

EcoRIS3 Policies & Measures to Support Local & Regional Innovation Ecosystems

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Analysis of the impacts of Covid-19 Metropolitan City of Turin | Piemonte, Italy

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1 Foreword

The Metropolitan City of Turin is a metropolitan public administration and, according to National Law 56/2014, has the competences of supporting local ecosystems of its territory, by acting as a connector between regional challenges and opportunities of RIS3, local innovation policies and stakeholders.

The improvement of the resilience capacity of S3, from one hand, and the support of the local innovative ecosystem in overcoming challenges, on the other hand, are the main objectives of the additional activities within the ecoRIS3 extension project. The territory has a key role in this process, since it is the milieu where inter-linkages, interdependencies and knowledge flows take place and since the RIS3 policies are place-based by definition.

The knowledge exchange opportunities offered by the cooperation with the ecoRIS3 partners – Fomento de San Sebastian (Lead partner), Cork Institute of Technology, Sunrise Valley Science and Technology Park, Kainuun Etu Ltd, Vidzeme Planning Region, Atlantic Cities, Ave Intermunicipal Community – have been particularly enriching for us, giving us the opportunity to improve the dialogue among the local stakeholders and therefore to raise the awareness and the territorial impact capacity of RIS3 policies. It has been of particular interest for the Metropolitan City of Turin, since our ecosystem suffers from excessive fragmentation and dispersion, even if it is rich and dynamic.

The opportunity offered by the two pilot actions has allowed the Metropolitan City of Turin to focus the attention from one hand on deepening the knowledge of specific good practices and on transferring them; on the other hand to identify a territorial dimension where those practices could be tested, giving greater concreteness to the activity of knowledge exchange that characterises the projects financed by Interreg Europe programme.

We, as a metropolitan public administration, have the role of promoting better policies and measures to create virtuous cooperative mechanisms between key stakeholders, in order to make the local innovative ecosystems sustainable, responsive and resilient to the existing challenges and gaps, such as Covid-19 crisis. Cities and Metropolitan areas are indeed in the front-line and have a key role in the mitigation of the impact of present and future challenges, such as the pandemic.

The Covid-19 pandemic experience was emblematic: it empirically showed how Metropolitan Areas, and the functions they express, have a key role in mitigating the impact of the virus on their territories. We have been, and still are, at the front-line of the fight against the pandemic, showing with even more evidence than before, the need to strengthen institutions closest to citizens – such as ours – so that they can effectively and quickly respond to new challenges and obstacles.

The main aim of this document is to analyse challenges, obstacles and opportunities deriving from the pandemic crisis in our territory, both for innovative ecosystems and for the implementation of regional smart specialization policies. Furthermore, we analyse how has the ecoRIS3 Italian action plan altered due to the pandemic and what changes are needed to still achieve our original goals.

The analysis will be mainly based on data collected from existing research done by the Social Economic Research Institute of Piedmont (IRES) [1], who studied the impact of Covid-19 in Piedmont Region also in support of the new regional Smart Specialisation Strategies 2021-2027 of Piedmont Region. It will also take into account the OECD Study [2], published in 2021 and which analysed the Regional Innovation in Piedmont and its innovation ecosystem. This report will also address the main changes in the implementation of our initial Action Plan, furthermore, it will present best practices and successful initiatives coming from universities' startup incubators, such as I3P (Incubator of Polytechnic of Turin) and 2I3T (Business Incubator of the University of Turin). In terms of data, even if it is collected at regional level, the territory of the Metropolitan City is the half of the regional one, so, the data reflect correctly the metropolitan framework.

The expected result of this analysis the mapping of good practices and successful initiatives developed by local innovative ecosystems to strengthen their resilience capacity in overcoming the Covid-19 crisis as the starting point for future perspectives of RIS3.

Table 1. Policy instrument addressed

<p>The Action Plan aimed to impact</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Investment for Growth and Jobs programme <input type="checkbox"/> European Territorial Cooperation programme <input type="checkbox"/> Other regional development policy instrument
<p>Name of the Policy Instrument Affected</p>	<p>ROP ERDF - Action I.1b.4.1 Support for creation and consolidation of innovative start-ups with high intensity of knowledge application and research spin-off initiatives</p>
<p>Managing Authority</p>	<p>Piedmont Region</p>
<p>Period of implementation</p>	<p>Still to be implemented: 22/03/2019 till 30/06/2023</p>

2 Impacts of the pandemic

Impacts of the pandemic on key sectors and stakeholders of the innovation ecosystem

The impact of the healthcare crisis has hit the Italian economy particularly hard, with the national GDP falling by 8.9 % in 2020, mainly due to the collapse of domestic demand and consumption. The crisis also affected the labour market: the decline in employment rate initially affected mainly temporary employees and the self-employed people, but later on it also affected permanent employees. In April 2021 the number of unemployed people increased by more than 800 thousands units in relation to the pre-pandemic period.

