

Cross-Border Cooperation for Research and Innovation in the Alpine Region

An Explorative Study of the European Smart Specialization Strategy

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Abstract: The paper presents three cases from a pilot study of the EU funded A-RING project on the impact of transborder collaboration in innovation and research in the Alpine Region and develops prescriptions to foster interregional partnership in the framework of the Smart Specialization Strategy. The analysis shows two results: 1) smaller and diverse territories enact a more open and discontinuous strategy; 2) larger territories with higher diversity are less open to newcomers, more rigid with regard to fund allocation, topics of interest, and less responsive to stakeholders. In the conclusion, we provide a policy proposition for interregional and cross-border collaboration.

Keywords: cross-border collaboration, Alpine Region, smart specialization strategy.

JEL classification: O18, R11, R58.

1. Introduction

This article presents the result of a pilot study on the impact of EU projects in innovation and research on (bordering) Alpine Regions. The context of the research is the A-RING project¹, funded by the European Regional Development Fund (ERDF) under the Interreg Alpine Space² programme of the European Union (EU) over the period 2019-2022. Interreg supports cooperation across borders to find common solutions to environmental and economic challenges. In this framework, the A-RING project is a partnership of universities, public administrations, and business associations of the Alpine Region, and explores opportunities and obstacles for cooperation in

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¹ A-RING Alpine Region Research and Innovation Capacity, <https://www.alpine-region.eu/projects/ring-alpine-region-research-and-innovation-capacity> (last access March 2023).

² Interreg Alpine Space Programme, <https://www.alpine-space.eu> (last access March 2023).

research and innovation (R&I) in the area. The EU adopted a Strategy for the Alpine Region (EUSALP) in 2015 targeting a population of around 80 million in seven countries, five (Austria, France, Germany, Italy and Slovenia) are EU Member States and two (Switzerland and Liechtenstein) are not (EU, 2015a). The Alpine Region is «is one of the richest areas in the world and among the economically most dynamic, innovative and competitive areas in Europe» (EU, 2015a, p. 1) and a tourist destination. The main added value of the Strategy for the Alpine Region will consist in a new relationship between metropolitan, peri-mountain, and mountain areas. EUSALPS adopts three thematic policies: *Competitiveness and Innovation*, *Environmentally friendly mobility*, and *Sustainable management of energy, natural and cultural resources* (EU, 2015b).

The paper aims to present policy prescriptions to foster research and innovation partnership in the framework of the Smart Specialization Strategy (RIS3) of the European Union (McCann, Ortega-Argilés, 2014; for a discussion, see Iacobucci, 2021). The actions and strategies of the European Union in this macro-region are essential (Capello, Cerisola, 2019), especially in light of the current transformation of the European economy, dealing with the post-pandemic recovery as well as economic and territorial resilience, for which the NextGenerationEU (NGEU) is the most important strategy for supporting research in environmental sustainability, energy transition, and digital transformation. The regional divide, however, is still relevant in determining economic inequalities and central in the action of the European strategy (Pavone *et al.*, 2021).

The Alps offer great potential in terms of cooperation and synergies but this is unfortunately hindered by a lack of cooperation and communication in the research and innovation landscape, which prevents the transnational Region from becoming a European innovation hub. The A-RING is a project in the context of the EU Smart Specialisation Strategies S3/RIS that looks at the R&I policy initiatives and the institutional frameworks of the Regions with regards to innovative topics, e.g. Digital Divide, Climate Change, Biodiversity conservation, Advanced Manufacturing, Tourism, and ICT, with the aim to promote a more coherent S3 approach in the Alpine Region. Indeed, the project looks to fill the gaps in this fragmented landscape, by generating a coordinated approach to define RIS3. A-RING focuses on creating and maintaining strong ties between multiple actors; improving the communication and transparency between research institutions, businesses, public authorities, and civil society. By improving these ties, the project aims to align policy development with real civil and market drivers.

This paper addresses the issue of cooperation among different actors within and across Regions in the Alps. The research is based on a pilot study that explores three cases: Burgenland in Austria, Lombardy in Italy, and Slovenia. The three Regions in the analysis differ in terms of size, population, development, and institutional settings. The analysis focuses on the

development of practices of collaboration between Regions and on how the sharing of knowledge helped to foster innovation in other Regions. This approach looks at a few, digitalization and sustainability in particular, which are necessary to promote joint Smart Specialisation Strategic approach topics in the Alps. The aim is to provide a cooperation model that seeks to create stronger links between Alpine Regions.

The paper unfolds as follow. The next paragraph depicts the framework for this study and the following section reports about the methods and source of data linked to the A-RING project. Then, the paper presents the analysis of the three regional cases and the sector analysis for digital transformation and sustainability. The result section shows the process of collaboration and discusses propositions to foster collaboration at the interregional level. The conclusion sums-up the results and prescribes policy interventions.

2. Background

The European Union has implemented strategies devoted to territorial cohesion since 2009. These strategies pertain to the regional level, and design macro-regions that need to strengthen their cooperation on economic, social and territorial cohesion policies (Camagni, 2010; Pagliacci *et al.*, 2020). The macro-regions overcome administrative borders and find their identity in the historical evolution of the territory (Faludi, 2013). Among the several macro-regions, the Alpine Region includes border Regions located across seven countries on the Alps. Among the European Regions, the Alps area suffers particularly from economic inequalities and uneven development.

Mountainous areas share difficult conditions of isolation and uneasy accessibility to basic social services such as healthcare and education and infrastructure such as communication and energy (Villeneuve *et al.*, 2004; Kohler *et al.*, 2004). The Alps present demographic, social, and economic and productive diversity (Capello, Cerisola, 2020). Despite the need for cooperation, the socio-demographic and accessibility issues of mountains deprive the area of the opportunities to interact with neighbours and form collaborations (Ferretti *et al.*, 2020). The EU-Strategy for the Alpine Region (EUSALP) «aims to ensure mutually beneficial interaction between the mountain Regions at its core and the surrounding area» and constitutes a strategic agenda to develop cooperation at the EU, national and regional level³.

