

ALPINE GREEN ECONOMY: SCREENING OPPORTUNITIES AND CHALLENGES FOR THE ITALIAN ALPS

REPORT 1

THE GREEN ECONOMY IN THE ITALIAN ALPS: KEY ECONOMIC SECTORS AND THEIR POTENTIAL DEVELOPMENT

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Report developed within the framework of activities of the Memorandum of Understanding between the Italian Ministry for the Environment and the Permanent Secretariat of the Alpine Convention for the “Co-operation on the implementation of the Protocols to the Alpine Convention in the territory of the Republic of Italy”



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Table of Contents

1. Introduction	3
2. Policy frameworks for the Green Economy in mountain regions	4
2.1. International policy frameworks	4
2.2. European policy framework	6
2.3. Regional policy frameworks	9
2.4. National policy framework	12
3. Multi-criteria analysis of key green economic sectors in the Italian Alps	16
3.1. Methodology	16
3.1.1. Performance matrix.....	16
3.1.2. Scoring and weighting.....	19
3.1.3. Aggregation	20
3.2. Results	21
3.2.1. Energy.....	22
3.2.2. Transport	26
3.2.3. Agriculture and farming	28
3.2.4. Forestry	31
3.2.5. Tourism.....	34
4. Conclusions	40

1. Introduction

The project “Alpine Green Economy: Screening Opportunities and Challenges for the Italian Alps” is developed within the framework of activities of the Memorandum of Understanding between the Italian Ministry for the Environment and the Permanent Secretariat of the Alpine Convention for the “Co-operation on the implementation of the Protocols to the Alpine Convention in the territory of the Republic of Italy”. The Permanent Secretariat of the Alpine Convention was established by a decision taken at the 7th Alpine Conference in Merano in November 2002. The Permanent Secretariat supports the bodies established by the Alpine Convention. It offers a professional, logistic, administrative help and assists the countries in carrying out the actions, required by the Convention and its Protocols.

The project aims to identify concrete steps for implementing the “Green economy Action Programme” in the Italian Alpine region, coherently to the 6th Report on the State of the Alps “Greening the Economy in the Alps” and the latest advice of the Alpine Green Economy Board. The projects goals are: to identify specific solutions and a suitable procedure in order to deliver significant improvements in the green economic performance of some economic sectors in the Italian Alps; to identify suitable procedures that may ease and support processes of innovation and ensure sustainability in the economic context of the Italian Alps; to define a strategy for the replication of the approach developed in other Alpine contexts. The Table below summarizes the project Deliverables and the related Reports in which each Deliverable is included.

Alpine Green Economy: Screening Opportunities and Challenges for the Italian Alps	
Deliverables	Final Reports
Deliverable 1.1 “Policy frameworks for the Green Economy in mountain regions” Deliverable 1.2 “Multi-criteria analysis of key green economic sectors in the Italian Alps”	Report 1 “The green economy in the Italian Alps: key economic sectors and their potential development”
Deliverable 2.1 “Analysis of the key case-study regions for the Alpine green economy” Deliverable 2.2 “Identification of regional projects in the key sectors and regions”	Report 2 “The green economy in the Italian Alps: framework for regional evaluation and implementation”
Deliverable 3.1 “Innovative governance: cases of successful implementation, scalability and replicability” Deliverable 3.2 “Innovative financial instruments: cases of successful implementation, scalability and replicability”	Report 3 “Implementation of the Green Economy in the Italian Alps: governance and financial instruments”