COVID-19 has indeed affected Italy more than many other European countries, particularly in the early months of the pandemic. The economic effects of the crisis and the very stringent measures were magnified by the country's openness to trade and its specialisation in sectors heavily affected by the virus, such as tourism. The OECD forecasts a slow recovery in Italy for 2021 (+4.1%) and 2022 (+4%); the unemployment rate is also expected to increase from 9.4% in 2020, to 11% in 2021, and 10.9% in 2022.

According to available OECD data, Piedmont has been one of the most affected regions by the pandemic crisis in the OECD zone: containment measures introduced by the government affected around 29.1% of total employment in the region, compared to the OECD regional average of 27.8%. By some estimates, the regional GDP has been fallen by 8% in 2020. The drop of exports, accounting for 35% of regional GDP, has been estimated by 12.2% in 2020 [3].

The restrictive measures in the region lead to a deterioration of all the main economical indicators: an increase in the inactivity rate and a reduction in the employment rate compared with the previous year. Only the unemployment rate in the first half of the year appears to be reduced (down 13.5% on a trend basis). The year therefore closes with a return to 2019 levels of the unemployment rate and a decrease in the number of employed people of about 3%, while the inactive increased by 5.2% [4] (Figure 1).

Figure 1. The employment market in Piedmont in 2020. Trend variations (Source: IRES 2021)

	2020-T1	2020-T2	2020-T3	2020-T4
Inactivity rate	4.0%	9.8%	5.0%	5.3%
Employment rate	-0.5%	-3.4%	-2.9%	-2.9%
Unemployment rate	-13.5%	-16.2%	2.4%	0.0%

The following table (Figure 2) describes the effect of the containment measures implemented by the government in 2020 in Piedmont. According to data, about 767 thousands workers during the first lockdown operated in sectors that had to suspend their activities [5].

Figure 2. Number and share of workers operating in active and suspended sectors in 2020

(Source: IRES 2021)

Region	Employed in closed sectors lockdown (March - April 2020)	Percentage employed in closed sectors (March - April 2020)	Employed in closed sectors differentiated scenarios (November 2020)	Quote %
Piedmont	767.319	43.1%	20.723 - 151.667	1 - 9%

Analysis confirm that the COVID-19 pandemic in Piedmont has affected an already weakening economy. Almost all sectors (except ICT) reduced their output in 2020 in the region, following the national pattern. As reported by the Social Economic Research Institute of Piedmont (IRES Piemonte), the regional GDP is recovering in 2021 (+5%) and the 2022-2024 expectation is for a slow recovery (+2.7 yearly average growth rate of GDP) [4]. According to the OECD, it is unlikely that this rate will be sufficient to compensate for the region's economic losses in 2020 (Figure 3).

Figure 3. Piedmont growth prospects. Average yearly growth rates (Source: OECD, 2021)

	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	-3.2	3.3	2.3	-10.8	12.5	6.8

The 2020 crisis was initially a supply crisis, since it was linked to lockdowns, it was then immediately followed by a contraction in demand also initially driven by the containment measures. It should be noted that the persistence of successive pandemic waves has not caused the same effects on the economy of spring 2020. This was also due to a greater capacity of production to adapt to the new conditions, to a greater ability of businesses to alleviate some of the supply problems suffered in the first phase of the pandemic and their increased flexibility, due to the widespread use of digital technologies and of remote working.

However, the economic effects of COVID-19 have been asymmetric across territories, but also across sectors and firms. The sectors that are more exposed to international demand and value chains have suffered the most from the global supply and demand shocks. Sectors such as food service activities, tourism, transport and retail have been affected more than others by the containment measures. The capacity and possibility for remote working, and its relative costs, are highly differentiated among sectors: sectors involving direct contact, travelling, physical presence, etc. were more likely to be suspended to contain the spreading of the virus. The OECD estimates that in Piedmont around 29% of jobs were at risk from containment measures, since less or not at all adaptable to remote working [5].

In Piedmont the dynamics of production were more negative than at the national level, mainly due to the regional manufacturing specialization, more oriented towards particularly affected sectors. The automotive sector which, in the presence of highly internationalized production logistics, suffered the repercussions of the breakdown of production chains and it has been affected by the fall in demand for durable goods (Figure 4).