Regions in the Alps do not just lie in a mountainous area, in most cases they are also border Regions. As such, the Alpine Region is crossed by a great cultural and linguistic diversity, which made communications harder, besides the shape of the territories. The European strategy for the Alps

³ *Ibidem.*

considers cross-border commuting in the Alps as an indicator of regional integration (Chilla, Heugel, 2018). In this respect, cross-border commuting in the Alpine Region is important given the high density of the borders, differences in the economic characteristics, distance of attractive labour markets, degree of urbanization, and morphology (Chilla and Heugel, 2020). However, borders are not just barriers, and might be seen as «engines» (Möller *et al.*, 2018) or «resources» (Sohn, 2014a; for the Alps see: Giorgi, Scheurer, 2015) for economic growth. Traders, tourists, retail customers, freight flows, and all sort of business people cross borders (Scott, 2011). If we consider cross-border commuting as an indicator of integration (Van der Valk, 2018), there is evidence of the growing number of cross-border commuters (EUROSTAT, 2018).

The final goal of the European Union in this area is to develop a framework to address common challenges and open the way for cross-regional and cross-border collaborations. The European Union has 40 internal land border Regions and around 30% (150 million people) of the European population lives in border Regions and proposes a set of actions to enhance the cohesion of border Regions (EU, 2017). The EU aims to reduce «the complexity, length and costs of cross-border interaction» (EU, 2017, p. 4). National laws and administrative procedures set obstacles to greater cross-border collaboration in multiple fields, including work, education, transport, and health care. Reducing border-related obstacles can lead to economic growth and jobs creation in border Regions. In the last 20 years, intra EU trade increased by 15% and generated 2.5 million jobs (EU, 2017, p. 2). Nowadays, 2 million commuters cross borders daily or weekly, of whom 1.3 are cross-border workers (EU, 2017, p. 2). The cross-border commuters in the Alps are more than a quarter of the European total, at about 600 thousand (Chilla, Heugel, 2018, p. 8).

The European Smart Specialization strategy is a comprehensive approach to local development and international integration for territories and regional industries that set their priorities based on an entrepreneurial search in the context of interregional and macro regional interaction. Innovation performance differs among Regions, so it deserves targets and measurements tailored to Regions (Ghini *et al.*, 2021; Silva *et al.*, 2021), that can leverage their context (Fratesi, 2020) and proximity (Capello, 2020). The Smart Specialization strategy for Regions considers the connectivity of industries, digitalization, convergence of technologies, and the interrelated development of territories (Stryabkova *et al.*, 2021) and industry-university collaborations (Mascarenhas *et al.*, 2021). However, in the case of such complex and diverse areas, it is vital to respect their historical local vocation and productive specialization to make the best of any territorial policy that aims for economic growth and convergence among bordering Regions (Kemeny, Storper, 2020; Capello, Cerisola, 2021), as well as focusing on sustainable long-term development and involving local stakeholders (Battaglia *et al.*, 2019).

3. The A-RING project: methods and materials

The main source for this study is the A-RING project held within the framework of the Interreg Alpine Space programme and funded by the ERDF with 1,147,996 EUR⁴. The project lasted from October 2019 to June 2022. A-RING developed a strategic transnational collaborative framework on specific topics for the Alpine Regions, for example digitalisation, climate change, and biodiversity conservation. The project filled a void in transnational collaboration for research and innovation practices in the Alps. A-RING addresses the alignment between different R&I policy initiatives and institutional frameworks, and with this aim, it established an innovative bottom-up process. The project gathered expectations from business sectors and potential from academia, and developed a model for a successful policy process to meet the citizens' needs. Twelve partners took part in the project: the University of Milan (Lead partner); Vorarlberg University of Applied Sciences; the Ministry of Education, Science and Sport of Slovenia; the University of Ljubljana (Faculty of Public Administration); the University of Applied Sciences Kempten; Hochschule Konstanz University of Applied Sciences; Wirtschaftsagentur Burgenland GmbH; the Industrial enterprises Association of Belluno Province; Lombardy Region; Polymeris, French competitiveness cluster for rubbers, plastics and composites industry; USI Università della Svizzera Italiana; Area Science Park in Trieste. The final outcomes are a Blueprint for Alpine R&I Agenda, a policy brief, and The Alpine Research and Innovation Chart. The present study relies mainly on the pilot study performed during the project to explore and validate the premises of the European regional Smart Specialization strategy. The analysis combines quantitative and qualitative data derived from the reports and the institutional communications channel to inquire into the development of territorial strategies. (Russo *et al.*, 2019). The pilot study returned meaningful insights that we reframe and further develop in this paper.

The research investigates the first three designated territories in the Alpine macro-region, namely Burgenland (in Austria), Lombardy (in Italy), and Slovenia, in the period 2014-2020. Note that Slovenia has no official intermediary administrative units between the national government and the municipalities, so Slovenia as a whole is considered as a Region in the context of EUSALP. The three territories analysed in this project are significantly different in size (population, geography) and R&I strategy maturity, which demonstrates a need for the system to be flexibly applied to these different contexts that are present across the Alpine Space. Table 1 reports the main

⁴ A-RING, Alpine Research and INnovation Capacity Governance, Factsheet, <https://www.alpine-space.eu/project/a-ring> (last access March 2023).

Table 1: Main indicators for the three regions

Region	Burgenland	Lombardy	Slovenia
Country	Austria	Italy	Slovenia*
Area	3,965 square km	23,844 square km	20,273 square km
Population	296,000	9,980,550	2,111,461
GDP (million)	9,005	388,124	45,775
GDP per capita PPP	27.300	38.500	22.100
GDP per capita PPP (EU27 = 100)	90	128	87

Note: * Country and Region are the same in this study, see EUSALP website: <https://www.alpine-region.eu/7-countries-and-48-regions>.
Source: EUROSTAT (2020), GDP per capita in EU regions, Newsrelease 38, <https://ec.europa.eu/eurostat/documents/2995521/10474907/1-05032020-AP-EN.pdf/81807e19-e4c8-2e53-c98a-933f5bf30f58>.



