important for regions in industrial transition, such as Piedmont, that need to prepare local industries for current megatrends, such as digitalisation, technology shifts, and the growing complexity and interdependence of research and development (R&D) activities.

Innovation clusters have a strong history in Piedmont, but they face challenges. In 2009, Piedmont established 12 cluster management organisations (*Poli di Innovazione*). Each related to different technology domains in traditional and high-tech industries. In 2015, the cluster organisations were re-organised to better reflect the region's smart specialisation and innovation priorities. Today, the region has seven cluster management organisations that seek to support innovation in the smart specialisation strategy areas (OECD, 2020[10]). Their purpose is to channel public funding from European funds to collaborative R&D projects, and they are well-established knowledge brokers between firms and institutions/public bodies. These cluster management organisations also host trade fairs, help firms participate in them, and build relationships with other cluster organisations in Italy and internationally. Yet, there are (policy) challenges associated with the region's cluster organisations. The full strategic potential they offer is not fully tapped, and their contributions to advancing smart industrialisation and digital transformation in Piedmont could be further leveraged. In addition, some clusters organisations have a narrow activity focus and there is room to broaden SME membership and support activities in pursuit of regional innovation objectives.

The revision of Piedmont's smart specialisation strategy and its regional innovation policy for the 2021-2027 European Union (EU) Cohesion Policy funding period provides an important opportunity for Piedmont to review and upgrade its current cluster policy and model. Upgrading the current cluster model fits within the regional government's activities to revise its smart specialisation strategy and broader innovation policy as part of the 2021-2027 EU Cohesion Policy funding period. It is a particularly important exercise because

innovation clusters in Piedmont are meant to deliver on a range of objectives that can support the region's development and which are associated with national and EU level objectives as well.

This chapter offers recommendations on how Piedmont's clusters can strengthen innovation and knowledge-based development throughout the region. The chapter is organised in three main parts. First, it describes Piedmont's existing cluster model and its evolution. Second, it identifies the major challenges that Piedmont's innovation clusters face in supporting innovation. Third, it discusses how the current cluster model can be upgraded based on OECD experience and international learning models.

Piedmont's cluster policy and cluster model: 2009-2020

The development of cluster policies and programmes in Piedmont began in 2009 with the creation of 12 regional cluster organisations, building on a long tradition of industrial districts in Italy. In 2015, after a review process, the region merged the 12 cluster organisations into seven new ones. They reflect the priorities outlined in the region's Smart Specialisation Strategy (RIS3) for the 2014-2020 EU Programming Period: aerospace, automotive, green chemistry/cleantech, mechatronics, "Made In" (agri-food and textile), and life sciences (OECD, 2020[10]).

Objectives of Piedmont's cluster policy

The objective of Piedmont's cluster policy since 2015 has been to use innovation clusters to improve Piedmont's economic competitiveness through well targeted research and innovation. Innovation clusters in Piedmont are specifically focused on industrial modernisation, to be achieved through:

- the diffusion of digital skills, tools, and applications
- cross-sectoral technology fertilisation
- collaboration (e.g. large and small firms, industry and academia).

Piedmont's innovation clusters do not operate in a vacuum, but are part of a broader innovation environment (Figure 4.1). While clusters are a central instrument of regional innovation policy in Piedmont, other actors such as competence and technology centres, incubators, vocational training schools and universities also provide important innovation support services (see Chapter 2). One of the tasks that innovation clusters and cluster organisations strive to fulfil – with mixed results thus far – is to connect the different actors within the regional innovation ecosystem in order to maximise the impact of innovation policy support by all stakeholders.

Figure 4.1. The role of the innovation clusters in Piedmont's regional innovation policy

Source: (OECD, 2020[10]); Updated by the Regional Government of Piedmont, July 2021

The organisation of Piedmont's regional clusters

The Piedmont regional economic clusters unite innovation actors in a specific sector or technology. Each regional innovation cluster – not to be mistaken for cluster management organisation – consists of groupings of independent companies (innovative "start-ups", SMEs, large enterprises, research organisations, etc.) active in a particular sector and/or technology. They function as innovation ecosystems in the region that promote the transfer of technologies, the sharing of structures and the exchange of skills and knowledge between members.

Each cluster organisation in Piedmont has between five and nine staff dedicated to the cluster's management. The main services offered to cluster members are matchmaking, support for (R&D) project development, support to access financing and technology transfer. The number of participating firms - mostly SMEs - in each cluster ranges between 86 and 237, representing an industry coverage between 7.7% and 20%, depending on the sector (Table 4.1). It is important to highlight that start-ups, for reasons explained in further detail below, generally do not participate in activities sponsored by cluster management organisations. The different cluster specialisations may partially explain the difference in industry coverage. While some cluster organisations cover Piedmont's traditional industrial sectors (e.g. the agri-food and textile clusters) others are cross-sectoral by nature, covering large-scale enabling technologies and larger industries (e.g. mechatronics as in the case of the *MESAP* cluster, Information and Communication Technologies as in the case of the ICT cluster).

Table 4.1. Overview of the coverage and organisation of innovation clusters in Piedmont, 2019

Cluster Organisation	Main industries served	Number of members (industry coverage in percentage)	Number of staff dedicated to cluster management
bioPmed	Life Sciences	93 (20%)	5
C-Green	Green Chemistry and Advanced Material	164 (15%)	9
Clever	Energy and Clean Technologies	165 (10%)	8.5
MESAP	Smart Products and Manufacturing	265 (10%)	8
Pointex	Textile	95 (10%)	5
Polo Agrifood	Agriculture and Food	197 (15%)	5.5
Polo ICT	Information Technology and Analytical Instruments	239 (7.7%)	8

Source: (OECD, 2020[10]),

Total revenues of the cluster management organisations and the number of staff they employ differ significantly, reflecting the heterogeneity of the clusters and their associated partners. Revenues for the *Clever* cluster are almost three times higher than those of the *Pointex* cluster. All cluster organisations depend on support from the European Regional Development Fund (ERDF) administered by the Piedmont regional government. The *Polo Agrifood* cluster relies on ERDF for 66% of its revenues, the highest among the seven clusters. This is in contrast to the ICT cluster, which depends on ERDF financing for about one-third of its revenue, generating most of its income from other sources of funding (Table 4.2). All cluster organisations generate additional revenues from such sources as membership fees, fees for services or other EU funds (e.g. COSME). Yet, they mostly rely on ERDF financing, which is problematic for several reasons. EU funding processes, rules and regulations can be cumbersome to navigate for some firms, particularly small ones, which can prevent them from accessing necessary firms. They require project design and management expertise, co-financing, which might not always be available, and they are considered very bureaucratic. Furthermore, an overdependence on EU funds casts doubt on whether the clusters, and particularly the cluster organisations, would survive without public support, calling into question their long-term sustainability if they continuously depend on external funding for a significant percentage of their financing.

Table 4.2. Innovation cluster revenue and sources of funding in Piedmont, 2018

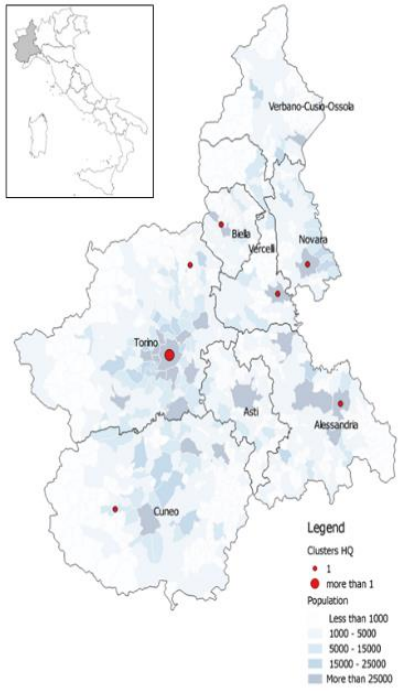
Cluster	Total cluster organisation financing (EUR)	Sources of financing	
		Regional funds (ERDF) in EUR	Other co-financing (membership fees, services, EU funded projects, in kind)
bioPmed	453 000	200 000 (or 44%)	253 000 (or 56%)
CGreen	700 000	296 000 (or 42%)	404 000 (or 58%)
Clever	840 000	350 000 (or 42%)	490 000 (or 58%)
MESAP	619 000	205 000 (or 40%)	414 000 (or 60%)
Pointex	285 000	135 000 (or 47%)	150 000 (or 53%)
Polo Agrifood	444 000	292 000 (or 66%)	152 000 (or 34%)
Polo ICT	827 000	265 000 (or 32%)	562 000 (or 68%)

Source: (OECD, 2020[10])

Innovation cluster organisations in Piedmont are headquartered throughout the region, either in Turin, or the area with the largest concentration of firms already operating in the cluster's specific industrial sector (Table 4.2). For example, the Agri-food cluster is located in Cuneo, in the south-west of Piedmont. While the location of innovation cluster organisations reflects local production and industry agglomeration

patterns, clusters serve the entire region. Expanding the membership base of innovation clusters within the region beyond their traditional catchment area is one of the objectives the regional government assigns to the cluster organisations.

Figure 4.2. The location of innovation cluster headquarters in Piedmont



Source: OECD elaboration.

Why cluster policy in Piedmont needs a rethink

Piedmonts cluster organisations have successfully channelled public funding for collaborative R&D projects. Yet, they have been less successful in accompanying companies through industrial transition. In the ten years since their establishment, Piedmont's cluster organisations have proven to be successful innovation actors, able to facilitate access to public funding (mainly the ERDF) for collaborative R&D projects. The open question, however, is whether the cluster organisations are sufficiently proactive and capable to accompany associated companies through the industrial transition underway in Piedmont. Looking ahead, cluster organisations must be prepared to support businesses during the recovery from the COVID-19 pandemic and to embrace global megatrends and their impact on emerging industries in Piedmont. Some megatrends relate to the diffusion of new disruptive technologies (e.g. automation), others are more closely related to demographic, socio-political, environmental and economic shifts (e.g. demographic shifts and the transition to a green and circular economy). These megatrends pose both significant challenges and opportunities for emerging industries in Piedmont by affecting business models, creating incentives or barriers to developing new markets, altering employment and productivity, causing shifts in skill requirements and disrupting existing value chains. Strengthening regional resilience in light of these megatrends requires a broader cluster vision than the current one and strengthened capabilities among cluster organisations to help local firms navigate these trends (OECD, 2019[7]).

Currently, the regional cluster organisations face a range of challenges, which they need to overcome in order to continue supporting industrial modernisation in Piedmont. Without overcoming these challenges, regional cluster organisations will not be able to use their full potential to advance smart specialisation and digital transformation in the region. The solution to overcome present challenges is not to abandon the role of innovation clusters and cluster organisations as central innovation actors, but, on the contrary, to upgrade the current cluster policy and cluster model so that Piedmont's regional clusters can better respond to changing industry needs, regional innovation and development objectives.

Piedmont's innovation cluster organisations have contributed significantly to the competitiveness of their member companies (IRES Piemonte, 2020[11]). This contribution is evidenced, for example, by a 6% average increase in annual firm revenue among cluster members in the first three years of membership[2]. Furthermore, belonging to an innovation cluster can be a decisive factor in a company's decision to innovate and to search for new business partners (OECD, 2020[12]). The contribution of innovation clusters to Piedmont's regional development is also illustrated by the level of R&D activity in the region (Table 4.3). Between 2017 and 2020, overall R&D investments activated by the cluster members amounted to more than EUR 200 million. Nearly 1 000 companies were involved in these activities, with a contribution of 2 100 full time equivalents (FTE)[3] of cluster organisation staff. Overall, contracts with a volume of over EUR 27 million were activated with research centres in R&D cluster projects (OECD, 2020[10]). This contribution, however, varies significantly by cluster. For example, while the *MESAP* Smart Products and Manufacturing cluster activated EUR 80 million in R&D investments, the *Pointex* Textile cluster activated EUR 21.5 million.

