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.)