Figure 1: The Alpine macro-region. Burgenland, Lombardy, and Slovenia in dark.
Source: Authors' elaboration.

indicators for the three cases and Figure 1 shows the Regions within the Alpine macro-region.

4. Case studies

4.1. Burgenland

Burgenland is the easternmost and least populous of the nine states in the republic of Austria, with a population of less than 300 thousand. In the east, it borders Hungary, and only marginally Slovakia in the north and Slovenia

Table 2: Strategies Relevant for Burgenland's Development & Innovation Ecosystem

Strategy	Year	Hyperlink
Burgenland 2020	2012	Link
FTI Strategy Burgenland 2025	2014	No Link
Research (Forschung) Burgenland 2025 Strategy	2014	Link
Mobility for all Burgenlanders Strategy	2015	Link
Burgenland Tourism Strategy 2022+	2018	Link
Burgenland 2050, Climate and Energy Strategy	2019	Link
Burgenland Future Plan/Strategy 2020-2025	2020	Link
Burgenland Smart Mobility Strategy	2022	No Link

Source: Authors' elaboration on data A-RING, report 848.

in the south. The border is of historical importance, being for decades on the «iron curtain» separating Europe in the second half of the twentieth century (Jankó *et al.*, 2022; Kaufmann, Wagner, 2005), and symbolically was among the first borders to open in 1989 (Graf, 2018).

Wirtschaftagentur Burgenland (WAB)⁵ represents the Region of Burgenland in Austria. Burgenland developed a strategy aimed at harmonizing its ecosystem and creating concrete competitiveness in 2014-2020. Burgenland decided to develop strong centres of expertise to enhance their attractiveness. To foster their territorial competitiveness, they defined three main priorities: to promote research, technology and innovation; support small and medium enterprises (SMEs); and reduce CO2 emissions (see Table 2).

The strategy implemented a top-down perspective, utilising Burgenland and Austria-wide development statistics. By the end of 2014, the federal and state-level developed the programme within the framework of both the European Regional Development Fund (ERDF) and the European Social Fund (ESF), and codified in the strategies and action plans of key organisations responsible for different aspects of delivering the development strategy. From here, the Federal and State governments delegated the research plan to three core organisations: the regional administration, the regional research agency (Research Burgenland/Forschung Burgenland GmbH), and the regional economic development agency (Economy Burgenland/Wirtschaft Burgenland GmbH). However, to consolidate this strategy, a bottom-up approach fostered stakeholder engagement in the territory. Therefore, working group structures were formed to gather input on the strategy. These triple-helix stakeholders included representatives of SMEs, large enterprises, business support organisations, research organisations, training centres, interest groups, and various departments of the regional public authority (see Figure 2).

⁵ Wirtschaftagentur Burgenland, <https://wirtschaftagentur-burgenland.at> (last access March 2023).

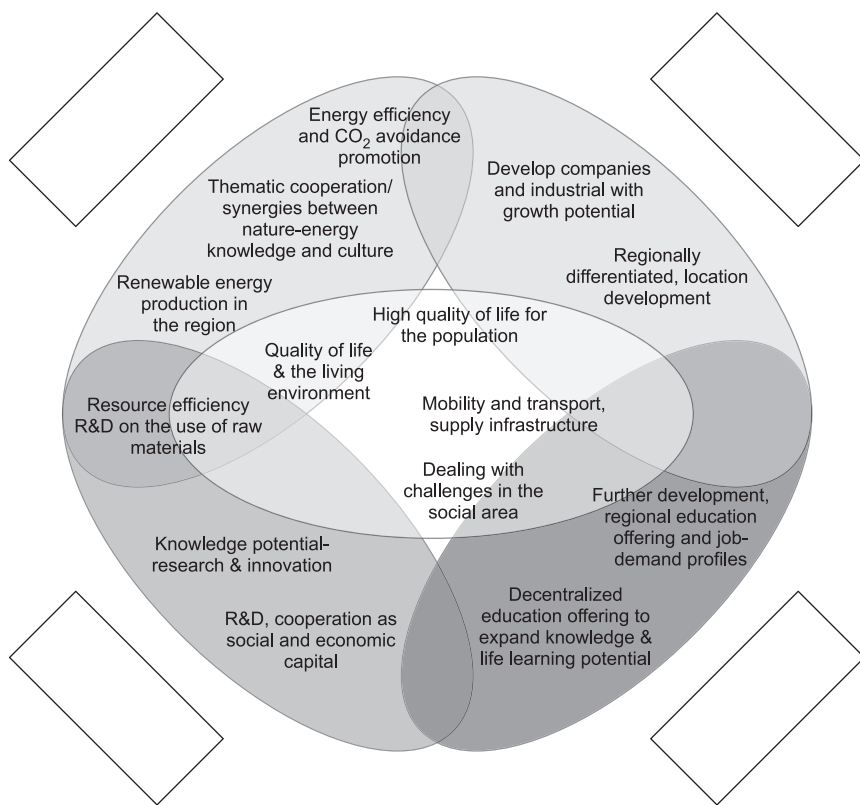


Figure 2: Burgenland Strategy.

Source: Burgenland Landesentwicklungsstrategie (Schremmer *et al.*, 2012, p. 21, translated).

Moreover, the simultaneous implementation of the 2014-2020 ERDF programming period made a valuable contribution to the economic development of the Region. Burgenland was able to develop cooperation with other Regions to exchange and learn from others' experiences and develop further and implement its 2014-2020 strategy.