2. Policy frameworks for the Green Economy in mountain regions

2.1. International policy frameworks

The global importance of mountains in the international frameworks has been recognized since the **Rio Declaration on Environment and Development** (UNCED, 1992), developed during the "Conference on Environment and Development" (also known as the Earth Summit). The Conference introduced the concept of "**Sustainable Mountain Development**" (chapter 13 of the "Agenda 21") and called for the study, protection, and restoration of these ecosystems and assistance to populations in regions suffering degradation. Ten years after the Earth Summit, the Rio+10 meeting of the United Nations, held in Johannesburg, adopted the "**Johannesburg Declaration on Sustainable Development**" and the "**Plan of Implementation of the World Summit on Sustainable Development**". In the Plan (paragraph 42), it is recognized that mountain ecosystems support particular livelihoods and include significant watershed resources, biological diversity and unique flora and fauna, as well as that many mountain ecosystems are particularly fragile and vulnerable to the adverse effects of climate change and need specific protection (UNCED, 2002). A set of actions to be taken at all levels were defined, among which: "develop and promote programs, policies and approaches that integrate environmental, economic and social components of sustainable mountain development and strengthen international cooperation for its positive impacts on poverty eradication programs"; "implement programs to address, where appropriate, deforestation, erosion, land degradation, loss of biodiversity, disruption of water flows and retreat of glaciers"; "implement programs to promote diversification and traditional mountain economies, sustainable livelihoods and small-scale production systems" and "promote full participation and involvement of mountain communities". In the framework of the Johannesburg World Summit on Sustainable Development, the **Mountain Partnership** was set up as a voluntary alliance with the objective of creating a platform for cooperation among all states, organizations and NGOs dedicated to improving the lives of mountain peoples and protecting mountain environments around the world. The Mountain Partnership addresses the challenges facing mountain regions by tapping the wealth and diversity of resources, knowledge, information and expertise, in order to ensure the improvement of the quality of life and environments of the world's mountain regions. It currently includes 50 governments, 16 intergovernmental organizations and 143 Major Groups (e.g. civil society, NGOs and the private sector) including the Alpine Convention. Its Secretariat is hosted by The Food and Agriculture Organization of the United Nations (FAO) in Rome. Global recognition of the importance of mountain environments was reinforced through the designation of the year 2002 as the International Year of Mountains. Twenty years after the Earth Summit, the **UN Conference on Sustainable Development** adopted "**The future we want**", a declaration on sustainable development and a green economy. The document includes three paragraphs on mountains (paragraphs 210, 211, 212)_recognizing the role of mountains as well as related ecosystems services (UNCSD, 2012). The document emphasizes that "mountains are often home to communities, including indigenous peoples and local communities, that have developed sustainable uses of mountain resources" and calls for "greater efforts towards the conservation of mountain ecosystems, including their biodiversity".

Furthermore, the document encourages States to “adopt a long-term vision and holistic approaches, including by incorporating mountain specific policies into national sustainable development strategies”.

Furthermore, mountains have been specifically considered in the 2004 **Convention on Biological Diversity**, during which the Programme of Work for Mountain Diversity was adopted (CBD, 2004). The programme consists of three interlinked elements to be mutually reinforcing and cross cutting in their implementation, and of specific goals and targets in each element: Direct actions for conservation, sustainable use and benefit sharing; Means of implementation for conservation, sustainable use and benefit sharing; Supporting actions for conservation, sustainable use and benefit sharing. Different approaches for assessing sustainable mountain development using the SDGs as a framework have been developed. Such assessments can help contextualize and highlight the specific needs of and challenges for mountain communities and ecosystems in addressing sustainable mountain development, as well as inform policy and decision-making at the global, national, and subnational levels in steering efforts (Bracher et al. 2018).

In 2015, world leaders adopted the **2030 Agenda for Sustainable Development** and its **17 Sustainable Development Goals** (SDGs), a collection of global goals set by the United Nations Development Programme that cover social and economic development issues including poverty, hunger, health, education, global warming, gender equality, water, sanitation, energy, urbanization, environment and social justice (UN, 2015). The goals are broad and interdependent, yet each has a separate list of targets to achieve. In total, there are 169 targets for the 17 goals. In 2017 the Inter-Agency and Expert Group on SDG Indicators identified 232 indicators that will measure compliance (IAEG-SDGs, 2017). The majority of the 17 SDGs are strictly related to the sustainability of mountain regions. Before the finalization of the SDGs for instance the FAO launched a call to action, addressing mountain countries, organizations, communities, aiming to help ensure that mountains were included in the Sustainable Development Goals (FAO, 2015). In paragraph 33 of the 2030 Agenda for Sustainable Development focuses on the impact that sustainable management of natural resources has on social and economic development and therefore, on the importance of conservation and sustainable use of mountains and of the protection of biodiversity, ecosystems and wildlife. More in detail, the goals and sub-goals directly mentioning the mountains systems are **SDG 6: “Ensure availability and sustainable management of water and sanitation for all”** and **SDG 15: “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”**. In particular, three sub goals directly consider mountain regions’ sustainable development (6.6, 15.1 and 15.4) and one of them (15.4) is directly devoted to mountains. These sub-goals and the relative indicators identified by the UN (2017) are presented in box 1.

Although only three SDG targets specifically refer to mountains, all SDGs should be considered for the sustainable development of mountains. In particular, other goals that are key for integrating the green economy and sustainable development in mountain regions are the SDG 8 and the SDG 12. The SDG 8 concerns the economic aspects of sustainable development, and calls for the promotion of “*sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all*”. The SDG 12 concerns “*sustainable consumption and*

production patterns". Following the Agenda 2030 framework, two call for actions have been developed by the Mountain Partnership in relation with the SDGs, focusing on energy (Mountain Partnership, 2015a) and on forests and biodiversity (Mountain Partnership, 2015b), the documents identify a set of actions and indicators for monitoring of some key sub-goals for mountain regions.