Table 4.3. Activated investments in R&D projects in million EUR by innovation cluster, 2015-2018

Cluster	bioPmed - Life Sciences	CGreen - Green Chemistry and Advanced Material	Clever - Energy and Clean Technologies	MESAP - Smart Products and Manufacturing	Pointex - Textile	Polo Agrifood	Polo ICT
Amount of R&D activated in million EUR	31.9	35	56.3	80	21.5	35.8	41.8

Source: (EOCIC, 2018[13])

Despite the successes, there is a pronounced risk that the performance of innovation clusters in Piedmont will decline over time, reducing their ability to support industrial transition. A gradual decline could set in if the regional innovation clusters are unable to adapt to changing markets and new technologies. This is well explained by the cluster life-cycle model (Box 4.1). The model argues that innovation clusters undergo different stages of development, starting with their emergence and followed by stages of growth, sustainment and potentially decline. Decline can be avoided if innovation clusters manage to a) renew and grow their membership base and activities, and b) adapt to changing market and technology needs. Piedmont's innovation clusters, and particularly its cluster organisations, were created in 2009 and re-organised in 2015, and were marked by an initial phase of growth. There are a number of arguments, elaborated in the bullet points below, indicating that Piedmont's innovation clusters have reached a stage of sustainment, which leads to decline if no action is taken:

- Many innovation actors perceive the cluster organisations' role to be one of facilitating access to Cohesion Policy funds. This means that those firms that do not wish to apply for such funding (due to lack of need, or due to excessive administrative burden) or do not have the capacity to participate in R&D networks, do not join cluster organisations. This perception may be compounded by the fact that the innovation cluster networks cover a limited number of firms, which further restricts the scale of their activities. This has several implications. First, small, and especially micro, companies shy away from cluster organisation participation, as they do not feel "ready" or "innovative enough" to participate in cluster activities or might not have the financial resources for membership. Second, especially for SMEs, innovation is more about organisational and management innovation, which cluster organisations are not perceived as supporting. Third, cluster organisations may find it

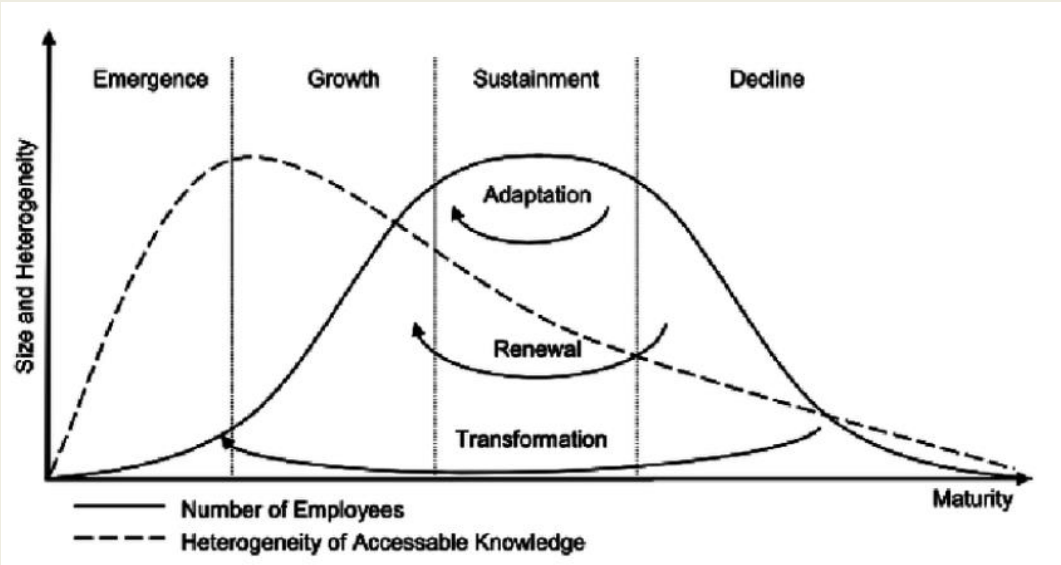
difficult to establish closer relationships with universities because the universities do not consider them as true counterparts in their work (OECD, 2020[12]). More and better engagement with the universities could help develop the cluster organisation/university relationship and expand innovation opportunities for both.

- Coverage of the industry is moderate for some clusters and cluster organisation membership is stagnant. One of the major criticisms of Piedmont's cluster organisations by regional innovation stakeholders is their lack of effort to engage with an increasing number of firms, especially small and micro-enterprises (OECD, 2020[12]). This might be related to the narrow sectoral focus of some cluster organisations. While some concentrate in broader and/or more traditional industrial sectors, such as the agri-food and textile clusters, other cluster organisations are more focused, such as the energy and clean technology cluster. It might also result from a political choice to focus regional policies on supporting R&D innovation, with potentially insufficient policy support for non-R&D innovation. Non-R&D innovation encompasses innovation methods that do not involve R&D activities, such as product or process innovation, and it can be just as powerful as R&D innovation. If the region would like to use cluster organisations to support innovation and innovation diffusion in small and micro firms that are not active in R&D innovation, then the scope should be broadened. This includes expanding the definition of innovation and matching the support and activities offered by clusters to the needs, interests and capacities of small and micro firms that do not have sufficient internal innovation capacities.
- Innovation clusters reinforce incumbents but do not always encourage industrial diversification. There are unexploited opportunities for cross-fertilisation among Piedmont's clusters. An innovative technical solution can often be transferred across sectoral value chains, which may lead to the emergence of new products or the transformation of processes that had previously appeared unrelated. Research and innovation projects managed by the region's clusters should not be strictly limited to projects falling within their scope of activity.
- There is a lack of collaboration among innovation clusters, organisations, and other actors in Piedmont's regional innovation system. For example, innovation clusters do not yet systematically capitalise on the strengths of Piedmont's three public universities. There is also little cooperation between the innovation clusters and the university incubators, although this is linked to 2014-2020 regulations that hinder start-ups from participating in projects supported by EU Cohesion Policy funds. Specifically, companies that wish to tap into these funds must prove a certain number of years of established economic returns - something that is not possible when a company is young. However, the region should take action to overcome this shortcoming, for example by launching a specific call targeted at start-ups and where they do not have to meet the same requirements as in the "regular" R&D calls. Finally, little cooperation takes place between cluster organisations and private sector actors, such as the bank foundations (OECD, 2020[12]).
- Some cluster organisations provide strategic guidance for future industry developments, but not all appear to have the capacity or willingness to do so. Cluster organisations could potentially play a greater role in vision-setting for regional innovation policies by contributing to the development and communication of medium- and long-term research and technology development objectives and maintaining close contact with the European Technological Platforms. For this to occur, each cluster manager would need to have the required competencies and industry experience. Such expertise may not be equally distributed among Piedmont's clusters (OECD, 2020[12]). Cluster organisations in Piedmont could also go further with new policy approaches and integrated strategies to solve regional societal and environmental challenges.

Box 4.1. The cluster life-cycle model

Innovation clusters follow different developmental stages: emergence, growth, sustainment and decline. A cluster's transition from one stage to another is based on learning processes among the cluster members and the resulting changes in the cluster knowledge base's heterogeneity. To move from the emergence to the growth stage, a thematic focus is necessary. During the growth phase, the number of firms that form the cluster grows, the firms themselves grow in terms of employees, and the firms become increasingly interconnected. Cluster members learn from one another through observation, interaction and cooperation. This leads to an initially high rate of innovation activities. But, at the same time, knowledge heterogeneity in the cluster decreases and firm knowledge bases become increasingly similar. Therefore, in the sustainment stage new knowledge needs to be brought into the cluster. Such knowledge needs to maintain a level of heterogeneity that is high enough for the cluster members to learn something new from one another, but at the same time low enough that the members in the cluster can benefit from synergies and agglomeration externalities. When the cluster does not increase knowledge diffusion, local actors may be attracted to inferior routines and solutions. The automobile cluster in Detroit is an example of this. After the growth stage with extensive funding for start-ups, this cluster relied extensively on leading companies such as Chrysler and Ford without bringing in new knowledge and eventually declined. Examples of sustaining clusters that managed to escape decline can be found in Baden-Württemberg. Those clusters constantly renewed connections of companies within the cluster to outside companies.

Figure 4.3. Quantitative and qualitative dimensions of the cluster life-cycle model



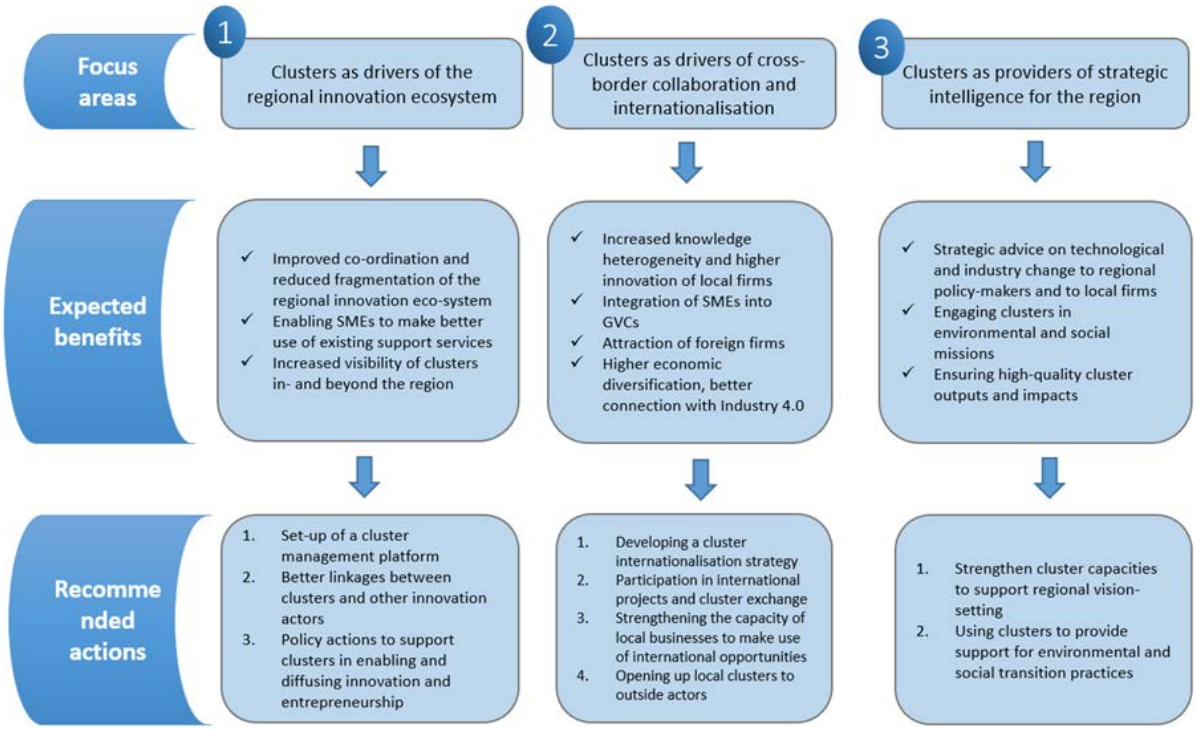
Source: (Menzel and Fornahl, 2010[14]) (Andersson, Evers and Griot, 2013[15])

Towards an upgraded cluster policy for Piedmont

Supporting industrial modernisation through innovation clusters and avoiding cluster decline requires relevant stakeholders, such as policy makers in Piedmont, to investment in maintaining strong, professional clusters. To stay relevant for the region, the innovation clusters in Piedmont need to create high value for the region in the form of innovation, knowledge provision, growth, solutions to societal challenges, international collaboration and attracting investments. To fully utilise the potential of their

innovation clusters, policymakers in Piedmont may want to pursue action in three areas that are associated with supporting innovation and productivity growth through clusters, and that need to be strengthened in the current Piedmont cluster model (Figure 4.4).