Burgenland developed a new, well-structured strategy (Zukunftsplan 2020-2025/Future Plan 2020-2025) to foster the development of the previous strategy developed in 2012 to plan the activities until 2025. This new strategy, in parallel to the new European Programming (ERDF) period 2021-2027, enables Burgenland to harmonize territorial and European interests, and therefore to develop territorial competitiveness through lots of projects and initiatives funded partially or totally by the European Commission. In its new strategy, Burgenland decided to foster stakeholders' engagement through the implementation of measures in the innovation landscape. In terms of content, the new strategy is aligned with the European programme with the objective of obtaining investment from both the European (e.g. ERDF) and

national funds. The aim is to successfully continue and develop the regional policy of the state of Burgenland with ideal and material support from the European Union, the Republic of Austria, the state of Burgenland and other partners. Therefore, this new strategy not only uses the results from the previous period (2014-2020) but also is created according to European perspectives. Therefore, this new strategy targets the development of the following topics in particular:

- support all types of businesses and the connections to research;
- develop the healthcare system;
- foster sustainability by developing exchange of best practices and support innovations;
 - support the development of a new agriculture, more technological and sustainability-oriented;
 - develop tourism;
 - education by the development of skills according to market needs, for instance increase the readiness of the workforce for digital transformation or increase the number of women in the technical areas;
- social by enhancing equality and support for citizens;
- mobility by developing smart solutions to enhance connections;
- politics by emphasizing the need for transparency, efficiency, and democracy;
- develop the connections with Europe and foster international relationships.

Burgenland Strategy 2020 and Burgenland Future Plan 2025 selected three topics to develop on a platform for internationalization in the framework of the A-RING project, namely digitalization, sustainability, and mobility. The concept of Platform Internationalisation serves the need for exchanges on good practices and experiences with other Regions and to sustain discussion and consensus in the Region.

4.2. Lombardy

Lombardy is a Region in northern Italy and is bordered on the north by Switzerland, with around one third of its territory and its border in the Alps. Lombardy is the most populated Italian Region and is «Italy's leading industrial and commercial *region*» (Britannica, 2022).

The smart specialization strategy responds to the conditionality of the EU 2014-2020 cohesion policy, as it represents a necessary condition to access the funds. The regional strategy is consolidated in the EU scheme, to further strengthen the definition of «territorial-based» innovation policies.

The five strategic objectives of the European Cohesion Policy for the next period 2021-2027 are: 1) a smarter Europe, through innovation, digitization, economic transformation and support for small businesses; 2) a greener and carbon-free Europe, thanks to investments in the energy transition,

renewable energy and the fight against climate change; 3) a more connected Europe, equipped with strategic transport and digital networks; 4) a more social Europe, which supports quality employment, education, skills social inclusion and equal access to healthcare; 5) a Europe closer to its citizens, which supports development strategies managed at the local level and one sustainable urban development plan across the EU⁶.

The Smart Specialization Strategy, or the «Regional strategy of smart specialization for research and innovation», constitutes one of the enabling conditions for access to these resources. In particular, ensuring «good governance of the Intelligent Specialization Strategy»⁷ represents the first enabling condition to which seven criteria are connected.

1. Carrying out an updated analysis of the obstacles to the diffusion of innovation, including digitization.

2. The existence of competent regional institutions or bodies responsible for managing the Strategy.

3. The definition of monitoring and evaluation tools aimed at measuring the performance of the Strategy with respect to its objectives.

4. The effective functioning of the entrepreneurial discovery process.

5. The definition of the actions necessary to improve the regional research and innovation system.

6. The definition of specific actions to manage the industrial transition.

7. The identification of international collaboration measures.

The Smart Specialization Strategy of the Lombardy Region for the period 2021-2027 follows the «integrated trajectory» of development that started in previous plan for the years 2014-2020. The aim of the Strategy is to identify resources and skills, innovative potential, priorities in terms of industrial transformation and resilience of the Lombard economic-productive system and emerging technological areas, on which to concentrate regional investments in the next seven years⁸ (see Table 3).

The strategy for the 2021-2027 period relies on a tested governance system. The governance process involves both horizontal coordination – between *Direzioni Generali* and together with the entities and companies of the Regional System – and vertical coordination – at the national and European level.

At the regional level, a working group named «Gruppo di Lavoro Inter-direzionale» prepared the strategy 2021-2027 to stimulate horizontal synergies between regional intersectoral programmes and implement integrated development interventions. The presence of already well-established stakeholders' engagement mechanisms boosted the vertical coordination, thanks

⁶ EU, Priorities for 2021-2027, https://ec.europa.eu/regional_policy/policy/how/priorities_en (last access March 2023).

⁷ Good Governance: Principles and Challenges, <https://s3platform.jrc.ec.europa.eu/good-gov-governance> (last access March 2023).

⁸ Lombardy Region's Smart Specialisation Strategy, <https://www.s3.regione.lombardia.it/wps/portal/site/s3/lombardy-s3-in-brief> (last access March 2023).

Table 3: Strategies Relevant for Lombardy's Development & Innovation Ecosystem

Specialization Area	Link
Aerospace	http://www.aerospacelombardia.it/
Agri-food	https://www.s3.regione.lombardia.it/wps/portal/site/s3/lombardy-s3-in-brief
Green industry	
Creative and Cultural industries	
Health industries	
Advanced manufacturing	
Sustainable mobility	

Source: Authors' elaboration on Strategia di Specializzazione Intelligente di Ricerca e Innovazione – S3 2021-2027, Regione Lombardia, <https://www.s3.regione.lombardia.it/wps/portal/site/s3/strategia>.

to the introduction of the Entrepreneurial Discovery System process and the enhancement of operational tools such as the Lombardy Technological Clusters (CTL) and the Open Innovation (OI) Platform. These give stakeholders – and firms in particular – the opportunity to express their needs, ideas, and to actively participate in the process of defining new solutions.

The Lombardy Region acknowledged the need to move away from vertical approaches, in both analysing and decoding phases in its territory and in its governance. Over the years, the CTLs have become key aggregated stakeholders in the area, encouraging public debate between the academic and business worlds and bringing their needs within the innovation system. Clusters are effectively used as tools for intermediate governance between the territory and the regional administration to involve systematically in the planning of regional strategies.

In tracing the development trajectory of the territory in the coming years, the Lombardy Action Plan takes into account the weaknesses and threats in the territory. Four major actions have been identified.

1. Enabling action to strengthen the Lombardy system of research and innovation through the paradigms of Responsible Research and Innovation (RRI) and Open Innovation.