Box 1: The SDGs and mountain sustainable development		
SDG	Sub-goal	Indicator
	SDG 6.6: By 2020, protect and restore water-related ecosystems , including mountains, forests, wetlands, rivers, aquifers and lakes.	6.6.1 Change in the extent of water-related ecosystems over time.
	SDG 15.1: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services , in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.	15.1.1 Forest area as a proportion of total land area 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
	SDG 15.4: By 2030, ensure the conservation of mountain ecosystems , including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.	15.4.1 Coverage by protected areas of important sites for mountain biodiversity 15.4.2 Mountain Green Cover Index

2.2. European policy framework

Roughly 36% of Europe's area is defined as mountainous (29 % of the EU-27) and 63 million people, corresponding to 13 % of the population, live in mountain areas (EEA, 2010). The EEA defined the mountain areas as the 'ecological backbone of Europe' and recognized that Europe's mountain areas have a unique social, economic and environmental capital (EEA, 1999). Given their relevance, it is not surprising that mountain areas have been often addressed within the European Union both directly and indirectly through different policy schemes (Nordregio, 2004): sectoral policies which have a particular effect on the development of mountain areas (as for instance the EU Agricultural Policy); general policies with a territorial impact relevant for some mountain issues (as for instance the EU Cohesion Policy); relevant actions or programs involving mountain zones (as for instance the Interreg Alpine Space Programme). Furthermore, at the Member State level more explicit measures and policies directed at mountain areas have been developed in order to meet their particular needs (three countries have a formal integrated mountain policy: France¹, Italy² and Switzerland³).

¹ Creation of Massif Commissariats, 1973; Mountain Law with delimitation of massifs, 1985.

² Mountain communities, 1971; Mountain Law, 1994.

³ Law on Investment in Mountain Regions, 1974.

Agriculture is the most relevant sector in which European policies have traditionally addressed mountain-specific issues. In fact, the EU first recognized the specific characteristics of mountain areas in 1975, when the European Economic Commission published a Directive on **mountain and hill-farming in “Less-Favoured Areas”** (EEC, 1975). The Directive was the first European legislative document recognizing that agriculture in mountain areas needed to be assigned specific resources because of physical constraints. In the Directive’s framework the compensation of such ‘handicaps’ had to be fostered supporting infrastructure and investment and subsidizing activities such as grazing and dryland crops. The actual implementation of this framework was left open to each Member States.

EU policies on forestry are another example of the relevance of mountain regions: in 1988 the EU adopted a new strategy (Com. 88/255) and a **Forestry Action Programme** clarifying the various roles of forests (production, environment, and recreation), and their contribution to rural development in four main roles: through afforestation of agricultural land, better use of forests in rural areas, cork production, forest protection, and other accompanying measures. Furthermore, in 1992 the Community’s measures on the forestry sector entered a more ambitious phase with the regulation 2157/92, which strengthened the measures to protect forests from atmospheric pollution and fires.

Nature conservation and biodiversity are other extremely important policy areas defined at the European level and directly affecting mountain systems. The **Habitats Directive**, adopted in 1992, ensures the conservation of a wide range of rare, threatened or endemic animal and plant species (EC, 1992). Of the 233 habitat types listed in Annex I to the Habitats Directive, 42 are exclusively or almost exclusively linked to mountains and 91 also occur in mountain areas, while as for the species listed in the Habitats Directive, 181 are exclusively or almost exclusively linked to mountains, 130 are mainly found in mountains and 38 occur in mountains but mainly outside them (BISE, 2019). Furthermore, it has been increasingly recognized by bodies as the European Environmental Agency that these issues are strictly related with the other sectors and EU policy areas, and in particular with agriculture. The functional diversity in many ecosystems depends directly on traditional types of agricultural land use and farming practices, as for instance fifty-one per cent of Europe's High Nature Value farmland is situated in mountain areas (EEA, 2010).