Figure 4.4. Overview of proposed strategic goals, expected benefits and recommended actions of a revised cluster model for Piedmont



Source: OECD elaboration.

Action in the three focus areas should underpin regional cluster policy objectives to build a cohesive cluster structure, new emerging growth areas, innovation in industries, as well as inclusive development throughout the region. It should further ensure an effective and cohesive cluster infrastructure in Piedmont that is attractive to enterprises (both SMEs and large enterprises) as well as knowledge institutions and other relevant innovation actors. In more specific terms, the objectives of each focus area are:

- To strengthen collaboration among the different innovation clusters and their managing organisations, and with other actors in the regional innovation ecosystem, so that greater cohesion and synergy is created within the regional innovation ecosystem and in overall innovation and enterprise policy efforts (Focus area 1).
- To strengthen the internationalisation of Piedmont's innovation clusters so enterprises can access leading international knowledge and international business partnerships (Focus area 2).
- To ensure the innovation clusters contribute to new and emerging priorities in innovation and regional development, such as the digital transition and the transition to a net-zero economy (Focus area 3).

This can be achieved through the delivery of a joint and coordinated cluster policy by the regional government and the individual cluster management organisations. It should be noted that this vision and

the objectives do not stand in contrast to the current cluster policy objectives. Instead, they aim to further strengthen the role of clusters as innovation actors in the regional innovation ecosystem and to help the clusters, and cluster organisations, take on new roles and responsibilities in response to current megatrends and changing regional development needs (see Chapter 1).

The remaining sections of this chapter assess the status quo in Piedmont for the three proposed focus areas, including urgent bottlenecks and major challenges for the region. For each of these areas, the current cluster model in Piedmont will be evaluated in light of today's biggest challenges, such as the COVID-19 pandemic and megatrends (e.g. globalisation, digitalisation and new technologies, and the transition to a climate-neutral and circular economy), and against international good practices. Recommended policy actions are proposed to address the cluster-related challenges confronting innovation policy and its implementation. Importantly, challenges to innovation and innovation policy cannot be viewed in isolation but are interdependent. For example, integrating SMEs into global value chains requires providing them with access to foreign markets, and enhancing the ability of companies to use such opportunities. Since effective cluster policies need to take into account complementarities between different pillars of innovation support, the following analysis emphasises potential overlaps and complementarities of policies in the various areas of cluster and innovation policy in Piedmont.

Focus area 1: Innovation clusters as drivers of the regional innovation ecosystem

A variety of regional stakeholders working for the clusters, universities, incubators and the non-profit foundations have shared their desire for innovation clusters, and cluster organisations, to take on a stronger role in connecting different regional industries to strengthen the regional innovation ecosystem (OECD, 2020[12]). Local industries in Piedmont are increasingly interconnected, for example in the ICT and the agriculture industry. Better coordination of innovation activities through the innovation clusters would support local companies so they can learn about the interconnectedness of regional industries and value chains and develop new products or business models based on emerging industries and niches. This would not just benefit local firms but also strengthen the role of innovation clusters as drivers of the regional innovation ecosystem.

Using clusters to strengthen the regional innovation ecosystem requires two lines of action. First, strengthening coordination and collaboration *among the existing innovation clusters*. This can enable knowledge and innovation spillovers between clusters and give cluster organisations a more central role as services providers and innovation advisors. Leveraging the knowledge, capabilities, and local specificities of innovation clusters to strengthen economic diversification will likely imply creating a joint cluster management structure. Second, improving the coordination *between clusters and other actors in the regional innovation ecosystem* could enhance the cohesion of regional innovation support efforts. This involves using clusters and cluster organisations more effectively to better coordinate university-industry collaborations, match regional skill supply and demand, and provide support to SMEs and entrepreneurs.

Improving cluster collaboration within the regional innovation ecosystem

Collaboration among individual regional cluster organisations needs to improve for several reasons. First, closer collaboration among the clusters will support industrial diversification. Industrial diversification refers to firm-level processes where knowledge and resources from existing industries are used in new industries. The literature differentiates between two concepts: so-called related and unrelated variety (Content and Frenken, 2016[16]). Related variety refers to different industries that build on similar types of knowledge. Diversification based on related variety is a process where firms mainly diversify into technologically related products (Boschma et al., 2009[17]). For instance, the maritime industry may apply competencies originally used to install oil platforms to the installation of offshore wind parks, thereby moving into the renewable

energy sector (Grillitsch and Markus, 2018[18]). By contrast, unrelated variety refers to industries that do not share similar knowledge. Industrial diversification (i.e. a more diverse productivity and trade structure) will be important if Piedmont is to move along its trajectory of industrial transition. Second, and looking ahead, clusters must be prepared to embrace global megatrends and their impact on Piedmont's more traditional and low-tech industries, such as manufacturing or agriculture. Some megatrends relate to the diffusion of new disruptive technologies (e.g. automation). Others are more closely related to demographic, socio-political, environmental and economic shifts (e.g. ageing, the transition to a green and circular economy, and increased urbanisation). They affect business models, create incentives or barriers to developing new markets, alter employment and productivity patterns, cause shifts in skill requirements and disrupt existing value chains (OECD, 2019[7]). These megatrends will likely blur the boundaries of traditional industries and, with that, the boundaries of the existing industry clusters, as well. Clusters will need to collaborate with each other to make sure that local companies are able to benefit from these megatrends and develop new lines of business. Third, closer cluster cooperation and collaboration will become even more important if the Piedmont government decides that cluster organisations should offer more services and reach out to more firms. Increased collaboration allows the cluster organisations to offer a broader spectrum of activities than a single cluster could afford and it brings together expertise and knowledge from different industry sectors.

A cluster management platform could promote synergies and foster cross-sector diversification

A cluster management platform helps disseminate information and know-how to and among the cluster management organisations and can help strengthen their role as drivers of the regional innovation ecosystem. Past cluster analysis shows that merely providing funding to individual cluster management organisations is not always the most promising way to achieve sustainable cluster development (Mueller et al., 2012[19]). One way of better coordinating and integrating cluster activities is through a cluster management platform. Such a platform can take various forms (Kergel, Meier Zu Köcker and Nerger, 2014[20]). It can be part of a broader regional development agency, a regional innovation agency, or a dedicated cluster secretariat serving all regional clusters. Whatever the design choice, each individual cluster needs a point of contact with the management platform or at least one staff member who is employed directly by the platform. This point of contact should assist the individual cluster management and provide information on the various schemes and initiatives provided to support cluster managers. A cluster management platform can provide support services to individual cluster managers, and boost networking among clusters to foster cross-cluster and cross-sectoral collaboration, including internationalisation activities (OECD, 2009[9]). The cluster management model established in Baden-Württemberg, Germany offers a good example of a platform that combines an overall cluster portal with a cluster agency providing dedicated services to cluster managers (Box 4.2).

Box 4.2. *ClusterAgentur*: Baden-Württemberg's regional cluster agency

In Baden-Wuerttemberg (Germany), there are a considerable number of well-established regional clusters. Practical experience highlights that close relationships between the cluster management organisations and the respective member companies can create concrete added value for their members. This is the case for finding new business partners or entering into new collaborations with regional universities. This in turn calls for a high level of professionalisation and individual, demand-oriented services on the part of the cluster and network management.

The region's cluster agency, *ClusterAgentur,* is a service provider for the regional cluster initiatives, networks and cluster policy in the German region of Baden-Wuerttemberg. The cluster agency's objective is to train the cluster managers to offer their members tailor-made services. Together with the cluster initiatives and regional networks in Baden-Wuerttemberg, *ClusterAgentur* develops new services to be implemented by the clusters in joint initiatives with their members. Furthermore, *ClusterAgentur* assists the Ministry of Economic Affairs, Labour and Housing in implementing the objectives of Baden-Wuertemberg's cluster policy.

ClusterAgentur is operated in a close partnership among actors from VDI/VDE Innovation + Technik GmbH, the Steinbeis-Beratungszentren GmbH and the Baden-Württemberg International GmbH, which are all companies that provide innovation and technology services. There is also close cooperation with the various federal agencies in Baden-Wuerttemberg.

Source: https://www.clusterportal-bw.de/en/

Cluster management platforms can offer a broad spectrum of cluster support services ranging from a "one-size-fits all" concept to very individualised support services. The following types of support can be distinguished:

- General support activities offered to all cluster management organisations, for example public relations and marketing or cluster branding.
- Specific training focused on a particular technological and/or industrial sector or on the individual needs of a smaller group of cluster management organisations, for example on Industry 4.0 applications.
- Very specific and individual activities meeting the special needs of a single cluster management organisation, for example with regard to managerial and technical support (OECD, 2018[21]).

Offering very specific direct support and coaching to cluster management organisations is probably the most challenging type of service. It must be implemented in a tailored fashion, and must consider the individual needs of a cluster management organisation, as well as the overall objectives of the cluster. Therefore, when establishing such a support structure it is important to know what type of support service is needed and what type of service provider (with which competences) is most suitable to provide such services. In Lower Austria, Austria, the regional government charged the Lower Austria Regional Development Agency *ecoplus* with hosting the cluster management for all of the region's clusters. The agency hired a cluster manager and a cluster management team to support individual cluster organisations with advice, training, and information. An evaluation of the approach identified the following key factors of success in the Austrian context (Kergel, Meier Zu Köcker and Nerger, 2014[20]):

- Communication between the service provider (*ecoplus* in the case of Lower Austria) and the cluster management organisations is based on trust. Both groups need to perceive themselves and each other as partners. Cluster managers should not fear any negative impact or

consequences when talking about areas that need improvement and/or where training might be appropriate,

- All parties share a common understanding of the main purposes of the support services offered. The demand for additional training and support services shall not be considered a failure of the cluster management organisation, but rather as an opportunity for improvement.
- The implementation agency has sufficient knowledge of cluster management issues and current industry trends in order to be accepted by the cluster managers. Training measures should be demand-oriented, tailor-made and of high quality to ensure high levels of service acceptance and impact.
- Feedback loops after each training to ensure follow-up and/or further improve services, where needed.
- Conflicts of interest are to be avoided but could occur when the implementation agency is responsible for making decisions on cluster funding while also tasked with coaching or training a cluster management organisation on how to apply for and win funding from the same organisation.

Assigning an existing regional institution with the task of supporting the overall cluster management or creating a new agency to perform similar tasks may be considered unfeasible for financial, administrative or political reasons. If so, overall cluster management can also be supported through measures such as drumming up cluster manager participation in courses or workshops that seek to strengthen their skills in facilitating inter-cluster collaboration or exploring joint solutions to specific problems that arise in the different clusters.