Figure 4. Economic development in Piedmont. % changes at constant prices (Source: OECD, 2021)

	2000 2007	2008 2014	2015 1018	2019	2020	2021	2022 2024
Exports	1.6	0.8	2.4	-3.4	-12.2	12.5	4.6
Agriculture	-0.5	1.6	-0.4	-1.3	-6.6	0.4	1.4
Industry	0.0	-2.7	3.7	-1.0	-11.8	8.8	2.8
Construction	2.3	-6.0	0.2	1.2	-6.5	12.7	4.8
Service	1.5	-1.0	1.1	0.2	-8.3	3.4	2.7
Totale	1.1	-1.6	1.6	-0.4	-9.1	5.1	2.8

The region's ability to unlock investments to support innovation-led growth is indeed challenged by COVID-19, affecting an already weakening economy. This ability will be crucial to foster innovation-led development in Piedmont and in the Metropolitan City of Turin territory. As aforementioned, the Piedmont economic structure was already vulnerable, since characterised by a high percentage of SMEs. Indeed, two-thirds of Piedmont's workers are employed by firms with less than 50 employees, which – even before COVID-19 – were reducing employment. SMEs are more vulnerable to the pandemic impacts, facing higher risks and being less resilient than larger companies, particularly in terms of their dependence on debt for financing their activities. The greatest risk for SMEs is the shortage of liquidity due to COVID-19 economic shock, which can lead to their insolvency and in turn can increase the death rate of 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” [2].

The pandemic underlined the importance of connectivity, digitalisation and digital literacy, all crucial for people, institutions and firms to access services and markets and to maintain economic activity. As mentioned, the ability to telework often supported business continuity during the COVID-19 containment measures: “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”.

The OECD estimated that 32.1% of jobs in Piedmont were adaptable to teleworking based on the tasks required and whether they could be performed remotely, in line with the OECD average of 31.47%. Nevertheless, Piedmont lags behind in the provision of fast digital infrastructure (key enabling factor of remote working), 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% [6].

The digital divide between best performing firms and lagging enterprises may increase due to the pandemic and it could be further exacerbated by inequalities in access to digital infrastructure and services among urban, rural and mountain areas. Furthermore, teleworking capacity varies across workers: highly skilled workers are able to easily switch to remote working, while low-skilled workers are generally employed in jobs that cannot be performed by remote work, and they usually face higher health, economic and social impact consequences as a result of the virus spreading.

Piedmont is a region in industrial transition, therefore characterised by 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. Being Piedmont in industrial transition, the automation of industrial processes and jobs is already challenging and affecting job polarisation, unemployment and skill mismatch. The pandemic is accelerating these processes, resulting in an even poorer job market structure.

“Place-based policy responses become critical in such instances – such as RIS3 policies – 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”.

According to the 2021 EU Innovation scoreboard, Piedmont is a moderate innovator+ – having an innovation performance below the EU average – with considerable innovation potential. This means that Piedmont, while showing positive trends in some aspects related to innovation (e.g. private investments in R&D), is also characterised by some drawbacks, related for instance to human capital and cooperation. According to the OECD, the financing mechanism is perhaps one of the largest framework challenges to innovation policy. The majority of its funding comes from EU Cohesion Policy and other funds, somewhat limiting the region’s range of action and creating significant administrative burden and complex financing requirements. Therefore, the ability micro and small enterprises to participate in the regional innovation ecosystem may be challenged.

The impact of the crisis on investment programs and policy demand

Investment contracted sharply (down 10.8%), but less sharply than expected, and was concentrated in the initial phase of the pandemic before picking up considerably in the next part of the year: the rate of business investment, as a ratio of investment to value added increased. Among the factors that could have contributed to this dynamic, one could identify a reactive effort put in place by companies, which reorganised their productions to deal with the health emergency, along with others enabling factors. A good availability of credit, through the financial support and the derogation of the ban on state aid decided by the European Commission until the end of 2021 has made it possible to maintain adequate levels of liquidity, whilst support has contributed to containing costs in the presence of reductions in turnover and supporting profitability. Indebtedness and reduced profitability remain, however, critical aspects for future evolution of the production system and the exit from the crisis [7].