On top of agriculture, forestry and biodiversity, other key European policy domains addressing issues related to the socio-economic development of mountain areas are the EU Rural Development and Cohesion Policies. The **Second Report on Economic and Social Cohesion** identified mountains as regions with 'permanent natural handicaps', and stressed the importance of development in all territories, including mountain regions, to achieve balanced development across the EU (EC, 2001). The **Green Paper on Territorial Cohesion**, reinforced such approach by identifying mountain regions, “which are often border regions and in which more than a third of the people live in rural region” as one of the three specific types of region facing particular development challenges (EC, 2008). For the 2007-2013 programming period EU regional policy consisted of three objectives: Convergence (Objective 1), Regional competitiveness and employment (Objective 2), and European territorial cooperation (Objective 3). Therefore, a total of 78% of the area of the EU15 was identified as being covered by Objective 1 or 2, of which a remarkable part was overlapping with European mountain regions (Nordregio, 2004). EU

structural policies have targeted less favored mountain regions with the aim to develop their assets and potential areas of comparative advantage and to overcome the possible constraints on growth imposed by their specific features.

Another policy dimension concerns actions or programmes involving mountain zones. Among such policy schemes the most relevant is the **Interreg Programme**, designed to stimulate cooperation between member states of the European Union through financial resources made available through the European Regional Development Fund. Interreg differs from the majority of Cohesion Policy programmes as it involves a collaboration among authorities of two or more Member States. Among its sub-programmes, one of the most relevant for European mountain regions is the **Alpine Space Programme**, which provides a framework to facilitate the cooperation between economic, social and environmental key players in seven Alpine countries, as well as between various institutional levels such as: academia, administration, business and innovation sector, and policy making. The Programme will focus on four main priorities: Innovative Alpine Space; Low Carbon Alpine Space; Liveable Alpine Space; Well-Governed Alpine Space. Total Regional Development Fund (ERDF) contribution to the program amount to over 116 million euro (EC, 2019).

It is important to take into consideration the role of mountains in the backbone of European Policies for the period 2014-2020, the **EU 2020 Strategy**, as it is strictly related to mountain development. The Strategy stressed that the EU's sustainable socio-economic future is based on the three main themes – smart, inclusive and sustainable growth. Furthermore, at the end of 2013 European Union adopted the **7th Environment Action Programme (EAP)**, that sets the framework for environment policy and actions by the EU institutions and the Member States until 2020 (EC, 2013). As it stated, it identifies three key objectives: to protect, conserve and enhance the Union's natural capital; to turn the Union into a resource-efficient, green, and competitive low-carbon economy; to safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing. There are in fact several ways in which Europe 2020 Strategy and the Environment Action Programme can foster sustainable mountain development (Euromontana, 2004; Antonescu, 2014): as for smart growth, the deployment and uptake of ICT is, for instance, much lower in remote mountain territories than in the rest of Europe and mountains have huge potential for innovation in the green and bio-economy; as for sustainable growth, mountains are a remarkable source of renewable energies (water, wind, sun, biomass...), for themselves and for territories in the lowlands; as for inclusive growth, mountains are home to many rural poor people and marginalized communities, with improvable access to services, health, education and economic opportunities.

Finally, it is important to include among the EU policies related to mountain regions the **EUSALP**, a “Macroregional strategy” endorsed by the European Council to address common challenges faced by the Alpine area. The EUSALP strategy recognizes that Alpine region is a unique territory, which has an important potential for dynamism, but is facing major challenges, such as: economic globalization, demographic trends, climate change, energy and specific transport challenges due to its role as transit region. The EUSALP strategy concerns 7 Countries, of which 5 EU Member States (Austria, France, Germany, Italy and Slovenia) and 2 non-EU countries (Liechtenstein and Switzerland), and 48 Regions. The Strategy will build upon three

general action-oriented **Thematic Policy Areas** (TPA) and one **Cross-cutting Policy Area**. The first TPA is Economic Growth and Innovation, with the objective of “fair access to job opportunities, building on the high competitiveness of the Region”. The second TPA is Mobility and Connectivity, with the objective of “sustainable internal and external accessibility to all”. The third TPA is Environment and Energy, with the objective of “a more inclusive environmental framework for all and renewable and reliable energy solutions for the future”. The Cross-cutting Policy Area is Governance, including Institutional Capacity, with the objective of establishing a “sound macro-regional governance model for the Region”. The core of the EUSALP implementation of the TPAs is represented by the Action Groups. In total, 9 Action Groups have been established, each focusing on one of the following specific themes: Research and Innovation; Economic Development, Labour market, education and training; Mobility; Accessibility; Resources; Green Infrastructures; Risk Governance; Energy.