Cluster management organisations can also facilitate networking and support economic diversification strategies. The benefits of regional industrial diversity have long been advanced as a fertile ground for new ideas and innovations (Jacobs, 1969[22]; Koo, 2007[23]; Frenken, Van Oort and Verburg, 2007[24]) (Koo, 2007[23]). Clusters can support economic diversification by promoting knowledge spillovers and by facilitating joint activities. The region of Bremen, Germany provides an example of how a diversification strategy can be pursued through a cluster management platform (Box 4.3).

Box 4.3. Economic diversification through clusters in the region of Bremen, Germany

Bremen's smart specialisation strategy builds on three main clusters: i) offshore wind energy; ii) maritime industries and logistics; and iii) aerospace and aeronautics. The regional development agency, *Wirtschaftsförderung Bremen WFB,* is responsible for the overall management of innovation and economic development policies in the region. Individual clusters are coordinated by a cluster manager and support staff working within the WFB. Combining dedicated staff for each cluster and ensuring that they work for the same agency creates opportunities for cross-sectoral coordination.

One such opportunity was the development of the Maritime Safety and Security project, which was coordinated by the cluster manager for maritime industries. The manager identified a wide range of stakeholders connected to the maritime industries, including firms, research institutes, and universities, and discovered that there was a group dedicated to marine safety. They created a network in 2010, called Marissa, with monthly meetings that attracted over 20 partners, to discuss and identify new market opportunities. The firms involved include Airbus-Astrium, a satellite company of Airbus specialised in military applications but that also builds satellites for maritime applications; a company that builds drones; maritime companies like Atlas, specialised in underwater systems; and a company that builds radar systems. The WFB also developed relationships with the federal government and EU organisations.

Such a project can promote developing applications for the off-shore wind industry for example, that must manage huge volumes of staff movement between land and sea. The WFB helped obtain funding for research projects, created a bridge between business and politics, and lobbied the government to obtain favourable conditions for these firms. This network led to the creation of a data fusion centre that could provide real-time data on a wide range of conditions at sea. These data could be used by clients in the off-shore wind industry, or in ship transportation, to deal with safety and security issues, including piracy attacks on container ships. This is being developed by private partners, but the WFB was involved in helping write the funding application and had coordination responsibilities.

Source: (Marques, 2021[25])

Using clusters to support university-industry collaboration

There is potential to strengthen the interaction among Piedmont's knowledge institutions and the clusters. Doing so can create greater cohesion and synergy in overall research and innovation policy activities, which seem sometimes disconnected in Piedmont, especially with regard to supporting innovation diffusion in lagging companies (OECD, 2020[12]). A principal purpose of regional clusters is to build knowledge bridges between knowledge institutions and the business community, thereby enabling new research and knowledge to be quickly and efficiently shared and utilised (OECD, 2009[9]). One particular task of regional innovation clusters is to offer enterprises a single access point to the various knowledge institutions that exist within the network's professional field, including the regional universities and training institutions.

Strategic collaboration between clusters and universities on regional knowledge transfer

The regional government of Piedmont should encourage universities to strengthen their engagement with the innovation clusters in order to deepen knowledge exchange with the local business community. Clusters can be a particularly effective instrument to promote dialogue among educational institutions and Piedmont's many SMEs that do not currently engage with a local university. The collaboration can focus on delivering collective dissemination of knowledge to cluster enterprises, providing easier access for clusters and their members to research findings and infrastructure, as well as facilitating greater

involvement of SMEs in collaboration projects. Today, universities in Piedmont participate in the work of clusters as part of joint project work in (EU-) funded R&D projects, but there are opportunities to strengthen their engagement with local industry. To structure the dialogue with universities, the regional government will need to boost its active engagement with key university representatives and identify how to strengthen their strategic collaboration with clusters and cluster organisations. The region could, for example, integrate both cluster managers and university representatives in continuous stakeholder engagement roundtables on regional innovation policy. Doing so would enable Piedmont's universities to reach out to companies, particularly SMEs, in the region that do not yet work with the universities. Other possible measures include student placement schemes, or the development of curricula that are linked to industry needs.

Strengthened interaction on education programmes that match the needs of companies

Cluster organisations in Piedmont should further support the co-creation and development of educational material and curricula. Currently, clusters communicate industry needs mostly to the *Istituti Tecnici Superiori* (ITS), but less so to the local universities. Clusters could complement this by facilitating *ad hoc* partnerships between companies and universities to work on curriculum design and co-author educational materials when appropriate. This could allow companies to contribute to defining and developing the scope of curricula so that education programmes fit better with current and future skill demand. Working with local universities could also allow educators to enhance the level to which their curricula prepare students for their first jobs (OECD, 2020[26]). Partnerships with universities can also focus on reskilling or upskilling company employees. As part of a life-long learning effort, professionals could be enrolled in educational tracks tailored to their career phase and skills needs (OECD, 2020[27]). Creating such tracks requires intensive coordination between the companies and the universities on the partnerships and educational tracks' content and structure, and ultimately how they are developed and funded. Cluster organisations could facilitate this. This may, in turn, require financial contributions from the private sector (OECD, 2020[26]). The regions of North Middle Sweden (Sweden) and North Brabant (the Netherlands) provide examples of collaboration between higher education institutions and the regional business community (Box 4.4).

Box 4.4. Examples of collaboration between innovation clusters and higher education institutions

A recent survey conducted by the European Observatory for Clusters and Industrial Change (EOCIC) in 10 European regions found that there is significant room for improvement in terms of co-developing educational curricula with the private sector. In fact, less than 30% of survey respondents agree that joint curricula exist at university level. Examples from the North Brabant region in the Netherlands, and North Middle region in Sweden illustrate that collaboration between the regional business communities and higher education institutes can extend to the development of curricula and education policies to match industry needs.

North Brabant region, the Netherlands

In *Brainport Eindhoven*, located in the North Brabant region, technologies and networks are clustered around five thematic campuses in order to create economic value and facilitate business development. All of these campuses house a mix of companies and educational and knowledge institutes, thus allowing for cross-pollination between education and industry. Among other things, companies help define the curricula to ensure today's students learn the skills that those companies will need tomorrow. Likewise, the educational institutes provide interns and skilled professionals for the companies present on the campuses.

North Middle Sweden, Sweden

North Middle Sweden faces challenges in improving access to relevant competencies in the field of advanced manufacturing and biotechnology. In order to tackle the issue, the regional priorities of advanced manufacturing are integrated into education and training policies as a means to facilitate collaboration between companies and regional education institutions. For example, Karlstad University, which is represented on the board of one of the region's innovation clusters, has been working to diversify its education schemes according to the needs of regional businesses.

Source: (European Union, 2019[28]), (Brainport Eindhoven, 2020[29]), (Kristensen and Mikkola, 2016[30])

Cluster organisations can also support firm survival after they leave a regional university incubator. In addition to supporting training and education, universities increasingly generate new spin-offs and tech start-ups (Mathisen and Rasmussen, 2019[31]). They have become increasingly aware of the need to disseminate the knowledge within universities and of the economic and social benefits resulting from the transfer and commercialisation of academic knowledge. Piedmont hosts three university incubators, which, over time, have supported several hundred university spin-offs and technological start-ups. They offer working spaces, support in applications for seed funding, European funding and other types of financing, and mentoring. Cluster organisations could be particularly helpful to ensuring the survival of such firms, which is an issue that has been reported by many incubated start-ups emerging from the university incubators (OECD, 2020[12]). In order to do so, Piedmont's cluster organisations would need to broaden their scope of activity with regard to SME and entrepreneurship support.

Supporting skills for industry through clusters

Skills have rapidly risen to the top of the agenda for industry in Piedmont given global technological, environmental and demographic trends. These trends affect the demand and supply of different types of skills in place-specific ways. On the one hand, digitalisation and climate change are driving changes that demand particular skills. On the other hand, population ageing, which is a large problem in Piedmont,

influences the skill supply. Furthermore, the COVID-19 pandemic placed further and immediate pressures on Piedmont's labour market, also affecting skill supply and demand (Chapter 2).

Innovation clusters are an ideal focus for the collaborative dynamics essential to address regional skills shortages and mismatches. Cluster organisations can help match the supply of cluster specific skills to demand, a role that is particularly important for regions in industrial transition that struggle with high skills mismatches. By bringing together the triple helix (firms, higher education institutions and government) in a place-based context, clusters can provide critical mass and brokering capacity to effectively address regional skills imbalances (OECD, 2019[7]). Piedmont's clusters, and particularly cluster organisations, could, for example, raise awareness of skills imbalances, provide strategic intelligence on regional or sectoral trends, and communicate information on funding programmes and training initiatives. They could also design and implement *ad hoc* training activities (e.g. on cloud computing or cyber security). One concrete way of addressing skills mismatches in the region is to better link the regional clusters with the seven ITS.

Better linking clusters with the Istituti Tecnici Superiori

Links among Piedmont's seven ITS and the clusters could be further reinforced. Six of the ITS based in the region focus on technological/sectoral areas that are similar to those of the clusters, and one supports the tourism industry. The ITS, similar to vocational education and training (VET) in general in Italy, suffer from a poor reputation and low visibility despite high rates of student placement in regional firms. While the ITS are connected well to Piedmont's cluster specialisations, there are opportunities to strengthen their links with the clusters. For example, technological and industrial changes are happening fast. This means that education and training programmes should be revised regularly to keep up with industry demand. Cluster organisations are also well-placed to communicate changes in industry demand to the ITS, helping balance employer needs with the skills available or that could potentially be available.

The clusters should work with local companies to encourage employers to collaborate with ITS to upgrade specific skills of their staff. In many cases, workplaces need to be restructured to accommodate changing technological and industrial realities (OECD, 2020[27]). Cluster organisations in Piedmont can play a stronger role in encouraging employers to support ongoing skill acquisition and skill upgrading among staff. They could do so by offering their employees, including managers, the time needed to learn such skills. In addition, they could create incentives and rewards for learning and skill attainment. Importantly, the skills requested by industry are not merely technical. Facing the challenges of automation and artificial intelligence, future employees need to be increasingly creative, innovative and entrepreneurial, capable of building relationships, advancing research and strengthening their organisation (OECD, 2019[32]). In addition, Piedmont's cluster organisations could more proactively work with the ITS to accustom students to working in a multi-disciplinary manner (i.e. involving multiple research areas) or proactively learning about related industries (e.g. through shared classes among the ITS). This needs to start from day one of their technical education. Such initiatives would help generate and reinforce individual and cross-sector networks, and could eventually lead to greater ease in collaboration across industries, sectors and disciplines.

Supporting SMEs and entrepreneurship through clusters

Since Piedmont's cluster policy is generally linked to its innovation policy, the majority of cluster programmes attach great importance to innovation objectives. This takes place either by promoting collaborative R&D projects or by supporting the commercialisation of innovation or industry digitalisation. However, cluster programmes in Piedmont seem largely focused on supporting innovation and competitiveness in already innovative firms, and devote limited attention to promoting non-technological innovation in SMEs that need to raise their innovation absorptive capacity. One explanation for this is the importance given to the Technology Readiness Level of projects in regional funding calls. This has led

cluster organisations to focus mainly on companies that are open to technology-intensive projects. There is also little evidence of clusters being used to support early-stage entrepreneurship and start-ups within specific industries.