2. Action to support technology transfer, industrial research and innovation in innovation ecosystems.

3. Action to support investments for the digital transition and the adoption of sustainable development models.

4. Action to support the internationalization of the research and business system and the attractiveness of the Lombardy system.

The Lombardy Region outlines four levels of indicators in line with the regulations provided by the European Commission on «monitoring and evaluation of the European cohesion policy» and in line with the Regional Development Plan (DGR 113 – 14 May 2013 and DCR X/78 – 9 July 2013).

1. Context indicators: providing a dynamic picture of the Lombardy context and measuring the evolution of the regional system.

2. Impact indicators: percentage variation of context indicators on which regional policies intend to act.

3. Result indicators: selected for each action foreseen in the programming phase, they measure the change connected to the regional interventions implemented.

4. Progress/implementation indicators: measuring the percentage progress of the process linked to an action, the financial progress and the outputs – intended as «physical» results obtained thanks to the use of the resources obtained through regional interventions.

The Lombardy Region has undertaken and maintained international and, in particular, European cooperation activities through active participation in networks and initiatives in support of R&I, aiming at supporting the internationalization of companies and the attractiveness of the Lombardy system. The concrete implementation of the S3 will also be ensured through the supervision and participation in the European initiatives and networks to which the Lombardy Region adheres, which offer a strategic platform for networking and interregional cooperation activities, at the same time favouring a greater impact on strategic positioning activities.

4.3. Slovenia

The Republic of Slovenia has been an independent country in central Europe since 1991 and was a socialist republic of the Yugoslavia federation (Banerjee, Jesenko, 2015). It is also an Alpine Region that has borders with the Austrian Alps to the North and Italy to the West.

Slovenia has rolled out an entirely new model of development and innovation cooperation between the key stakeholders and has significantly improved its integration in the European and global development and innovation networks, thematic platforms, and consortia. The Slovenian Smart Specialisation Strategy sets out national strategic development priorities and niches that are supported on the ground by a comprehensive, focused, and tailored policy mix⁹. The Strategic Research and Innovation Partnerships based the development of the Slovenian innovation ecosystem on a cluster-based approach.

The Slovenian Ministry for Development and European Cohesion Policy established a working group that discussed and approved a draft document of the renewed the Smart Specialisation Strategy on 23 December 2021. Other government offices that took part the working groups are the Ministry of Economic Development and Technology, the Ministry of Education, Science and Sport, and the Ministry of Public Administration.

⁹ Slovenian Smart Specialisation Strategy, https://www.eu-skladi.si/portal/en/post-2020-1/programming-1/slovenian_smart_specialisation-strategy (last access March 2023).

The working group presented a draft document depicting the «Slovenian Sustainable Smart Specialisation Strategy»¹⁰ based on the results of an entrepreneurial discovery process that took place in 2021, a bottom-up process driving stakeholder engagement to prioritise investments. A series of vents involved a broad audience with the widest public interest.

A total of 10 workshops took place between 26 March and 19 April 2021. Every event explored priority domains of Slovenian Smart Specialisation Strategy. The online workshops have been held by the Government Office for Development and European Cohesion Policy as part of the exercise of preparing an updated Smart Specialisation Strategy for the programming period 2021-2027 on the basis of an entrepreneurial discovery process. The kick-off workshop focused on presenting the process of updating Slovenian Smart Specialisation Strategy and outlining the relevant expert and programme bases of the Ministry of Education, Science and Sport, the Ministry of Economic Development and Technology, the Ministry of Public Administration, the Ministry of Labour, Family, Social Affairs and Equal Opportunities and the Government Office for Development and European Cohesion Policy that the updating exercise should build on. The workshops were widely attended, bringing together over 900 stakeholders from the business sector, public and private institutions, civil society, government departments and other spheres. All presentations and workshop videos are publicly available. All the sessions of the entrepreneurial discovery process are recorded and publicly available on the Slovenian Smart Specialisation Strategy website (see footnote 2).

The resulting document identified nine topics within which to form Strategic Research and Innovation Partnerships (SRIP). SRIPs are public-private clusters to facilitate knowledge exchange and bring together stakeholders (i.e., companies, educational and research institutes, non-governmental organisations, other interested partners and public entities) around a common theme. Table 4 reports examples of SRIP undertaken in Slovenia.

The aim of the Slovenian smart strategy is to develop on circular economy principles based on its natural resources (**Slovenian Smart Specialisation Strategy, 2017**)¹¹. A green transition is at the core of the strategy, with «industry 4.0» and digital economy as priorities.

SRIPs are already undertaking internationalisation activities with a range of innovation stakeholders; international activities include connecting with international associations, contacting representatives of similar initiatives and companies abroad, participation in international events, foreign delegations,

¹⁰ Strategija pametne specializacije 2030, in Slovenian, <https://www.eu-skladi.si/sl/dokumenti/kljucni-dokumenti/2021-12-20-osnutek-strategije-pametne-specializacije.docx> (last access March 2023).

¹¹ Slovenska strategija pametne specializacije, <https://www.gov.si/assets/ministrstva/MKRR/S4-Slovenska-strategija-pametne-specializacije/Slovenska-strategija-pametne-specializacije.pdf> (last access March 2023).

Table 4: Strategic Research and Innovation Partnerships (SRIP) in Slovenia

Strategy	Link
SRIP Smart cities and communities	http://pmis.ijs.si
SRIP Smart buildings and home including wood chain	https://srip-pametne-stavbe.si/
SRIP Network for transition to circular economy	https://srip-krozno-gospodarstvo.si/
SRIP Sustainable food production	https://www.gzs.si/srip-hrana/
SRIP Sustainable tourism	https://www.srip-turizem.si/o-sript/
SRIP Factories of the future	http://ctop.ijs.si/sl/o-partnerstvu/
SRIP Health – Medicine	https://www.sripzdravje-medicina.si/
SRIP Mobility	https://www.acs-giz.si/o-acs
SRIP Materials as end products	https://matpro.gzs.si/

Source: Draft document of Smart Specialization Strategy in Slovenia, available at: <https://www.eu-skladi.si/sl/dokumenti/kljucni-dokumenti/2021-12-20-osnutek-strategije-pametne-specializacije.docx>.

and visits. One example is the «Go International Slovenia programme» of the Chambers of Commerce¹².