2.3. Regional policy frameworks

The Convention on the Protection of the Alps (henceforth “**Alpine Convention**”) is an international treaty between the Alpine Countries (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia and Switzerland) and the EU for the sustainable development and protection of the Alps. It was signed on 7 November 1991 in Salzburg and entered into force on 6 March 1995. The overall aim of the Convention is to set up a comprehensive framework for the preservation and protection of the Alps by applying the principles of prevention, payment by the polluter (the 'polluter pays' principle) and cooperation, after careful consideration of the interests of all the Alpine States, their Alpine regions and the European Economic Community, and through the prudent and sustained use of resources (as stated in Article 2 of the Convention). Its creation was a landmark achievement for mountain related policy frameworks as it is the first treaty for the protection of a mountain region worldwide that is binding under international law.

The Alpine Convention has identified the key priorities and action for the following different priority areas: population and culture; spatial planning; prevention of air pollution; soil conservation; water management; conservation of nature and the countryside; mountain farming; mountain forests; tourism and recreation. Over the years, several **Protocols** were elaborated containing concrete steps to be taken for the protection and sustainable development of the Alps: Energy, Transport, Spatial Planning and Sustainable Development, Soil Conservation, Mountain Farming, Forestry and Tourism (Alpconv, 2019). In addition to Protocols, two Ministerial Declarations on specific topics have been adopted in November 2006 from ministers of the Convention’s parties: the **Declaration on Climate Change** and the **Declaration on Population and Culture**. The Declarations set a specific context for greening the economy by highlighting both the need of the Alpine area to contribute to the mitigation of and adaptation to climate change and the need to promote a high quality of living in the Alps (Alpconv, 2019).

The Convention’s Multi-Annual Work Programme for the years 2005–2010 has established the periodical development of the **Report on the State of the Alps**, an instrument designed to provide periodical information on ecological, economical, and social development in the Alpine space, and at the same time, a basis for strategy development for politics and administration. Since 2007,

seven reports have been published, each of them focusing on one specific key issue for the Alpine region (Transport and Mobility, Water, Sustainable rural development and innovation, Sustainable tourism, Demographic change, Greening Economy; Natural hazard risk governance).

The **sixth Report on the State of the Alps** (PSAC, 2017a) describes the status of Green Economy approaches by presenting selected topics and indicators. Several opportunities for the development of a Green Economy in the Alpine area are identified based on this analysis. The RSA observes that despite some progress, there is a strong need to strengthen the efforts to fully integrate environmental and social aspects into economic policies. Based on this evidence, a set of recommendations are formulated by the Report (see box 2).

On top of the ongoing development of the Reports on the State of the Alps, under the Convention's Multi-Annual Work Programme for the years 2017–2022 the Conventions has identified six priorities for fostering the sustainable development of the Alps: Focusing on people and culture; taking action on climate change; Conserving and valuing biodiversity and landscape; Greening the economy; Promoting sustainable transport; Playing a leading role in EUSALP.

Box 2: The recommendations of the sixth Report on the State of the Alps

The following recommendations are based on the conclusions of the sixth Report on the State of the Alps “Greening the economy in the Alpine region” (PSAC, 2017a):

1. Use **Green Economy as an engine** for regional development.
2. Use **climate and energy** challenges to trigger **eco-innovation**.
3. Consider **ecosystems and biodiversity** as an **economic asset** in the Alpine area.
4. Turn the Alpine area into a **resource-efficient, circular and cost-effective economy**.
5. Use Green Economy to **support the competitiveness** of the Alpine Convention area.
6. Use opportunities for the **creation of green jobs**.
7. Improve the **quality of life and well-being** of Alpine residents through a Green Economy.
8. Improve **data availability and monitoring**.
9. Prepare a comprehensive and ambitious **Action Programme for a Green Economy** in the Alpine area by 2018.

Furthermore, at the XIVth Alpine Conference, held in Grassau in 2016, two **Declarations**, “**Fostering a sustainable Economy in the Alps**” and “**Sustainable Spatial Development in the Alps**” were developed. The former Declaration mentions that the Alpine region should gradually shift to a green and sustainable economy which respects the environmental limits of the region, addresses challenges such as climate change, demographic developments and limited natural resources, and contributes to good health and high quality of life of the population. The latter Declaration addresses common needs concerning the necessity to develop long-term prospects for the population living in the Alpine Convention area with regard to the protection of health and quality of life, the promotion of employment opportunities and sustainable economic development, as well as the attractiveness of regions and services of general interest.

In line with the sixth Report “*Greening the Economy in the Alpine Region*”, the XIVth Alpine Conference entrusted the **Green Economy Advisory Board**, with the task of elaborating the **Green Economy Action Programme** (GEAP) by 2018. The purpose of the GEAP is to further

develop and specify the recommendations given in the 6th Report on the State of the Alps (RSA), and to identify concrete fields of action and relevant actors for the implementation. The GEAP, approved by the Alpine Conference on 4 April 2019 during its XV meeting in Innsbruck (Austria), formulates a new set of priority objectives with regard to progress towards an Alpine green economy in 2030 and identifies 33 actions that represent processes that are manageable, realistic and impactful and that help to foster the transformation toward an Alpine green economy (see box 3).