Why don't cluster organisations provide SMEs and entrepreneurs with adequate support? There are two reasons. First, other organisations within the regional innovation ecosystem, such as the bank foundations, also provide SME and entrepreneurship support. For example, the bank foundations recently collaborated to open a new accelerator for smart mobility (Box 4.5). Second, Piedmont's cluster organisations consider initiatives related to entrepreneurship, start-ups/spin-offs and scale-ups less important than other support measures (OECD, 2020[12]). Nevertheless, evidence consistently highlights that cluster policies and initiatives can be effective instruments for organising and delivering SME and entrepreneurship policies thanks to their bottom-up dynamics and ability to exploit synergies with other support services (OECD, 2019[33]).

Box 4.5. The Piedmont Smart Mobility Accelerator

The Piedmont Smart Mobility Accelerator provides access to a 90-day accelerator programme with personal mentorship, office and meeting space. The programme funds all types of tech-oriented start-ups, working in different industries and using diverse types of business models. Usually, ten companies are chosen per accelerator cycle. The 2021 Program of Techstars Smart Mobility took place in partnership with *Fondazione Compagnia di San Paolo*, *Fondazione CRT* and the Intesa Sanpaolo Innovation Centre. In addition to providing mentoring support, the programme provides each start-up in the accelerator with USD 20 000, which is commonly used as a stipend to support the living expenses of the start-up team. In return, the accelerator receives 6% equity in the company until the company raises a priced equity financing of at least USD 250 000.

Source: https://www.techstars.com/accelerators/smart-mobility

Piedmont should continue to make use of clusters to support entrepreneurship. Some cluster organisations are already very active in the promotion of start-ups and in linking innovative and entrepreneurial companies with academia. For example, the Bioindustry Park, which is the managing body of the bioPmed cluster, has been included as a best practice in the EOCIC "Smart Guide to Entrepreneurship Support through Clusters"[4], published in July 2019. The park functions as a hub between academia and industry. In addition, since 2016 the Environment Park, the managing body of the CLEVER cluster, has organised an annual Climathon. This is a hackathon aimed at generating new entrepreneurial ideas to fight climate change. In 2018, the city of Turin and the Environment Park were chosen by Climate KIC International to host the international Climathon event in addition to the local Climathon. Indeed, the 2019 Turin edition of Climathon[5] was the largest in Europe.

Current activities could be extended to reach out to SMEs with still low innovation capabilities. There are large differences among Piedmont's SMEs in productivity levels. There is also a relatively long tail of low-productivity SMEs at the bottom end of the productivity distribution. Cluster organisations could develop activities to strengthen SME management capabilities, including for example technology adoption and IT engagement, which is often a leading enabler for productivity-enhancing activities in SMEs (OECD, 2017[34]). Cluster organisations could also engage in facilitating mentoring activities. Mentoring can be a key tool for supporting the ambition and success of start-ups and scale-ups. Success depends on an expansive pool of mentors, together with support to mentors and entrepreneurs in establishing and operating mentoring relationships. In addition, clusters could better connect start-ups and scale-ups to existing venture capital fund networks in order to acquire external capital, which is currently lacking in the region, and more expertise in technologies and businesses.

As a general rule, cluster organisations often provide business support services for SMEs and entrepreneurship in partnership with different institutions. These are often other cluster organisations, universities, SME or industry associations, technical and vocational schools or the public sector (Lämmer-Gamp, Meier zu Köcker and Köhler, 2016[35]). These services are not only provided to support the creation of new business ventures but are delivered as part of a package of services that cluster organisations offer to their members (Table 4.4).

Table 4.4. Cluster organisation support service for SMEs and entrepreneurship

Dimension	Conditions supporting entrepreneurship	Instruments
Market conditions	• Access to domestic markets • Access to foreign markets	Distribution of information, networking, matchmaking, legal advisory services for export related activities, international cluster partnerships
Access to finance	• Access to public funding • Networking with private investors • Inclusion of financial institutions and venture capitalists	Distribution of information, networking and facilitation of contacts with investors, support and advice with submission of project proposals for public grants or loans
Knowledge creation and dissemination	• R&D investment • Technological cooperation between firms and other institutions, such as research centres • Technology dissemination	Project development, facilitation of contacts, matchmaking, support with the acquisition of public funding for innovation
Access to entrepreneurial capabilities	• Business and entrepreneurship education • Training and experience of entrepreneurs • Entrepreneurship infrastructure	Training and seminars, co/development of curricula and courses with academic and vocational training institutions, incubators

Source: Adapted from (OECD, 2019[33]; Lämmer-Gamp, Meier zu Köcker and Köhler, 2016[35]).

In addition to providing specific services to entrepreneurs, start-ups, scale-ups and SMEs, cluster organisations can also support entrepreneurship that is focused on new and emerging industries and/or serving environmental or social objectives. In these cases, the support does not target specific individuals or companies, but it benefits the entire cluster by stimulating demand for specific technologies (e.g. green solutions, digitalisation), leading to the development of new markets, supply chains and value chains. The region of Värmland, Sweden, has successfully used industrial clusters to support industrial modernisation, including among SMEs (Box 4.6).

Box 4.6. Towards a matured cluster ecosystem in Värmland, Sweden

Since the establishment of the cluster strategy "Värmland Model 2.0" in 2012, clusters have played an important role in the success of the regional smart specialisation strategy, facilitating and bridging local industry, including SMEs, and academia. Värmland, situated in North-Middle Sweden, is home to several strong clusters, including the Paper Province Cluster, the Compare Cluster, the Glava Energy Centre, the Steel & Engineering Cluster and Visit Värmland, a cluster linked to tourism. All clusters have a dedicated cluster manager, a team of cluster advisers and strong membership of local companies. The Paper Province cluster emerged out of the need to strengthen the pulp and paper industry after it faced international competition in the 1990s and early 2000s. The Compare cluster emerged as a way to fill a gap in ICT-related competences.

Clusters in Värmland fulfil several important cluster functions: they help fostering networks that enhance knowledge spillovers among actors within the cluster and outside; they represent their members on international markets; and they support the transition to industry 4.0 by identifying future skills and investment needs and actively participating in skills needs assessments.

One example of the success of Värmland's cluster strategy is the development of the bio-economy industry. Traditionally, the region has been dominated by pulp and paper, steel, and engineering. Since the 1990s, the region has experienced an ongoing structural change in the pulp and paper industry due to increased international competition and crises in the sector. Through a cluster approach, the region expanded from the traditional pulp and paper industry into a broader bio-economy model. The Paper Province Cluster became instrumental in bringing together the forest value chain as well as public authorities and Karlstad University to develop a vision for the regional industry. The Paper Province Cluster stressed that both 1) developing a strong vision on where to go with the bio-economy in the next 15 years and 2) active collaboration among stakeholders in the region to reach that goal have been instrumental in accessing funds for the region and driving industrial diversification. The cluster has also been instrumental in developing pragmatic and innovative solutions for local SMEs, for example through close collaboration and shared leadership with the company managers and study visits and exchanges with other clusters in Finland, Norway and Canada.

Source: (OECD, 2020[26])

Focus area 2: Clusters as drivers of cross-border collaboration and internationalisation

The discussion on strengthening internationalisation through clusters is not new. Some of the most successful clusters have always combined 'local buzz' with 'global pipelines' (Bathelt, Malmberg and Maskell, 2004[36]) and cluster initiatives frequently look beyond their traditional geographic boundaries for new opportunities. However, large-scale cluster policy programmes that simultaneously foster place-based innovation and internationalisation are scarce and their effects and limitations are not well understood yet (Dohse, Fornahl and Vehrke, 2018[37]).

In Piedmont, cluster collaboration occurs primarily within the region, leaving room to increase cross-regional and international collaboration. To continue the success of its regional innovation activities, it is crucial for Piedmont to improve its internal and external connections, prioritise complementarities and combine the various strengths of its clusters. To further develop the competitiveness of businesses and innovation, Piedmont should position itself in European and global value chains with the help of clusters. For this purpose, it should improve connections and cooperation with clusters in other regions within Italy

and globally that can connect local businesses with foreign innovation players. This is important for the internationalisation of companies, for attracting foreign partners and financiers to the region and for increasing participation rates in European projects, such as Horizon2020.

Most of Piedmont's clusters have established some international networks. International cross-border cooperation is somewhat limited geographically, taking place primarily with Piedmont's two neighbouring French regions: Auvergne-Rhône Alpes and Provence-Alpes-Côte d'Azur. There is room to further explore cooperation with regions in other neighbouring countries, for example in Switzerland. Piedmont's participation in EUSALP (the European Union Strategy for the Alpine Region) may contribute to expanding these opportunities, particularly given the macro-regional strategy's Thematic Policy Area 1: Economic Growth and Innovation (EUSALP, n.d.[38]). At the international level, most regional clusters have established networks related to their respective areas of interest. Some of these networks are informal, some have flourished thanks to the participation in EU-funded projects and others are the result of their membership in formal international cluster networks or associations. All of Piedmont's clusters are members of the European Cluster Collaboration Platform.

Cluster internationalisation helps to increase knowledge heterogeneity in Piedmont's clusters

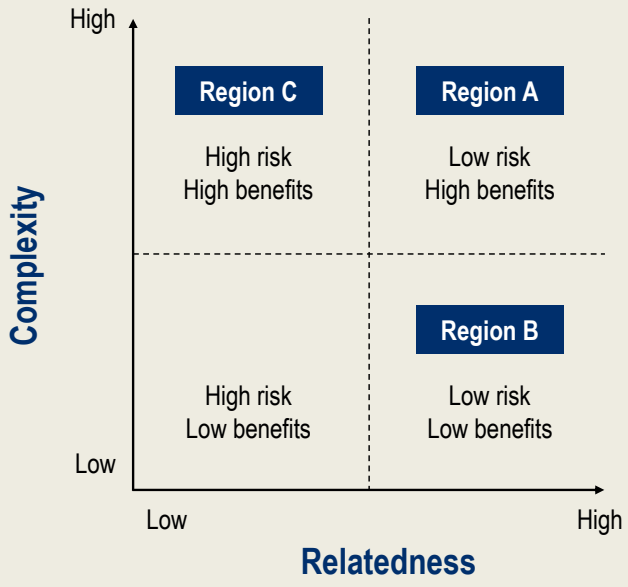
Cross-border collaboration and internationalisation can increase knowledge heterogeneity and introduce new and related economic sectors into a region. This is key in preventing an innovation cluster from slipping from sustainment to decline (Box 3.1). Clusters are well suited to support internationalisation because they can help firms overcome prominent obstacles to internationalisation, such as barriers to market entry, a lack of reliable or suitable business partners abroad, problems managing international activities, and culture and language barriers (Dohse, Fornahl and Vehrke, 2018[37]). Cluster organisations can support cluster members develop an internationalisation strategy or to find appropriate business partners. In addition, firms can benefit from cluster reputation effects (Li et al., 2019[39]). Small and young firms that often lack financial capacity and foreign experience can significantly benefit from information about foreign markets collected by the cluster organisations. They might also benefit from better access to finance if improved cluster reputation attracts more investors. However, there are other obstacles to internationalisation, such as regulatory barriers to entry for example, that cannot be tackled by clusters alone.

Cross-regional and international collaboration could strongly encourage economic diversification in Piedmont (Box 4.7). Arguably, the diversification of regional economic structures is one of the most important challenges for industrial transition regions (OECD, 2019[7]). According to recent academic research, diversification of regional economies through the emergence of new economic activity is more likely to happen with sectors that share a similar technology with sectors that already exist in the region[6]. Through internationalisation efforts, the cluster organisations could open their thematic boundaries to include high value-added technologies, industries or knowledge bases that are related to Piedmont's current specialisations. Such strategies could foster economic diversification (Balland et al., 2018[40]).