The Chamber of Commerce performs an important and stable role as a national reference point of various European networks and hubs, while also providing development opportunities. The SRIPs internationalisation activities support members by registering them for international projects and with international events, i.e., conferences. Several SRIPs prepare and implement workshops for small and medium-sized enterprises. For example, SRIP MATPRO developed a training initiative focused on the integration of members into international global markets. Integrating into digital communities of practice is also occurring, for example SRIP Health-Medicine became a full member of the Twin International Multihelix (TIM) super cluster. Some SRIPs have been in communication with foreign embassies and Slovenian ambassadors abroad, with limited impact.

5. Analysis

The key topics inside A-RING Project were 1) Digitalization, 2) Sustainability, 3) Recovery from COVID and 4) Smart Mobility. The topics of digitalization and sustainability are in line for the strategic action of Burgenland, and hold true for Slovenia, which showed additional interest to the circular economy, and Lombardy, which included in its strategy also tourism and medical technologies.

¹² International Relations Department at the Chamber of Commerce and Industry of Slovenia (CCIS), <https://eng.gzs.si/pripone/BROSURA%20GB.pdf> (last access March 2023).

5.1. Digital transformation

Digital transformation or digitalization is a transversal topic included in lots of different sectors. Digitalization is at the centre of several EU strategies at the local, country, and European level, including the NextGeneration EU and in the National Recovery and Resilience Plan of Italy at the country level, being the first mission of the plan (for a discussion, see Bellandi *et al.*, 2022).

The digital transformation has not been considered as one specific topic in the strategy developed by Burgenland. However, the Region chooses to foster digitalisation in specific sectors, and by all types of organisations (SMEs, Research, Public Administration) and also in households by the increased use of the Internet. The Burgenland Council for Research and Technology Development is developing a regional digitization strategy. The priorities of the strategy are promoting research, encouraging and supporting businesses, developing the healthcare system, fighting against climate change and fostering the protection of nature, fostering the development of a consistent agriculture and building strategy, enhancing tourism and smart mobility.

The A-RING project enabled Burgenland to foster and accelerate the process of digitalization according to its strategy. The many events held during the project emphasized the need to include all types of stakeholders in every phase of the development and implementation of the strategy. A peer review on what has been implemented is crucial, in order to build upon it for further actions. The Platform Internationalization and the development of other projects such as S3HubSinCE have accelerated the process of digitalization in the European Union. Indeed, through the creation of working groups (Navigation Crews, a functional aspect of S3HubsinCE), Burgenland was able to learn from other stakeholders on specific topics related to DIHs specialization and digitalization. Lots of projects and initiatives have contributed and still contribute to the creation of a harmonized digital ecosystem in Europe and more specifically in Burgenland.

To take a few illustrative examples. «Digital Twins» is a project aimed at fostering the ecosystem of Digital Innovation Hubs (DIHs) by connecting different part of Europe and enhancing mutual learning from discussions. The «Digital Village» initiative has the aim of enhancing cross-border cooperation on the topic of Digitalization. The objective for the Region is to engage with specific stakeholders and to develop bilateral and multilateral cooperation. Through the Digital Village initiative, the Burgenland Region wants to develop further cooperation with Slovenia on the topic of digitalization and to build upon its previous experience, developed with Slovakia on the same topic between 2014 and 2020. Indeed, the project DIGIVIL SK-AT funded by Interreg SK-AT focused on enhancing digital transformation in different sectors: learning and cooperation, in healthcare, for communication and for daily-basis usage for citizens. Therefore, new planned cooperation based on these foundations and past experiences between Austria and Slovakia should

enable the new cooperation between Austria and Slovenia to be more effective and create high added value.

The Digital Slovenia 2020 Strategy¹³ is one of three key strategies that provide guidelines for the establishment of an innovative knowledge-based society, alongside RISS – Research and Innovation Strategy of Slovenia, and SIP – Slovenian Industrial Policy. It envisages actions to harness the social and economic potential of ICT and the Internet for digital growth, focusing on digital infrastructure, the intensive use of ICT and the Internet, cyber security and an inclusive information society.

Lombardy identified five priorities in digitalization: industry 4.0, circular economy, bioeconomy, cybersecurity, and social innovation. Another topic is artificial intelligence, a domain inside the digital transformation agenda that has cross-cutting and trans-sectoral applications. The Region launched an «open innovation» platform where operators can share information and results towards access to the digital transformation, financing opportunities that arise, both by the direct initiative of the Region and from other private or public sources¹⁴. An example of collaboration is the Cluster for Advanced manufacturing (AFIL)¹⁵, a platform promoting the participation of companies and stakeholders in a shared ecosystem of digitalization.

The A-RING project organized two Alpine Transnational Live Learning (ATLL) events on digitalization in January and October 2021. On those occasions, the Burgenland Region was able to develop its understanding of the potentialities offered by the digital transformation. The A-RING project was integrated in a broader context of a global European digitalization. Other projects ran at the same time and created consistency in the territory. Indeed, Burgenland through Forschung Burgenland was also included in the project S3HubSinCE funded by Interreg Central Europe¹⁶. This project's main objective was to build and connect Digital Innovation Hubs by enhancing the exchange of good practices and lessons learned.

5.2. Sustainability and circular economy

The European Commission prioritized Sustainability for the period 2021-2027. The circular economy represents a huge opportunity and challenge. According to the European Commission, the transition to a circular economy

¹³ DIGITAL SLOVENIA 2020 – Development Strategy for the Information Society until 2020, <https://www.gov.si/assets/ministrstva/MJU/DID/Digital-Slovenia-2020-Development-Strategy-for-the-Information-Society-until-2020.pdf> (last access March 2023).

¹⁴ Regione Lombardia, Open Innovation, <https://www.openinnovation.regione.lombardia.it/en/home> (last access March 2023).

¹⁵ AFIL – Associazione Fabbrica Intelligente Lombarda, <https://www.afil.it/en/> (last access March 2023).