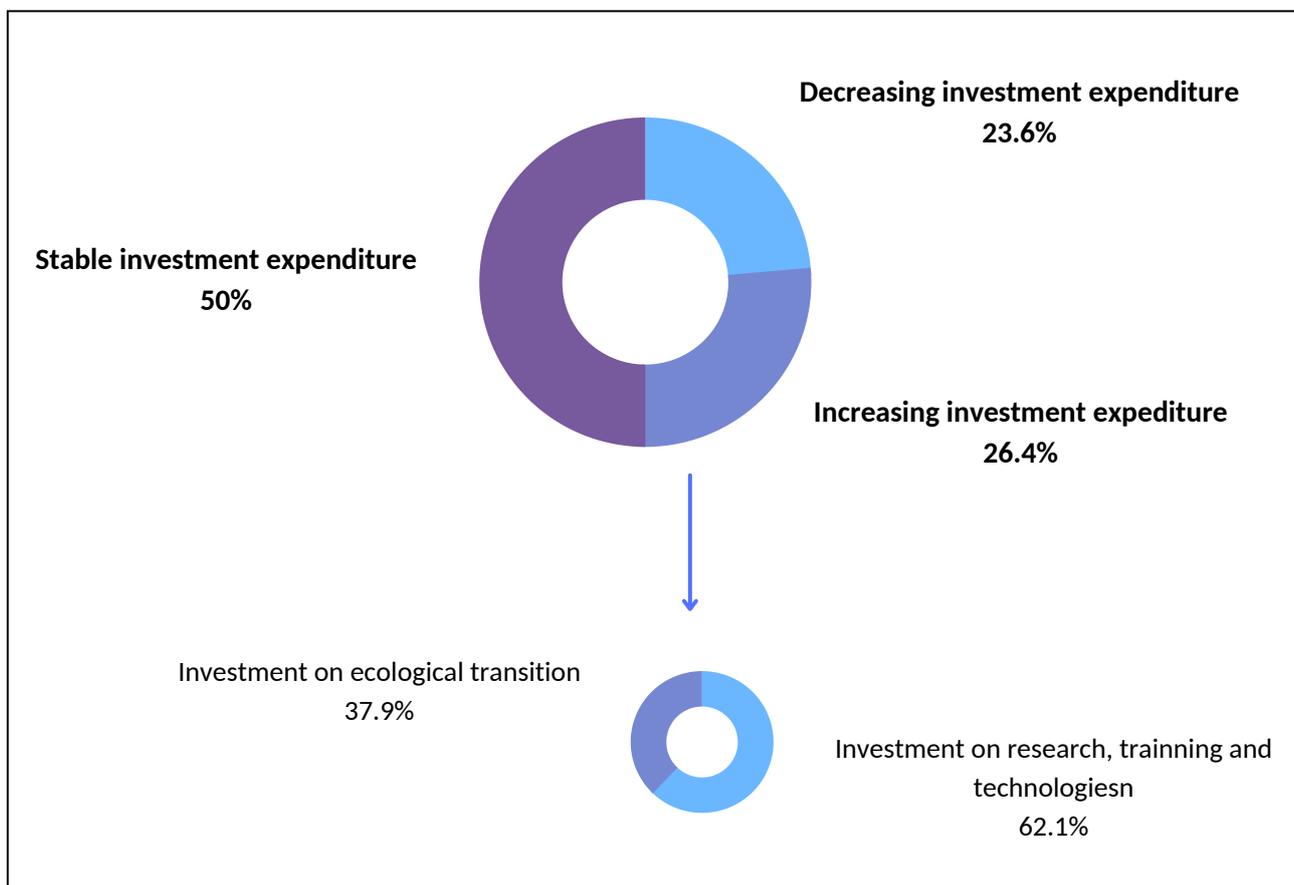
The impact of the crisis on investments in innovation has been evident. Considering that more than half of the companies reached by IRES survey had declared that they had no innovation programs underway, of the remaining cases, 61% have cancelled, suspended or scaled down their activities.

There remains a minority (17% of the total) of companies that have confirmed, redefined or even strengthened their innovative development programs, mostly concentrated in the manufacturing sectors, with significant peaks in the Food, Chemical-Pharmaceutical and Machine production sectors. Moreover, despite the heavy crisis suffered, 43% of companies in the transport sector have confirmed or strengthened applied research programs or innovation programs in general.

The forecasts made at the time of IRES survey (Figure 5) suggested that investment spending over the next two years would be cautious or highly selective. The joint analysis of the investment intentions expressed in relation to the different types proposed by the questionnaire (machinery, IT, eco-efficiency, training, research and innovation) reveals the following profiles:

- the largest group, equal to half of the sample, is represented by companies that foresee a stable investment expenditure;
- almost 24% of companies forecasts a decreasing of investment expenditure for all items;
- around 26% of the sample is represented by companies that foresee an increase in investment expenditure. They can be divided into two subgroups for category of investment:
 - the 62% of them is going to invest on research, training and new technologies;
 - almost the 38 % of them is oriented towards investments related to ecological transition.

Figure 5. Groups by investment forecast in 2021 - 2022 (Source: IRES, 2021)



Companies planning to increase investment are more concentrated in certain sectors. As for the manufacturing, the areas of transport and chemistry-pharmaceuticals stand out, along with light manufacturing. The aspect to be highlighted is the potential contribution that the ecological transition could have in the relaunch of investments, which in the manufacturing sector can contribute to an important increase in planned expenditure.

As for services, the expected expenditure increase is forecasted in welfare (health, assistance) and education, but also in advanced high-tech services: in this case, the expected increase is mainly driven by investments in knowledge, training and digital resources.