Box 4.7. The risks and benefits associated with different diversification strategies

There are different ways in which a region can support economic diversification, with different assumptions on what the benefits of diversification are and how cross-regional and international collaboration can contribute. Should a region pursue an incremental economic diversification strategy or strive towards radical diversification into sectors with no related knowledge? Unfortunately, no simple answer exists. The challenges to diversification are well illustrated in Figure 4.5.

Figure 4.5. The complexity/relatedness matrix



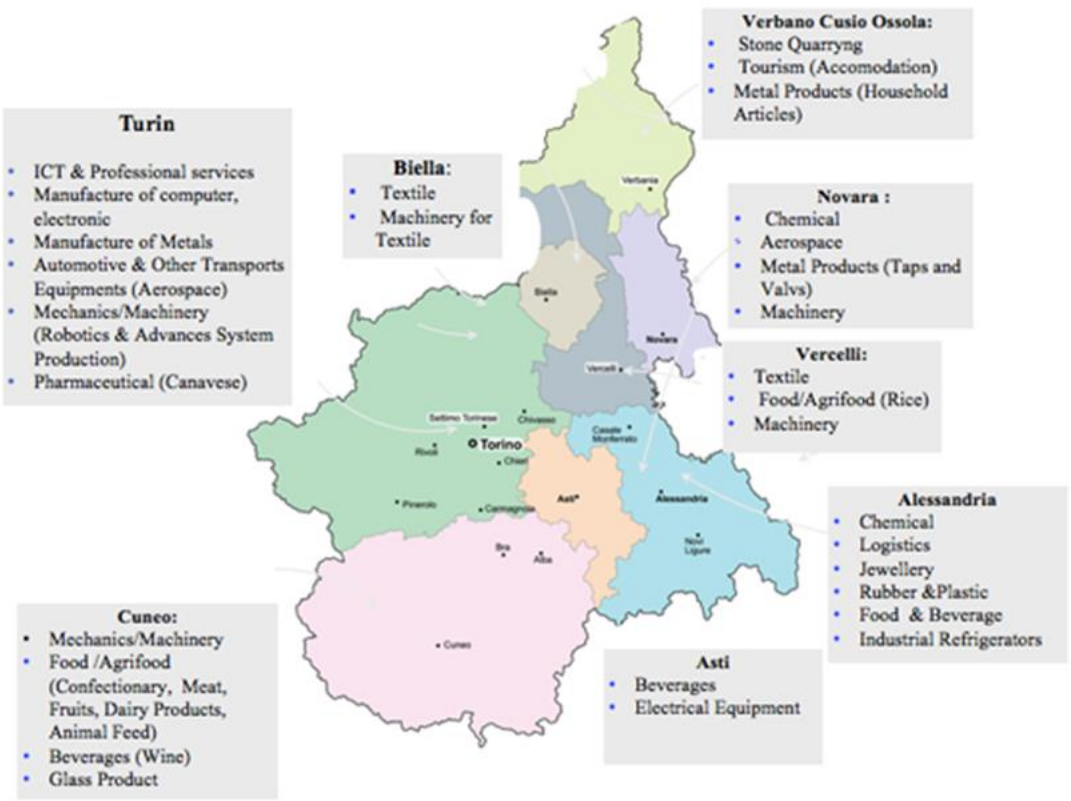
Source: (Marques, 2021[25])

Regions can pursue different types of economic diversification strategies. Such strategies can be either low or high in technological relatedness to current regional activities, as shown on the horizontal axis, and low or high in technological complexity, as displayed on the vertical axes. A low-risk/high-benefits situation (region A) occurs if a region invests in or attracts a complex economic sector that is also highly related to current strengths. A region that is investing in highly-related but low-complexity sectors (region B) would have a low-risk/low-benefits strategy, since the new sector would add little to the current context in terms of opportunities for innovation and productivity growth. On the other hand, a region attracting high-complexity economic activities that are not related to current economic structure (region C) would have a high-risk/high-benefit strategy, which could potentially pay off in terms of changing the growth path of a territory. But it would also involve a high level of risk-taking, which may be difficult for policy makers to accept. At the same time, relying too much on related economic structures may result in too many incremental innovations with rather limited economic potential in the long term. Hence, in order to create a long-lasting competitive advantage, more radical innovations may be necessary, too.

Sources: (Balland et al., 2018[40]) (Marques, 2021[25])

Piedmont's cluster organisations could enhance their contribution to economic diversification within the region and through internationalisation efforts. This in turn could help upgrade Piedmont's economic sectors, particularly those that are medium- and low-tech (e.g. agri-food or textiles). Piedmont's industry is primarily located in the area surrounding the city of Turin. Smaller industrial specialisations exist throughout the territory, such as agriculture and agri-food in Cuneo, textiles in Biella, water taps, valves and other machinery in Novara, and viticulture machinery and equipment in Asti and Alessandria (Figure 4.6). One way to accomplish this diversification and internationalisation is for the cluster organisations to open their thematic boundaries and add related technologies, industries or knowledge bases from inside the region of Piedmont. This is already happening in some industries. For example the environmental industries in Piedmont are associated with companies from several industries, such as chemistry, agriculture and renewable energies, that work jointly on innovations in the field of pollution management and cleaner technologies for farming (OECD, 2020[12]). Another option is to include knowledge from the thematic field of the innovation cluster but from different locations. This includes going international. Doing so could foster more complex and more innovative economic activities and could potentially reverse declining productivity growth over the past 10 years.

Figure 4.6. Productive specialisations in Piedmont



Source: (IRES Piemonte, 2021[41]; OECD, 2020[42])

When assessing whether focusing on cluster internationalisation efforts on a specific sector would be valuable, Piedmont should make sure that the sector is related to its current specialisations, and that it is a sector with high value-added, such as advanced manufacturing. This ensures that internationalisation efforts provide additional opportunities for innovation and productivity growth. The Cluster Partnership for Photonics for Advanced Manufacturing (PIMAP) has identified a series of success factors in internationalisation strategies, which might help Piedmont in its internationalisation efforts (Box 4.8).

Box 4.8. Lessons learned from the Cluster Partnership for Photonics for Advanced Manufacturing

Good practices on cross-sectoral cooperation and internationalisation

The Cluster Partnership for Photonics for Advanced Manufacturing (PIMAP) is led by four European clusters to support the adoption of photonics and microwave technologies for the development of advanced manufacturing and related industrial applications. The project provides a springboard for European cluster SMEs to internationalise towards the US and Canada. It is funded by the European Commission under the project call named "Cluster Go International", aiming at strengthening cross-sectoral cooperation and internationalisation of clusters and their members, especially SMEs.

The PIMAP partnership has identified a series of success factors and developed recommendations for collaboration with international markets and maximising its impact for SMEs:

- **Identify common market interests**: Exploring the grounds for cooperation is essential prior to entering international markets. It is essential to have a good knowledge of each partner needs and expectations. The PIMAP Partnership conducted an analysis of market trends and opportunities in the US and Canada to identify the main global trends and opportunities, major sector industrial associations and information regarding international trade.
- **Develop a common approach towards international markets and explore the needs of SMEs**: The development of a common approach towards international markets in alignment with SME needs creates a critical mass and facilitates their access to international markets.
- **Engage with international stakeholders**: Connections with stakeholders based in the own country such as Chambers of Commerce and accelerators facilitate market penetration.
- **Define Key Performance Indicators to monitor the results**: Key Performance Indicators (KPIs) measure the benefits of international activities by the clusters and its SMEs. KPIs from the PIMAP Partnership include (i) international third-country visits conducted by cluster managers to test the PIMAP concept and value chain; (ii) exchanging experience with cluster managers and Cluster Go International projects; (iii) participating in international matchmaking events; (iv) organising workshops, and (v) engaging with business networks and regional development agencies.

Source: (PIMAP Partnership, 2019[43])

Improved cluster collaboration and internationalisation requires several policy actions

Supporting greater internationalisation among Piedmont's clusters can generate greater knowledge exchange and encourage economic diversification in the region. The following actions are suggested to enhance cluster internationalisation in Piedmont:

Developing a cluster internationalisation strategy for Piedmont

It seems that some cluster organisations in Piedmont provide internationalisation activities to participating firms and research institutions, yet the region lacks a strategic approach to overall cluster internationalisation. A written and integrated internationalisation strategy would help ensure consistency in internationalisation efforts of clusters in space and over time and ensure broad support among all participants in the clusters. It could also help identify opportunities for cross-sector collaboration and closely align the regional internationalisation activities pursued by the regional internationalisation agency CEIP with cluster internationalisation activities. Such an approach would first require understanding the regional need for internationalisation. It is especially important to get this first phase right, so as to ensure 'buy in' among cluster members. It is also important to be clear about which countries and markets the clusters wish to target. Regional clusters should undertake a joint analysis of market trends and internationalisation opportunities in a coordinated fashion. This is currently not done in Piedmont (OECD, 2020[12]), but would help build synergies between clusters and explore foreign market opportunities that combine business activities from several clusters. Second, clusters also need to have access to the right competences and resources to be able to work internationally. Finally, the international work must be financed, which is something to address early in the strategy's planning. As part of the strategy, an action plan and clear milestones should be drawn up for all international activities. Finally, the momentum can be kept by maintaining and developing international networks and services. The Flemish Cluster Network, as well as the international agency of Baden-Württemberg in Germany provide examples of how regional innovation actors can support the development of cluster internationalisation efforts (Box 4.9).

Box 4.9. Examples of internationalisation support through clusters

The Flemish Cluster Network, Belgium

The Flemish cluster policy distinguishes two types of clusters: innovative business networks and spearhead clusters. Innovative business networks (IBNs) are populated by intensively collaborative organisations building innovation networks. The networks are expected to implement concrete action plans with a visible economic added value for each of the participating organisations. IBNs are typically small-scale initiatives with a support period of three years. This cluster type also includes mutual initiatives in emerging industries such as creative and digital industries. Spearhead clusters differ from IBNs in terms of scale, maturity, time horizon and ambition level. They are typically large-scale, ambitious and can receive up to 10 years of funding. They must be active in a domain that is of strategic importance to Flanders, which limits their number. Currently, there are six. The Flemish Innovation & Entrepreneurship Agency supports both types of clusters in their internationalisation efforts.

Baden-Wuerttemberg international, Germany

In Baden-Wuerttemberg, the regional internationalisation agency bw-I (Baden-Wuerttemberg international) provides different financial and advisory tools to support the internationalisation activities of regional clusters and networks. One of them is the possibility to obtain funding for the development of internationalisation strategies. These strategies define target markets and cluster-specific measures with a view to opening up to foreign markets. The agency also advises clusters on their strategies and helps find synergies between individual cluster strategies.