Box 3: The Green Economy Action Programme

The GEAP, approved by the Alpine Conference on 4 April 2019 during its XV meeting in Innsbruck (Austria), formulates a new set of priority objectives with regard to progress towards an Alpine green economy in 2030 (Palenberg et al., 2019):

- achieve **high energy efficiency**, using **clean and renewable energy** and **absolute decoupling** of economic growth from greenhouse gas emissions.
- increase **resource efficiency** and transform its production and consumption patterns into a **circular economy**, thereby focusing on the sustainable economic use of forest, water and soil within the framework of an **ecosystem services** approach.
- preserve its **natural capital** and prevent the **loss of biodiversity** and **ecosystem services**. The application of the concepts of **ecological networks** and **green infrastructure** are considered crucial.
- improve the **quality of life** and **well-being** of Alpine residents, especially through reduction of harmful emissions and the creation of green jobs.

In order to translate such objectives into practical steps, the GEAP identifies 33 actions clustered into the following action fields:

- Greening finance and the financial support structures;
- Encouraging eco-innovation;
- Greening regional development;
- Valorising ecosystems and biodiversity;
- Living and working in a green economy.

Finally, in order to guarantee a long-term impact of the GEAP actions, the GEAP requires institutional arrangements through the Alpine Convention and its bodies for the integrated implementation and management of its proposed actions.

The Alpine Convention's activities include in fact an "external aspect", which takes the form of direct or indirect support to relevant governance bodies in other mountainous regions of the world. This cooperation has led to a fruitful worldwide exchange of experiences and to the building of a global platform for representing the interests of mountainous regions. The Alpine Convention States played an active role in the process of establishment of the Carpathian Convention, after an "**Alpine-Carpathian partnership**" had been launched during the UN International Year of the Mountains 2002. The Framework Convention on the Protection and Sustainable Development of the Carpathians ("**the Carpathian Convention**") was signed in 2003 by 8 countries: Czech Republic, Hungary, Poland, Romania, Serbia, Slovak Republic and Ukraine. It has entered into

force in 2006. Similar to Alpine Convention, it consists of a framework Convention and thematic protocols (on Biodiversity, Forests Management and Tourism). The initiative for the negotiations of the Carpathian Convention was given by the UNEP Regional Office for Europe (ROE), which also hosts the Interim Secretariat of the Convention. On 2006 the Presidencies and Secretariats of the Alpine and Carpathian Conventions signed a “Memorandum of Understanding” to foster the cooperation between the two Conventions. Furthermore, the Alpine Conference of 2006 declared the **Western Balkans** to be an area of “**priority importance for cooperation**” for the Alpine Convention. A common **Resolution “on the sustainable development of the Dinaric arc region”** was approved in 2011 by the Ministers or High representatives of Albania, Croatia, Former Yugoslavian Republic of Macedonia, Kosovo, Montenegro and Slovenia, during the eleventh Alpine Conference, to set the way to a possible future instrument of international law similar to the Alpine and Carpathian Convention.

The Pyrenees represent an important landscape and biodiversity reservoir shared by three States: Andorra, France and Spain. The Pyrenees Climate Change Observatory was set up in 2010 by the Working Community of the Pyrenees with the main aim of following and understanding the climate evolution in the Pyrenees, limiting its impacts and providing adaptation to its effects through adaptation strategies for socio-economic sectors and the most fragile natural areas. Cooperation between the Permanent Secretariat of the Alpine Convention and the Pyrenees Climate Change Observatory is ongoing.

2.4. National policy framework

In 2017 the Italian Ministry for Environment, Land and Sea Protection issued the “National Sustainable Development Strategy” (NSDS), with which the national government engaged in gearing the 2030 Sustainable Development Goals (SDGs) to the economic, social and environmental planning. The NSDS is organized in five core areas: People, Planet, Prosperity, Peace and Partnership. Each area consists of a set of national strategic choices articulated in strategic national goals. The goals integrate the three dimensions of sustainable development and are the result of a synthesis and abstraction procedure of the most relevant issues emerged in the consultation process (MATTM, 2017). The strategic choices most closely related to mountain systems’ sustainability issues are summarized in the box 3. In order to achieve the strategic choices number I and III, the NDSN considers ensuring the 2030 Agenda targets number 6.6 and 15.1 as a priority. Furthermore, mountain areas appear in the NSDS under the “Partnership” Area, within the Strategic choice “Preservation of Cultural and Natural Heritage”.