The preferences expressed by entrepreneurs regarding an ideal priority agenda for regional policies is of particular interest: the 58.5% of respondents indicated as important or very important, in addition to aids for technological investments, also training, staff retraining and internalization of qualified skills. This highlights the need to accompany the transformations through a strong investment in skills appropriate and required for the new competitive environment. A significant percentage also attribute high or very high importance to circular economy projects and green production (47.4%) (Figure 6).

Figure 6. Importance of certain policy areas for future regional programming (Source: IRES, 2021)

	High relevance
Aid for systems/machinery/software renovation	64.6
Training Aid/Qualified Personnel/Reskilling	59.2
Services/aid for acquisition of expertise, technology transfer	49.5
Support circular economy projects, eco-efficiency, green products	47.5
Fostering business collaboration for innovation or research	39.2
Business innovation support programmes (even without R&D)	36.7
Services for internationalization	36.4
Support for social impact and welfare initiatives promoted by businesses	35.3
Aid for business research, advanced or pre-commercial stage (TRL high)	30.3
Aid for company research, initial phase (low TRL)	19.0

In the next chapter some of the opportunities associated with the pandemic crisis will be analysed. 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.

Impacts of the pandemic on original SWOT Analysis

This chapter intends to focus on the potential effects produced by Covid-19 on the innovation ecosystem of the Metropolitan City of Turin. To achieve this objective, this chapter will analyse different data and research sources in order to compare and identify possible changes of direction with respect to the studies carried out prior to the advent of Covid-19 and the SWOT analysis originally produced.

The chapter will therefore develop starting from the recovery of previous data, which effectively contextualises the background of the Metropolitan City of Turin, and then try, starting from the comparison with these elements, to identify potential changes/evolution/new data useful to clearly define the impact of Covid-19 and the effects it produced on the territory.

It is clear how complex it can be to identify precise data and elements that effectively describe the process of change brought about by Covid-19, as we are still in a period of socio-economic and health uncertainty. However, by analysing in-depth studies and research already carried out, a number of common and partly logical elements can be identified which underline the actual change in the innovation ecosystem caused by Covid-19 [8].

Strengths, weaknesses, opportunities and threats will then be analysed in order and complemented by the inclusion of any new features, changes and mutations.

- **New Strengths**

According to several researches previously conducted, innovation clusters and their corresponding cluster management organisations have played and will play an important role in Piedmont and in the Metropolitan area of Turin to implement their innovation policy and to 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. 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. 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) [9].

- **New Weaknesses**

What international observers are most concerned about is the centrality of the world of small and medium-sized enterprises in the industrial and productive sector of the Piedmont region and of the Metropolitan City of Turin. For instance, 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.

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. 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 [12].

- **New Opportunities**

Despite the enormous level of uncertainty and various problems caused by the pandemic crisis, it also offers some opportunities for Piedmont's economy. In fact, according to several studies, 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.

COVID-19 accelerated the digitalisation of public administration and public services delivery. 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, and offer strong prospects for job creation [10].

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. Such shifts 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.

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.

In addition, the various funding programmes for Research and Innovation such as Horizon Europe, or the economic plans aimed at post-pandemic economic recovery such as the recovery plan (PNRR) will be the fundamental tools in order to achieve the set goals. In fact, the adoption of expansionary policies by the regulatory authorities and central banks of the main economies, with the injection of substantial resources into the real economy, provides a favourable framework for investments in innovation. This regulatory discontinuity is set in a context of acceleration of the great engines of social and economic transformation, one of which is technological, the so-called “digital transformation”, the other driven by precise regulatory choices, the “ecological transition”.

- **New Threats**

According to the OECD analysis, job polarisation has become a 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. 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).

Being Piedmont in industrial transition, the automation of industrial processes and jobs is already challenging and affecting job polarisation, unemployment and skill mismatch. The pandemic is accelerating these processes, resulting in an even poorer job market structure. Piedmont shows relatively high levels of risk in labour market from both Covid-19 and automation: according to OECD rankings, Piedmont is in the top 30% regions in terms of combined risks of automation of works and Covid-19. This is confirmed by data showing that regions 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 economic structure intuitively show a lower combined risk.

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. In fact 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. 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 rethink 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.