¹⁶ Interreg Central Europe, S3HubSinCE, <https://programme2014-20.interreg-central.eu/Content.Node/S3HubsinCE.html> (last access March 2023).

is a huge opportunity to create competitive advantages on a sustainable basis¹⁷. Clean Energy is also a challenging topic. According to EUROSTAT, renewable energy is an integral part of Europe's energy mix and more than half of the EU's electricity supply is climate-neutral. Energy efficiency measures, including energy labelling, have reduced energy consumption in recent years. As part of the Energy Union regulation, the EU level targets of reaching at least 32% renewable energy of total energy consumption and at least 32.5% energy efficiency in 2030 will allow us to go beyond our commitment under the Paris Climate Agreement to reduce greenhouse gas emissions by at least 40% by 2030, compared to 1990 levels¹⁸. Europe has developed a strategic plan towards 2030 to address five policy objectives¹⁹.

1. A more competitive and smarter Europe.
2. A greener, low-carbon transitioning towards a net zero carbon economy.
3. A more connected Europe by enhancing mobility.
4. A more social and inclusive Europe.
5. Europe closer to citizens by fostering the sustainable and integrated development of all types of territories.

According to the «Future Plan for Burgenland 2020-2025», a central focus of the regional government is on climate protection. As part of the implementation of Burgenland's climate strategy, there will be the development of photovoltaic applications and technologies, a new focus on environmentally friendly mobility, the expansion of the use of geothermal energy, an increase in the capacity of existing wind power plants, and an initiative to phase out oil heating. Further steps in the fight against climate change will be taken with measures for green housing subsidies and the implementation of the bio-transition in agriculture. Therefore, the province of Burgenland and its businesses have a special role to play here, as they should act as role models to motivate other players to take committed steps in the areas of climate protection and energy. Climate protection in Burgenland should primarily focus on positive incentives and create opportunities for private individuals and companies. It should be designed to be socially acceptable and fair. Thus, a new department for Energy and Climate Protection focusing on these topics has been created.

In Slovenia, the three priorities to develop a circular economy are sustainable tourism (e.g. Polderman *et al.*, 2020), sustainable food production, and «Networks towards Circular Economy», implemented through the SRIP «Circular Economy». This SRIP aims to overcome the fragmentation of relevant knowledge. It also provides a link for local SMEs to international and

¹⁷ European Commission, a Sustainable Europe by 2030, https://commission.europa.eu/publications/sustainable-europe-2030_en (last access March 2023).

¹⁸ EUROSTAT, Renewable Energy Statistics, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics (last access March 2023).

¹⁹ European Commission, New Cohesion Policy, https://ec.europa.eu/regional_policy/2021-2027_en (last access March 2023).

EU-level collaboration and financing. Technologies, R&D infrastructure and attractiveness to investors, business models as well as a suitable regulatory support environment are all elements of this public-private partnership.

The A-RING project organized an event on Sustainable Innovation with a focus on Green and Renewable Energy in October 2020. On that occasion, Burgenland presented its territorial strategy, including Energy Burgenland and Research Burgenland's Energy Lab, one of Austria's largest innovation laboratories. Following this event, Burgenland started a Platform Internationalisation on Circular Economy to exchange best practices. For example, the Finnish Region of the capital city Helsinki shared its roadmap regarding carbon neutrality and presented 6 main topics: 1) Mobility, 2) Land-Use and Construction, 3) Carbon sinks and emissions, 4) Consumption and production, 5) Circular economy, 6) Energy. Burgenland acquired lots of information and insights on how to build upon their own sustainability strategy and define priorities on 1) Climate Neutrality, 2) Citizens' City, 3) Industrial Modernisation through digital transformation.

In the context of the A-RING project in July 2021, Burgenland and Slovenia met to share practices. The meeting created great outcomes as it fostered knowledge exchange and connections. On the subject of knowledge exchange, Burgenland learnt about Slovenia's detailed SRIP for community-led strategic management of the circular economy across the Region. With regard to establishing connections, it engaged in a follow-up discussion on the topic of agricultural waste for industry products, for example with InnoRenew, a research institute based in Slovenia, and specialized in renewable materials and sustainable building research, by focusing on wood modification and restorative environmental and ergonomic design.

The Lombardy Region presented the circular economy pilot hub during an A-RING event in January 2021, presenting the need to achieve a large-scale impact and fundamental transformation of the regional industrial ecosystem towards circular value-chains. Lombardy introduced a pilot action as a fundamental process to get rid of barriers against the adoption of new policies; practically, it consists of learning how to support companies in the uptake and integration of sustainable circular technologies and processes in their production systems and business practices. Lombardy decided to pilot circular economy initiatives for manufacturing in the automotive industry, the new mobility context being one of the most challenging for a traditional industry such as the automotive industry²⁰.

²⁰ «Annex to the Intervention Plan of The Collaboration agreement for the creation of an innovative regional pilot infrastructure to support the transition towards the circular economy», Regione Lombardia, 2021.

6. Evidence and results

The comparison of the three Alpine Regions provides key observations of convergent or coordinated development. Burgenland developed the concept of Platform Internationalisation to facilitate talks and exchanges inside and outside of the Alpine Space on the key topics of digitalization and sustainability. The Lombardy Region has undertaken and maintained international and, in particular, European cooperation activities through active participation in networks and initiatives in support of R&I, aiming at supporting the internationalization of companies and the attractiveness of the Lombard system. Slovenia involved local stakeholders and held workshops and training focused on the integration of members into international global markets. Slovenia and Lombardy emphasized the use of the entrepreneurial discovery process to develop their strategies, implementing SRIPs and working groups respectively.

All the three partners acknowledged a strong focus on digitalization and started close cooperation with each other. For instance, in the context of the digitalization partnership, Lombardy organized an event on artificial intelligence that forced Burgenland to improve the application of AI inside manufacturing. Afterwards, Burgenland held two webinars on digital transformation in the framework of the Platform Internationalisation on «Innovation Corridors», aimed at providing insights on how to create regional competitive territories on the specific topics of digitalization. The other side of this interregional collaboration is the local diffusion of knowledge that impacts alpine communities. For example, Burgenland started the «Science Village» initiative to bring a mix of topics from science, digitization and education to communities and villages, with a focus on practical application and low-threshold applicability. This EU-funded trend aims to bring typical urban topics to rural Regions to make local people more aware of science, education, and digitization.