The implementation of the National Sustainable Development Strategy (NSDS) is closely linked with the existing national programming documents, namely the National Reform Programme and the Economy and Financial Document, as well as with the binding objectives set by the European Semester, in particular the EU 2020 Strategy. Local and regional involvement is a key aspect of the strategy, as the NSDS calls on regional and local authorities to take part in the implementation of the Strategy according to their specific institutional mandates and competencies. The strategy was endorsed at regional and local level, through the adoption of the document in the State and Regions Conference. The establishment of a Permanent Forum for Sustainable Development,

comprised of stakeholders from civil society, local authorities and SDG experts, aims to further strengthen this process of policy continuity (OECD, 2017; 2018).

Box 4: the NSDS and mountain sustainable development	
Area “Planet”	
Strategic choice	I Halt the loss of biodiversity
Related SDGs	    
National Strategic Goals	<ul style="list-style-type: none"> • Safeguard and improve the conservation status of species and habitats in terrestrial and aquatic ecosystems • Halt the spreading of invasive alien species • Increase terrestrial and maritime protected areas and ensure their effective management • Protect and restore genetic resources and natural ecosystems linked to farming, forestry and aquaculture • Mainstream natural capital accounting in planning, programming and national accounting
Strategic choice	II Ensure the Sustainable Management of Natural Resources
Related SDGs	     
National Strategic Goals	<ul style="list-style-type: none"> • Provide biological diverse and dynamic seas and prevent impacts on maritime and coastal environment • Halt soil consumption and combat desertification • Minimize pollutant loads in soils, water bodies and aquifers, considering the good ecological status of natural systems • Implement integrated water resource management at all levels • Maximize water efficiency and adjust withdrawals to water scarcity • Minimize emissions and reduce air pollutants concentration • Ensure sustainable forest management and combat forest abandonment and degradation
Strategic choice	III Create resilient Communities and territories, protect Landscapes and Cultural Heritage
Related SDGs	      
National Strategic Goals	<ul style="list-style-type: none"> • Prevent anthropogenic and environmental risk and strengthen urban and territorial resilience • Guarantee high environmental performances of buildings, infrastructures and open

spaces

- Boost urban regeneration, ensure sustainable urban accessibility and mobility
- Ensure ecosystems restoration and defragmentation, strengthen ecological urban-rural connections
- Ensure the development of potential and the sustainable management of territories, landscapes and cultural heritage

Within the framework of the National Strategy for Sustainable Development, the theme of the circular economy has been directly addressed by the National policy framework as an instrument to pursue the objectives of the green economy and sustainable development with the development of the document "**Towards a circular economy model for Italy**", submitted to public consultation from 12 July to 18 September 2017, and published in November 2017 by the Ministries of the Environment and Economic Development (the document is issued as a preliminary work in preparation of the "National Action Plan on Circular Economy"). Despite not addressing directly the mountain and alpine areas, the document points out some key aspects of the Circular and that are relevant for the transition to a Green Economy, as the actions to be taken by businesses (product design, new business models, the industrial symbiosis, the bioeconomy and the Extended Producer Responsibility), by customers (new consumption patterns) and policy makers (economic and financial instruments).

Another important ongoing work at national level concerns the measurement of the Italian natural capital⁴. Article 67 of the Law n°221 of 28/12/2015 (known as the "Collegato Ambientale), mandates the establishment of the **Committee for Natural Capital (CNN)**, chaired by the Ministry of the Environment and composed of 10 Ministers, the ANCI, the Conference of the Regions as well as by public research institutes and experts appointed by the Ministry of the Environment. The main task of the CCN is the drafting of a Report containing information on the state of natural capital, accompanied by information and environmental data expressed in physical and monetary units, as well as ex-ante and ex-post evaluations of the effects of public policies on natural capital and on ecosystem services. The elaboration of the Report on the State of Natural Capital in Italy, which reached its second edition in 2018, allowed to highlight the fundamental role played by the Alps in the Italian natural capital. The Alps in fact correspond to one of the five eco-regions for which the Report assesses the ecosystems, habitats and species subjected to particular pressures are assessed, as well as the use and coverage of the territory (CCN, 2017; 2018).