Table 2. Update of SWOT Analysis of Metropolitan City of Turin Innovation System

Strengths	Weaknesses
<ul style="list-style-type: none"> • Good position of Universities on national and international rankings • High number of innovative enterprises compared to the national average • High percentage of enterprises expense in R&D 	<ul style="list-style-type: none"> • Low percentage of public expense in R&D, decreasing compared to the national and EU average • Gradual ageing of the population and reduction of the youth component
New Strengths derived from the pandemic	New Weaknesses derived from the pandemic
<ul style="list-style-type: none"> • Clusters as a key tool in the realisation and implementation of the innovation process • Resilience of firms in readapting their production to new market's needs 	<ul style="list-style-type: none"> • Lack of human capital and specialised skills • CMTo and Piedmont region are specialized in sectors that are more exposed to international demand (such as tourism, transport, retail and food service activities) • SMEs are not capable yet to cooperate in innovation
Opportunities	Threats
<ul style="list-style-type: none"> • Request of qualified competencies, in highly innovative sectors (ICTs, cleantech, ecc.) • European digital single market • Strengthen of the broad and ultra-wideband in line with the EU goals 	<ul style="list-style-type: none"> • Low position in European rankings on innovation • Complexity of the implementation processes and an insufficient communication among the different levels involved in the policies realisation • Gradual ageing of the population and reduction of the youth component. High rates: long-term unemployment youth unemployment
New Opportunities derived from the pandemic	New Threats derived from the pandemic
<ul style="list-style-type: none"> • Strong concentration of funds in the new European programming 2021-2027 (Horizon Europe, Digital Europe, EU4health) • Recovery Plan (PNRR) • Balanced territorial development (Potential change in geographical concentration) [14] 	<ul style="list-style-type: none"> • High level of long-term and youth unemployment • Shortage of liquidity due to Covid-19 economic shocks • Worsening of the Job Polarisation

3 Impact and deviation on your Action Plan

The objective of the present chapter is to report about any deviation, impacts and consequences that the Covid-19 crisis has had on the implementation of our Action Plan and on its related results.

The Metropolitan City of Turin Action Plan aims to operate within the following policy programmes: Investment for Growth and Jobs programme, European Territorial Cooperation programme and other regional development policy instruments. In this context, at the regional level, the Smart Specialization Strategy (RIS3) of Piedmont opened new season for the regional research and innovation policies.

The Piedmont Region, in line with its Smart Specialization Strategy (S3), focuses its resources on the following areas of innovation:

- industrial innovation;
- research;
- innovation for health;
- the digital society;
- the enhancement of the territory.

First of all, as a reminder of the main objectives, actions and planned results of the Action Plan, the following table has been compiled, where the general information is summarised:

Table 3. Main objectives, actions and planned results of the Action Plan

Objectives	Actions	Results
<p>Increase the coordination between the actors from innovation ecosystem and the synergy between the various initiatives implemented</p>	<p>One single strategic direction for the local S3 entrepreneurship ecosystem:</p> <ul style="list-style-type: none"> - Shared strategic planning process - Study for the definition of the local ecosystem's framework - Shared territorial innovation strategy 	<ul style="list-style-type: none"> - Metropolitan Strategic Plan 2021-2023 - Strengthen of the role of CMTo as coordinator - Raise of willingness of local actors to share and learn

Design a model of co-management of a university space based on the quadruple helix: an experience of dialogue between bodies, universities and companies to facilitate the access to the research laboratories of companies and above all of micro enterprises, and to create occasions of shared training and dialogue

Research, innovation and territory interaction promotion:

- Study phase for the definition of ways of collaboration of CMTo with the University of Turin for the use of shared spaces in the new scientific centre (Campus of Grugliasco)
- Joint reflection on necessary training and occasions of implementation

- Document on necessary training and specific initiatives to be implemented
- Unusual connection between sectors
- Sources of innovation and creation
- Communication tool on the mapped technical infrastructures and on access modalities through specific regulations (available at online)

Promote a shared reflection on the possible promotion of e-health for the local development and well-being: digital technologies are bringing the opportunity to completely innovate the entire healthcare section, putting patients at its centre

Coordination of initiatives in support of the creation and scale-up of micro-enterprises and startups:

- Internal analysis on e-health issue
- Reflection about a model of experimentation on the specific local contest of e-health services
- Place-based 4 helix e-health LAB
- Proof of concept phase and report

- Telemedicine in Piedmont
- In depth materials on e-health and new European programming
- Model for experimentation
- E-health services and product ready to tested
- Methodological guide and evaluation indicators
- LAB / Mini pilots

Regarding any difficulties and deviations in the implementation and assessment of the action plan, we can confirm that the monitoring process went smoothly and it was ensured through a regular presence of the staff in charge of ecoRIS3. A contact person in charge of the assessment process was identified, who periodically interviewed the staff of the Metropolitan City of Turin following the action plan activities.

Furthermore, in order to keep the stakeholders interested and involved, the Metropolitan City of Turin prepared dissemination contents for every conference and each pilot activity. The stakeholders' engagement has been enhanced by a Memorandum of Understanding, which concerned the following local actors:

- Piedmont Region;
- Metropolitan City of Turin;
- Municipality of Grugliasco;
- University of Turin;
- Turin Chamber of Commerce;
- Polytechnic of Turin.

For the implementation of the pilot action, we engaged 5 municipalities, health and social care services to sign another specific Memorandum of Understanding.