Collaboration at multiple levels proved vital to Regions in the Alps. The Burgenland Region was able to develop its understanding of the opportunities and challenges of the topic of sustainability by the implementation of the platforms internationalization. Burgenland was also able to acknowledge its strengths in the topic such as in the energy sector and more specifically in the field of research and development of renewable energy. Forschung Burgenland is involved in the research on renewable energy and waste treatment, with Energy Burgenland and Burgenland Waste Association. Therefore, it developed a strong territorial ecosystem of research on these topics. Moreover, we observed a strong cross-border ecosystem of cooperation. For instance, Burgenland has engaged in talks with Slovenia.

The weak inclusiveness and social innovation of Slovenia caused socio-economic disparities on a transnational level. Current scientific and tech-

nological transnational cooperation is hindered by factors such as different levels of knowledge transfers and innovations capacities. This means that the ability to implement knowledge-based and technology-intensive activities is still weak. The A-RING project has presented various ways to overcome these obstacles. Identification of a common platform and establishment of a single platform would boost the efficient operation of enabling networking and getting to know each other in our regional ecosystems. Platforms involve actors on an operational level providing that it bears proper funding at scale, and those clear synergies are established. Ideally the platform itself would comprise two parts: 1) an online digital tool to facilitate remote interaction and best-practice exchange, and 2) a physical platform to promote networking.

The circular economy pilot plan of Lombardy attracted interest from the Burgenland Region and Slovenia; the pilot practices brought up the need within the Alpine Region to access, share and replicate piloting experiences in the field. Piloting experiences in this sector can lead to numerous advantages, including the access to more funding opportunities. The object of the A-RING Policy Piloting Activity for Lombardy Region is to test the possible ways in which cross-regional cooperation can be brought up to complement long-term interregional cooperation. The aim is to validate:

- cross-regional initiatives, at different development stage;
- cross-border initiatives to tackle macro-level issues, such as the circular economy one;
- promote the right communication channels and paths towards cross-region and cross-border initiatives;
- test shared policy building on the Circular Economy inside the Alpine Region.

The opportunity to share and the piloting experience developed in Lombardy and non-Alpine Regions, represents on one side a core objective for the A-RING project and a huge opportunity for Alpine Regions to learn on transnational and transregional collaborations.

7. Discussion and conclusion

7.1. Propositions for future collaboration

The three Regions in our study stressed the need to move towards the creation of a European ecosystem. Lombardy calls for actions supporting technological transfer, industrial research and innovation in the innovation ecosystems (Lombardy, 2021). Local and cross-border ecosystems thrive in three cases. Slovenia proved to have a well-functioning local ecosystem; the Chamber of Commerce performs an important and stable role as a national reference point of various European networks and hubs, while also providing development opportunities. Lombardy and Burgenland have a strong indus-

trial ecosystem on several topics despite the difference in size. However, it is fundamental to find areas of collaboration where each territory can extend its competitive edge, in complementary ways with connected territories. A mutual competitive advantage is key to promoting cross-territory coordination on sustainable and smart specialisation strategies.

During the A-RING project, the pilot study presents several steps of collaboration with other Alpine Regions from the experience of Slovenia and Burgenland: 1) sharing the path towards the piloting hub construction; 2) sharing early results of the piloting hubs experiences; and 3) introducing other Alpine Regions' stakeholders to those which are currently piloting.

However, this ecosystem acknowledged that the weak inclusiveness and social innovation of the macro-region cause socio-economic challenges on a transnational level. Factors such as different levels of knowledge transfers and innovations capacities are hindering scientific and technological cooperation. This means that the ability to implement knowledge-based and technology-intensive activities is still weak. The A-RING project presented various ways to overcome these obstacles, like enabling networking and getting to know each other to further enforce transnational cooperation. Identifying a common platform would boost the efficient operation of actors on an operational level, providing that the platform bears proper funding at scale, and that it establishes synergies.

The current results are useful beyond the Alpine Region and may help other peripheral areas, i.e., Regions with limited industry clusters, sources of knowledge generation and transfer, and higher education institutions such as universities and research organizations (Tödtling, 2009; Capello, Lenzi, 2022).

7.2. Concluding remarks

Both small and large territories in the Alpine Regions share – though in substantially different ways – the same difficulties with regard to fostering cross-border collaborations for R&I project: hyper-specialization; high perceived bureaucracy; lack of clarity in the objectives and potential benefits of RIS3 strategies; lack (or overabundance) of information sources related to funds, project calls and cross-border initiatives.

This article presents an action plan to foster and strengthen transnational cooperation in Research and Innovation in the Alps. The A-RING final report proposes a visualization of functional connections/relations, funding programmes, infrastructures and processes that can be jointly adopted by a macro-region and its components to pursue higher impact results in R&I collaborative efforts.

The analysis of the three regional cases from the pilot study that served as a preliminary exploration for the validation of the aims of the A-RING project has two relevant implications. First, smaller territories (e.g. Burgenland), with fewer diverse potential stakeholders and higher geographical/

economical homogeneity, enact a more open and discontinuous process of involvement, i.e., they can issue calls for contributions with a higher frequency, can be more directly responsive towards different stakeholders' needs, etc. Second, larger (e.g. Slovenia) and/or more populated (e.g. Lombardy), with a higher diversity in geography, economy, and density of stakeholders, tend to privilege a long-term strategy, are less open to new-comers, and far more rigid with regard to fund allocation, topics of interest and less directly responsive to stakeholders.

This study acknowledges its limitation in the nature of an explorative study of a limited set of cases and thus calls for a broader analysis of the Regions in the Alps, yet it presents a structured analysis of strategies to apply to different Regions and sectors that could serve as guidance for policymakers at the EU and local level.

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