Source: (Baden-Wuerttemberg, 2021[44]) (Clustercollaboration, 2021[45]), (InvestinFlanders, 2021[46])

Participation in international projects and cluster exchanges

Through participation in international projects, cluster organisations and their members can find suitable partners and build trustworthy relationships, upon which further cooperation may be developed. While cluster organisations in Piedmont are supporting internationalisation activities, their breadth, scope, and coverage is not always clear. All regional clusters have developed some networks with international partners. Some cluster organisations are very active in using European and international platforms. Others, not so much (OECD, 2020[12]). Using the smart specialisation strategy (S3) thematic platforms created by the Joint Research Centre in Seville (Box 4.10) would allow Piedmont to coordinate with other European regions with similar industrial structures and apply for funding that would cover European-wide value chains. The S3 thematic platforms provide an interactive and participatory environment supporting inter-regional cooperation in smart specialisation in areas that are among Piedmont's regional strengths (e.g. agri-food and energy). Better cross-regional cooperation through smart specialisation could support internationalisation efforts by local firms. It could also push SMEs to work together to ensure that the value-added generated in value chains is more evenly distributed, and avoid arms-length behaviour from multi-nationals.

Box 4.10. S3 thematic platforms

Starting in 2015, the European Commission launched three thematic S3 platforms – in Agri-Food, Energy and Industrial Modernisation. The platforms offer participating clusters an opportunity to exploit synergies across partnerships and across sectors. Together, partner regions analyse and tackle various obstacles related to the implementation of their smart specialisation strategies. Thematic partnerships help regions to improve their regional knowledge base, leading to new paths of development and a better position in global value chains and to transnational joint innovation strategies.

Source: (European Commission, 2021[47])

Ensuring knowledge spillovers to local businesses not directly involved in internationalisation efforts

Piedmont's cluster organisations could further enable knowledge diffusion from firms participating in internationalisation activities to those that only conduct business domestically. Most firms that internationalise are usually already involved in funded R&D projects or have the capacity to access foreign markets. To make sure that internationalisation benefits also spill over to cluster members that are not directly involved in internationalisation activities – and to the economic cluster more broadly – cluster organisations could better prioritise the region-wide diffusion of contacts, knowledge, and good practices that facilitate internationalisation. Two important aspects need to be strengthened in Piedmont to influence knowledge diffusion. First, the possibility for intensive learning processes must be present in each cluster. These are strongly affected by the degree of social capital and by the direct and indirect links among cluster actors (Bathelt, 2001[5]). For example, such links can be established or strengthened through workshops and knowledge sharing events offered by cluster management organisations. Second, firms learn especially well from other actors that are comparable, i.e. in the same sector, with similar technological backgrounds, production processes, or similar in size or age. Cluster management organisations in Piedmont could use this "role model effect" to increase the likelihood that knowledge and information are incorporated by many firms. Several concrete practices can help knowledge diffusion (Box 4.11).

Box 4.11. Making use of knowledge-brokering practices to support SMEs in French clusters

Studying three French competitiveness clusters (Advancity, Axelera and Imaginove) based in the Ile-de-France and Auvergne-Rhône-Alpes regions, a recent analysis shows that innovation clusters can develop concrete practices to support knowledge exchange and foster open and collaborative innovation in clusters.

To facilitate access to knowledge by all cluster members, and especially SMEs, and to lay the foundation for knowledge sharing within and across regional clusters, the researchers observed several common practices implemented by the cluster governance in all three clusters:

- Monthly or bi-monthly meetings with a core group of 6-15 cluster members within a cluster to share experiences and identify new applications of technology.
- The creation of a collective identity at the cluster level to build cohesion between its members.
- The organisation of "speed meetings" between different cluster members to facilitate reciprocal discoveries and exchange.

Other networking devices followed, such as the Axelera Business Club, a club for SMEs to help them exchange good practices and develop business networks with larger firms, and the participation in professional fairs under a common banner to facilitate the access to external knowledge. Finally, the clusters also created collaborative innovation platforms as a tool to facilitate cross-fertilisation between industries. These platforms are physical spaces where tools, machines and resources are shared to facilitate the experimentation and the concrete implementation of the results of collaborative innovation projects.

Source: (Castro Gonçalves, Mitkova and Berthinier-Poncet, 2017[48])

Opening up local clusters to outside actors

Broadening cluster participation beyond the triple helix model can help Piedmont's clusters finance internationalisation activities. Even though, as stated earlier, the engagement between the cluster management organisations in Piedmont and academia can be improved, in general terms, both work with the triple helix model and emphasise the involvement of public and private actors plus academia in knowledge exchange and collaboration. However, the triple helix can become too restrictive. Two additional groups of partners will make cluster development much more effective, especially for internationalisation. These groups are the third sector and financial investors, including venture capital, business angels, banks, etc. At the various stages of cluster internationalisation, different levels of financing will be required that will need to come from a variety of sources. Including foreign firms, entrepreneurs from other fields (in particular ICT) and private risk capital could help Piedmont's clusters internationalise while also leveraging the necessary financing for local business innovation, including specific activities related to start-up acceleration and growth (OECD, 2020[12]).

Aligning internationalisation activities between the clusters and the foreign direct investment agency

Cluster internationalisation is an important tool for attracting foreign firms or investors. OECD experience has shown that regional foreign direct investment (FDI) strategies and cluster internationalisation strategies are not always well aligned (OECD, 2020[8]). This is particularly true if cluster management organisations target internationalisation activities to specific sectors or technologies, while FDI agencies have either

different or ill-defined priorities. At the same time, cluster internationalisation can help build FDI if the cluster develops an international reputation that attracts foreign investors (Andersson, Evers and Griot, 2013[49]). There seem to be some cooperation between the regional FDI agency *Centro Estero Internazionalizzazione Piemonte* (CEIP) and the clusters in Piedmont, but it takes place mostly on an *ad hoc* basis. It would be important for changes in cluster policy to ensure that any planned cluster internationalisation strategy aligns well with the strategic priorities of the regional FDI agency, and, ideally, vice versa.

Focus area 3: Clusters as providers of strategic intelligence for the region

Cluster organisations in Piedmont should serve their member companies, and support regional policy makers with strategic policy and sector intelligence. Some innovation clusters in Piedmont seem to be on top of technological and market developments in their thematic field. Yet, there is room to improve the ability of others in the use of strategic foresight tools and to develop technology roadmaps that help design regional innovation policy objectives. Cluster organisations can provide important guidance to local and regional policy makers and other stakeholders for developing future-proof innovation policies in important strategic areas, such as fostering the digital transformation and the transition to a net-zero carbon economy (Derlukiewicz et al., 2020[50]). Furthermore, based on their close collaboration with leading private industry firms, cluster organisations can help generate strategic intelligence for longer-term market and technological developments, which can and should inform the design of regional development and innovation policies (Dohse, Fornahl and Vehrke, 2018[37]). Cluster organisations and the regional policy makers in Piedmont should work together to design and implement foresight and technology assessment processes and roadmaps. They can provide decisive tools for strategic knowledge generation and transfer into new products and services and advance the regional agenda to use innovation and innovation policy for public missions.

Developing and implementing strategic foresight and technology roadmaps through clusters

One way for cluster organisations to support regional development is to develop technological and industrial roadmaps and strengthen foresight capacities. Such roadmaps should illustrate how Piedmont's industries can contribute to a green and digital transition and support broader regional development objectives. Such roadmaps can be developed with a set of foresight techniques that clusters in Piedmont do not yet use (OECD, 2020[12]). Foresight is about bringing together the key stakeholders of a region, or cluster, in order to think about the economic future and take the action that may be required (OECD, 2020[51]). It is a useful public private partnership economic development tool not least because it helps build trust and confidence among stakeholders. A key objective of foresight is to ensure that all relevant stakeholders have ownership of the strategy development process and a common understanding of problems and solutions. A range of formal techniques, from horizon scanning and megatrend analysis, to identifying a number of different plausible future scenarios, can be used for foresight analysis (Box 4.12).

Box 4.12. Strategic foresight methods for regional innovation policy

- **Horizon scanning**: seeking and researching signals of change in the present and their potential future impacts. Horizon scanning is the foundation of any strategic foresight process. It can involve desk research, expert surveys, and review of existing literature.
- **Megatrend analysis**: exploring and reviewing large-scale changes at the intersection of multiple policy domains, with complex and multidimensional impacts in the future.
- **Scenario planning**: developing multiple stories or images of how the future could look in order to explore and learn from them in terms of implications for the present.
- **Visioning and back-casting**: developing an image of an ideal (or undesirable) future state, and working backwards to identify what steps to take (or avoid).

Source: (Hynes, Lees and Müller, 2020[52])

Piedmont's regional clusters can make use of foresight analysis through technological roadmaps. In a cluster perspective, road mapping is similar to foresight although it clearly focuses on the implementation steps needed to get from A to B (Piirainen, Tanner and Alkærsig, 2017[53]). The first stage of road mapping is to identify the objectives. Is the objective to identify a completely new product? Or to improve aspects of an existing product? Or is it to switch from one type of technology to another? The second stage is to use strategic foresight tools (Box 4.12) to identify new areas of science, emerging technologies, and changes in markets – these are the parameters that help inform strategic choices. These two stages are not necessarily chronological and will clearly interact. The third stage is to determine how the objectives can be attained. The outcome of a road mapping exercise will be a schematic illustration of project actions, milestones and timelines. It will identify the new product, as well as those technologies needed to produce it. The action plan will show how those technologies can be created or acquired. Roadmaps can be created by a relatively small group of experts (from science, industry and end-users) but in a cluster perspective it is a good idea to involve all main cluster stakeholders in the process (Gheorghiu, Andreescu and Curaj, 2015[54]).

Foresight exercises are suitable and feasible only when clusters already have some experience working together, and when firms in the cluster are not in direct competition. It is often at the interface of different clusters that many innovation opportunities may be found, which means that cross-cluster collaboration in developing technology roadmaps based on foresight exercises is important (OECD, 2019[7]). Therefore, in a first step, Piedmont should benchmark current foresight activities in its existing clusters to understand how the tools described above are already used and by whom, and explore interests in collaborating among clusters. These questions can be answered using a semi-structured questionnaire or interviews. Following this step, a series of moderated workshops should be organised by the Piedmont regional authorities and cluster management organisations to compare and contrast stakeholder views about the future with the most up-to-date research on real trends. This approach stimulates debate amongst stakeholders. The aim of the workshops is to achieve a consensus position on action priorities and to identify areas for collaborative actions by each cluster. The foresight exercise conducted by the region of East and North Finland (Box 4.13) is an example of how examining skill needs helps re-skill workers, enabling them to participate in the changing economy.

Box 4.13. Regional foresight in East and North Finland

In east and north Finland, regional foresight coordination is a statutory responsibility of regional councils, and duties related to it are set out in the Act on Regional Development (1651/2009). The objective of the regional exercises is to monitor the regional operating environment, and identify changes in industry sectors, as well as in the needs of the labour force and its existing skills and expertise. Region-specific operational foresight platforms guide the foresight work in each region.

A key success factor of regional foresight work in Finland is cooperation among different relevant actors in order to create a shared understanding of future challenges and opportunities in the region, as well as a shared vision around future development objectives and the necessary means to reach set targets. Each region has launched place-specific regional foresight models and produced local analysis reports that feed into the support of regional policy strategies and programmes.

Source: (OECD, 2019[7])

Two difficulties need to be kept in mind when thinking about foresight and technology roadmaps. First, future events and trends or technological progress are very hard to predict with any degree of accuracy. This means road mapping must continuously use the best current strategic intelligence available and remain open, flexible and constantly under review. Second, even the best policy planning cannot foresee all possible eventualities and a range of policy related problems can occur, the COVID-19 pandemic, for example. This is why it is important to build consensus on the future development path of regional industries before introducing a new policy initiative.