The pilot action titled “eHealth Territorial Lab – Local Ecosystem as an Instrument to scale-up innovative local start-ups in eHealth topic” has generated great interest in local stakeholders, since it has demonstrated that medicine and innovation can work together even outside urban areas. The aim of the pilot was accomplished: it boosted a virtuous cooperation mechanism among health local entities, local municipalities and providers of connectivity and digital solutions.

Moreover, Covid-19 crisis has emphasised the importance the key role that eHealth will play in the near future. The results obtained so far will be a fundamental starting point for the development and scale-up of innovative local start-ups in eHealth related issues and for future Metropolitan area territorial growth.

The project was even more effective, thanks to several local articles published on the matter: the dissemination contributed to the internationalisation of the pilot actions’ results and made the beneficiaries aware of the social and economical opportunities that ehealth can provide. Actually, the pilot has effectively involved both public and private sectors, such as municipalities and health social assistance services, by enhancing the territorial dimension of the knowledge transfer process.

Table 4. Impacts and deviations on Action Plan - Main comparative data

Data	Planned	Implemented
Action 1	One single strategic direction for the local S3 entrepreneurship ecosystem	Through the Metropolitan Strategic Plan, approved after a long process of consultation and confrontation with territory. Final online public event presenting PSM on 24-03-2021
Duration	1st semester 2020 – September 2021	-
Nr. of beneficiaries	Piedmont Region, 312 Municipalities, 2 Business Incubators (I3P, 2i3T), 1 Turin Chamber of Commerce, 2 Universities (University of Turin, Polytechnic of Turin), 7 Innovation Poles, several Public and Private Research Centres, enterprises, other actors involved in the local innovation ecosystem	-
Action 2	Research, innovation and territory interaction promotion	Through a Memorandum of Understanding, signed on 02-02-2021. Strategic tool for innovation development of the MCT territory; it launched the idea of the Butterfly area - to create public spaces for teaching, research, business incubators
Duration	2nd semester 2020 – 2nd semester 2021	-
Nr. of beneficiaries	Metropolitan City of Turin, the University of Turin, the Municipality of Grugliasco, the Piedmont Region, the Polytechnic of Turin, the Chamber of Commerce of Turin	-
Action 3	Coordination of initiatives in support of the creation and scale-up of micro-enterprises and startups	Through a place-based laboratory in order to shape innovative and business-oriented e-health services; final public event 15-11-2021
Duration	1st semester 2020 – 2nd semester 2021	-
Nr. of beneficiaries	Piedmont Region, the local health authority ASLTO3, local municipalities (Mompantero, Giaglione, Venaus, Novalesa, Moncenisio), 12 citizens of Cenischia Valley	-

Finally, Covid-19 has also shown the resilience of Metropolitan City of Turin innovation ecosystem, which has faced multiple challenges and obstacles, by putting in place strategies and good practices which could be transferred in other contexts (Table 5).

Table 5. Good practices and actions carried out in the context of Covid-19 crisis

Date	Organization	Good practice	Positive impact
April 2020	Incubatore Politecnico di Torino (I3P)	Calls for proposals and calls for start-ups: innovation as a response to the Covid-19 emergency	<ul style="list-style-type: none"> - Proposals and calls for start-ups have been published to gather ideas projects and innovations to combat the Covid-19 emergency - Create solutions to combat this virus, but also and above all to prevent a situation of this kind from occurring again in the future - This page ables keeping track of what initiatives are promoted by the various bodies, so as to help entrepreneurs know and identify the opportunities available to them
December 2020	Incubatore Politecnico di Torino (I3P) and Torino City Lab	Participation in an event with Torino City Lab - the innovation laboratory of the City of Turin that connects the Public Administration with several public and private partners to implement activities of experimentation on the city territory of pre-commercial solutions of different nature -	<ul style="list-style-type: none"> - The "Torino City Lab" becomes "Torino City Love": an initiative of solidarity and open innovation launched by Torino City Lab and its partners, which has made available more than ninety resources, actions and skills to support citizens, businesses, institutions and schools to face the hardship and difficulties during COVID 19 emergency