Using clusters to support social and environmental innovation practices in Piedmont

Clusters can be important contributors to meeting sustainable development aims. According to the academic literature, clusters can contribute to sustainable development by developing new and sustainable technologies for emerging industries, creating new business activities, raising sustainability issues with major technology companies, and connecting local firms to sustainable value systems (Derlukiewicz et al., 2020[50]). In addition, clusters can participate actively in sustainable development as they promote knowledge creation, joint learning, technology transfer, as well as collaboration, and sustainable innovations. Finally, clusters can facilitate the sustainable upgrading of small and medium-sized enterprises and encourage the participation of stakeholders in the process of sustainable development (Li et al., 2019[39]).

Piedmont is ambitious in achieving sustainable regional development, and some clusters already have a strong focus on sustainability practices. The Piedmont Regional Strategy for Sustainable Development provides the overall strategic direction and operational roadmaps to achieve the sustainability objectives of the 2030 Agenda and the National Strategy for Sustainable Development. Already in the current cluster policy, cluster organisations in Piedmont play an important role in delivering regional sustainability policy objectives. For example, several cluster organisations are actively supporting the regional environmental and energy transition. The green chemistry and advanced material cluster aims to advance green energy and energy efficiency, while the agri-food cluster supports advanced packaging and environmental-friendly food processing and manufacturing.

Cluster organisations in Piedmont could go further to support sustainable business models. Cluster organisations could promote greater cooperation in sustainable development areas (e.g. smart mobility or the circular economy) that depend on input from diverse industries. They could also actively engage the third sector in this effort. Solving societal challenges requires connecting different and often disparate

sectors and types of actors. For example, addressing traffic congestion issues in city centres needs to take into account local solutions that address mobility, tourism, retail, logistics, etc. (OECD, 2020[55]). Clusters can serve as living laboratories and demonstrators of new solutions and innovations. Piedmont's clusters could more clearly emphasise sustainable technologies in future technology roadmaps. They could also conduct targeted workshops that help identify how individual regional clusters can further contribute to strategic sustainable development objectives and develop concrete action plans. Piedmont's cluster organisations should also regularly provide information and support to their member firms to adopt new sustainable business practices and models. This could be done directly or with the support of the third sector, for example in a workshop format. The region of northern Denmark provides an example of how local innovation clusters can facilitate the transition to sustainable business models (Box 4.14). This Danish experience could be adapted to the Piedmont region to promote greater integration among its innovation clusters. Clusters in Piedmont could jointly identify companies interested in going circular and develop new business models and business opportunities across traditional cluster boundaries.

Box 4.14. Using smart specialisation clusters to facilitate the circular economy transition for local companies in northern Denmark

The Northern Denmark S3 focuses on reinforced local partnerships to achieve innovation-based development. In line with this approach, between 2017 and 2020 the industrial area of Aalborg in northern Denmark developed a local partnership to support the circular economy in and around the Port of Aalborg. The initiative brought together different stakeholders in the region, including SMEs in the port's industrial area, the University of Aalborg and local public authorities. As a result, 42 circular business models were developed involving 25 companies located in the same area, with a cluster facilitator's help.

Together, these new business relationships led to significant decreases in energy consumption, material use and greenhouse gas emissions. At the same time, they brought substantial economic benefits thanks to product innovation and savings from the use of waste as a resource, as well as radically changing the thinking of many SME managers. A new 'sustainable business development tool' – the GAIA tool – was developed to help companies change their business model

Source: (Smart Specialisation Platform, 2020[56])

Conclusion and recommendations

Piedmont has a long tradition of innovative economic clusters, which can be leveraged to support industrial transformation and economic modernisation. The region's innovation cluster organisations support a significant number of (primarily) mid-sized firms in joining R&D networks of local large firms and international firms. They also lead a variety of networking initiatives, such as organising trade fairs. Yet, clusters could contribute even more to innovation in Piedmont by rapidly adapting to current and upcoming challenges and new realities. Stagnating membership among cluster organisations and a focus on already innovative companies risks a decline in cluster performance in Piedmont. To counter this, and to support the region's long-term development, clusters and cluster organisations should continue to play a key role in industrial transition and support companies through this process. This chapter argues that the current cluster policy needs revision to better integrate the themes of entrepreneurship, digital transformation, innovation diffusion, and up- and re-skilling in cluster activities. It further argues that such a revision should be based on three core focus areas: supporting clusters as drivers of the innovation ecosystem; supporting internationalisation; and ensuring that clusters have the capacity and means to contribute to regional

development needs and objectives. Capacity to implement and act within a revised cluster policy and model is as important as the revision itself. This includes designing incentives for clusters to cooperate and offer joint services, and to ensure access to the expertise, skills and insights necessary to support innovation among frontrunners and innovation diffusion among lagging companies.

It is recommended that Piedmont use the next iteration of its cluster policy and cluster model to upgrade the role and capacity of its clusters as central innovation actors. By doing so it will help its firms respond to changing industry needs and developments and more easily contribute to regional innovation and development objectives. A revised cluster policy should ensure that entrepreneurship, digital transformation, innovation diffusion, and up- and re-skilling are well integrated into cluster programmes.

Recommendations for action to develop a stronger cluster policy and model in Piedmont

It is recommended that Piedmont use the next iteration of its cluster policy and cluster model to upgrade the role and capacity of its clusters as central innovation actors, in this way helping its firms respond to changing industry needs and, and more easily contribute to regional innovation and development objectives. A revised cluster policy should ensure that entrepreneurship, digital transformation, innovation diffusion, and up- and re-skilling are well integrated into cluster programmes.

1. **Maintain clusters in the sustainment stage of the cluster life-cycle model:**

- Encourage stronger engagement between cluster organisations and other innovation stakeholders in the region, including small and micro enterprises, SMEs, universities and other education institutes.
- Reinforce the importance of an expanded definition of innovation, beyond technology and R&D, and proactively supporting this broader perspective, for example through specific project calls.
- Ensure that the activities and support offered by cluster organisations match the needs, interests and capacity of small and micro firms so they can grow internal innovation capabilities.
- Foster the development of projects, and their management by cluster organisations that extend beyond the scope of cluster organisation activity.
- Facilitate access to funding for start-ups, for example by launching a set of project calls targeting this type of firm.

2. **Reinforce clusters as drivers of the regional innovation ecosystem:**

- Strengthen collaboration among cluster organisations, for example by:
  - Introducing a cluster management platform to share information and good practices, and promote knowledge exchange/knowledge spillovers within a cluster and across cluster organisations.
  - Supporting joint cluster activities such as training sessions to address challenges, concerns or issues common to clusters and cluster management.
- Reinforce interaction and exchange among the cluster organisations, universities and other knowledge institutions (e.g. ITS), for example by:
  - Encouraging the co-creation of education material and curricula to match industry needs, and expanding student placement schemes.
  - Building dialogue opportunities between clusters and universities, for example through networking events, joint seminars, roundtables or workshops on progress in achieving the region's innovation policy objectives, new technologies, regional innovation needs, etc.
- Use clusters and cluster organisations to support skills for industry, including by:

- Applying the triple helix approach to identify and address skills imbalances, build skill sets that meet regional or sectoral innovation and industry trends, and disseminate information on funding programmes and training initiatives.
- Encouraging cluster members to collaborate with the ITS to upgrade specific skills among their staff to better accommodate changing technological and industry realities. Empower ITS to add this type of learning into its curricula.

- Ensure that cluster organisations continuously support SMEs and entrepreneurship, including by:
  - Assisting cluster organisations improve their outreach to SMEs with low innovation capabilities,
  - Generating opportunities for mentoring and developing more robust business support services.
  - Promoting cluster organisations as a channel to better link start-ups and scale-ups with existing venture capital fund networks.
  - Increasing the capacity of cluster organisations to support entrepreneurs focused on new and emerging industries, or those targeting an activity with environmental or social objectives.

3. Engage clusters as drivers of cross-border collaboration and internationalisation

- Encourage cluster organisations to open thematic boundaries, for example by supporting smaller industrial specialisations, and/or add related technologies and industries or knowledge bases already within the region.
- Develop a cluster internationalisation strategy or support cluster organisations to work together to develop one for Piedmont's innovation ecosystem.
- Increase participation in cross-border (inter-regional) and/or international projects by promoting cluster exchange, including via S3 thematic platforms.
- Prioritise region-wide diffusion of knowledge, contacts and good practices that will facilitate internationalisation throughout the innovation ecosystem. Consider using knowledge-brokering practices to support this.
- Expand past a triple helix model, proactively incorporating the third sector and financial investors into innovation activities.
- Reinforce the dialogue and partnership opportunities between CEIP, innovation stakeholders and cluster organisations.

4. Promote clusters as strategic intelligence hubs for the region

- Develop strategic capacity among cluster organisations (e.g. in horizon-scanning and foresight exercises), and partner with them to build strategic insights into future industry developments and innovation vision-setting for the region.
- Build cluster organisation capacity to design technological and industrial roadmaps highlighting how innovation actors can contribute to broader societal challenges (e.g. the green and digital transitions) and use them as a means to reinforce regional innovation.
- Create opportunities and incentives for clusters to contribute to larger-scale national and international development goals (e.g. the Sustainable Development Goals, recovery and resilience, a just transition, the international climate agenda, etc.).

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Notes

[1] A cluster initiative can be defined as an organised effort by a person, organisation or consortium to support a cluster and its activities. One form of a cluster initiative is a cluster organisation, which is an organisation with an office facilitating cluster building.

[2] IRES Piemonte conducted a counterfactual study to understand if the participation in the innovation poles has produced, or not, effects on business economic performance. The analysis sample is made up of participating capital companies in the 2007-2013 programming cycle. A positive effect on turnover is estimated equal to 6.2% on average in the three years following joining. The effect is calculated as a comparison between the performance observed in participating companies (group of treaties) and that observed in similar companies that are not members by sector of economic activity and budget structure located in Piedmont (control group). The study also found positive signs of participation in terms of total factor productivity (TFP) and number of employees.

[3] Full-time equivalent is the number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs (OECD, 2001[58]).

[4] https://www.clustercollaboration.eu/sites/default/files/eu_initiatives/eocic_smart_guide_to_entrepreneurship.pdf

[5] https://climathon.climate-kic.org/

[6] Technological relatedness refers to a level of similarity enabling the exchange of knowledge and efficient learning processes while providing the potential for new knowledge combinations and innovations (Balland and Boschma, 2021[57])

OECD Regional Development Studies

Regional Innovation in Piedmont, Italy

FROM INNOVATION ENVIRONMENT TO INNOVATION ECOSYSTEM

To make the most of its longstanding tradition of manufacturing and innovation, Piedmont, Italy, is undertaking a process of industrial transition, the success of which may be linked to an updated approach to its regional innovation policy. This should include promoting technology and non-technology driven innovation, building the innovation competences of micro- and small enterprises in addition to medium and large ones, better connecting regional innovation actors, and ensuring that innovation contributes to the region's broader development goals such as sustainable regional development. It also requires diversifying the role of Piedmont's innovation clusters and reinforcing the multi-level governance system for innovation policy. This report features a comparative perspective of the trends, challenges and opportunities for innovation-led growth in Piedmont, and highlights how Piedmont could build a dynamic innovation ecosystem based on its smart specialisation strategy, a fresh perspective on innovation, and future-oriented innovation cluster organisations. The report provides actionable recommendations and offers insights into making the most of innovation policy as a lever for place-based regional development.

Co-funded by
the European Union

PRINT ISBN 978-92-64-60443-8
PDF ISBN 978-92-64-58885-1

9 789264 604438