<p>February 2021</p>	<p>Incubatore Politecnico di Torino (I3P) and Hynnova</p>	<p>Hynnova, the Turin-based startup that optimizes anti-Covid19 vaccination</p>	<ul style="list-style-type: none"> - Through machine learning, it will be possible to maximize and make efficient use of the space and health resources in the field for the vaccination campaign - The machine learning platform, by reprocessing the information collected, is able to classify and order the activities to be carried out on the basis of available resources. The data is processed in such a way as to maximize the achievable result through the drafting of operational plans and work programs aimed at minimizing downtime - Rapidly test the solution in order to then be able to get in touch with the more than 100 local health authorities throughout Italy [13]
<p>During 2020-2021</p>	<p>Incubatore Politecnico di Torino (I3P)</p>	<p>ToTeM interviews, with direct and indirect relation with Covid-19</p>	<ul style="list-style-type: none"> - Casavo: a PropTech startup operating in the real estate sector with an innovative and unique business model - Giuseppe Russo: Director of Centro Einaudi, "now is the time to invest in innovation, first of all in artificial intelligence, foodtech and agritech."
<p>June 2020</p>	<p>Incubatore Imprese Università di Torino</p>	<p>Online education during Covid-19, three UniTo researchers win the 'Best Research Paper Award'.</p>	<ul style="list-style-type: none"> - Three researchers from the University of Turin - Marina Marchisio, Sergio Rabellino and Cecilia Fissore - won the "Best Research Paper Award", assigned at the EDEN 2020 International Conference, for their paper entitled "Secondary School Teacher Support and Training for Online Teaching During the COVID-19 Pandemic" - The group supported the online teaching in Italian secondary schools
<p>March 2020</p>	<p>Metropolitan City Of Turin</p>	<p>MIP - Mettersi in Proprio (Start up your own business) : The work of the MIP continued despite of the difficulties imposed by the crisis.</p>	<ul style="list-style-type: none"> - MIP worked in order to be able to provide consultancy activities even remotely, practice not originally foreseen but arisen as a response to the challenges imposed by the crisis.

4 Conclusions

As already stated, the Metropolitan City of Turin has the role of promoting better policies and measures to create virtuous cooperative mechanisms between key stakeholders, in order to make the local innovative ecosystems sustainable, responsive and resilient to the existing challenges and gaps, such as Covid-19 crisis.

The Covid-19 pandemic empirically showed how Metropolitan Areas, and the functions they express, have a key role in mitigating the impact of the virus on their territories, since they are at the front-line of the fight against the pandemic.

This document analysed challenges, obstacles and opportunities deriving from the pandemic crisis in our territory. We tried, although partially due to the lack of updated data, to map good practices and successful initiatives developed by local innovative ecosystems to strengthen their resilience in overcoming the Covid-19 crisis as the starting point for future perspectives of RIS3.

This year was of particular relevance for the operative part of the Action Plan implementation process for all partners, and due to the pandemic, it has not been easy to implement a number of initiatives and engage stakeholders. However, it was successfully accomplished. One of the most important milestones have been the follow-up meetings that took place during this year, to analyse the status of the implementations. Given the pandemic, it was important to share these experiences in order to help partners to accomplish each other's objectives.

As noted in the previous chapters, Covid-19 had a very important impact on the territory, influencing the implementation of the action plan but simultaneously emphasising its usefulness.

On the one hand, the action plan has brilliantly demonstrated the characteristics and weaknesses of the metropolitan area, confirming the need to intervene in certain specific sectors, by promoting innovation and entrepreneurial ecosystem, business growth and territorial development. On the other hand, the pandemic therefore emphasised the value of the pilot action, by demonstrating its potential and confirming the need to develop effective eHealth services.

In fact, the aim of the pilot was to promote a shared reflection on the possible promotion of e-health for the local development and well-being: digital technologies are bringing the opportunity to completely innovate the entire healthcare sector, putting patients at its centre. E-health technologies, products and services offer great opportunities to change clinical practices, increase the well-being of citizens and could radically change the way health and care services are delivered to patients. The beneficiaries of these transformations won't only be people and professionals but also the local healthcare system which, coupled with a new paradigm of health care management, could provide preventive activities and ameliorate the citizens' quality of life.

Moreover, the Action Plan was useful in order to enrich the Metropolitan Strategic Plan – a planning tool compulsory by National Law 56/2014 for each Metropolitan City, that covers a three-year period and must be updated every year. The strategic mission of the Metropolitan City of Turin is that of being an engine of economic and social development for local areas. It also represents a flexible governing tool able to coordinate municipalities within the metropolitan territory and cooperate with higher government levels in order to plan and implement effective public policies, according to the multi-level governance model.

Also the territorial analysis indicated that a revised approach for research and development policies is necessary and it has to be based on strengthening innovation ecosystem; furthermore the next start of the new European programming cycle and the detected need for a renewal of the regional S3 (more “open”, changing the focus from sectors to transversal drivers, and more “internationalized” S3) make it necessary for the local ecosystem to be more organized also in order to interface with the regional government in the process of defining policies.

In conclusion, the pandemic has highlighted the major issues that need to be addressed, as well as speeding up the process of digitisation of the production and health systems, but above all has underlined the key role that the eHealth sector can play in the near future. The results obtained so far, although partial, will therefore be a fundamental starting point for the planning of the metropolitan area in the coming years.

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