Finally, the recently published draft of the **Integrated National Plan on Energy and Climate**, or PNIEC, sets a ten-year plan for the governance of the energy union and climate action rules at the national level. The PNIEC builds on the 2017 Italian Energy Strategy and is intended to implement a vision of broad economic transformation, in which decarbonization, energy efficiency

⁴ Natural capital can be defined as "the entire stock of natural assets - living organisms, air, water, soil and geological resources - which contribute to providing goods and services of direct or indirect value to man and which are necessary for the survival of the environment from which they are generated "(UK NCC, 2013).

and renewables contribute to the objectives of a more environmentally friendly economy. The draft PNIEC includes a number of targets for several dimensions of the Energy Union and the results are very ambitious under several aspects (EC, 2019). Achieving the proposed targets and results will require a robust and comprehensive set of policies and measures as well as close monitoring and follow-up pursues the objectives of decarbonization, efficiency, energy security, a strengthening of the internal energy market as well as research, innovation and competitiveness (MISE, 2018). In practical terms, coherently with the EU Roadmap, it sets the following targets by 2030:

- renewable energy covering 30% of the final gross energy consumption, broken down into sub objectives of 55.4% in electricity, 33% in thermal and 21.6% in transport;
- reducing primary energy consumption by 43%;
- reducing GHG emissions from non-ETS sectors by 33%.

3. Multi-criteria analysis of key green economic sectors in the Italian Alps

The previous chapter underscored that the 6th Report on the State of the Alps and the Green Economy Action Programme contributed to clearly define the objectives and the actions needed for a transition towards an alpine Green Economy (PSAC, 2017a; Palenberg et al., 2019). The analysis of the potential contribution of different economic sectors and activities is an important further step in order to characterize the greatest opportunities for reaching the ambitious goal of a greener alpine economy. This chapter aims to identify the different sectors and sub-sectors of the alpine economy and assess their potential role for the transition towards a Green Economy.

3.1. Methodology

A multi criteria analysis (MCA) is conducted to provide a quantitative measurement of the heterogeneous contribution that different economic sectors may have to the development of the Green Economy. An MCA establishes preferences between options by reference to an explicit set of objectives that the subject performing the analysis has identified, and for which it has established measurable criteria to assess the extent to which the objectives have been, or can be, achieved (DCLG, 2009). The process of identifying objectives and criteria may alone provide relevant information. On top of these information, MCA offers a number of ways of aggregating the data on individual criteria to provide indicators of the overall performance of options. Therefore, MCA techniques can be used to identify a single most preferred option, to rank options and to short-list a limited number of options for subsequent detailed appraisal.

3.1.1. Performance matrix

A standard feature of multi-criteria analysis is a performance matrix, in which: each row describes one of the options that are being considered; each column corresponds to a criterion, or 'performance dimension', which is considered important to the comparison of the different options; the entries in the body of the matrix assess how well each option performs with respect to each of the criteria. In the present analysis, the **rows describe a set of economic sectors and sub-sectors of the Italian Alps**. The performance dimension instead is represented by a set of **Green Economy dimensions, each of which is described by a number of criteria**. The stylized for of the matrix is therefore the following:

Sector x	Dimension a	Dimension b	...
	Criteria a.1 ...	Criteria b.1 ...	
Sub-sector x.1			
...			
Sector y			
Sub-sector y.1			
...			

...			
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The transition towards a Green Economy in the Alps can be considered as a **multidimensional process involving a wide range of activities**, carried by different players and related to different sectors. The choice of investigating the multidimensionality of the Green Economy in terms of the different sectors and sub-sectors provides a useful framework for the definition of the contribution of different economic activities to the distinctive dimensions of the Green Economy, as well as on the synergies and trade-off between them.

The key sectors and sub-sectors have been identified from a review of the documents produced within the Alpine Convention as well as from other relevant literature (Nordregio, 2004; EEA 2010; UNEP 2011, 2014; Lo Bianco et al., 2017; EUSALP, 2019). A particularly important contribution to the identification derives from the Protocols of the Alpine Convention, which focused on the following themes: Energy, Transport, Spatial Planning and Sustainable Development, Soil Conservation, Mountain Farming, Forestry and Tourism (Alpconv, 2019). Furthermore, the 6th RSA and the GEAP provided a detailed overview of the most relevant aspects of the Green Economy in the Alps, with a particular reference to the key sectoral and regional differences (PSAC, 2017a).

Based on the evidence stemming from these sources, **five sectors and sixteen sub-sectors have been identified** (table 2). A detailed overview of the role that each of these dimensions can play for the Green Economy in the Italian Alps, conducted by integrating literature sources with the results of the MCA analysis, is presented in paragraph 2.2. The performance dimension adopted in the MCA was identified with the aim of providing an harmonized framework that could capture the broadness of the concept of the Green Economy as defined by UNEP (2011) and, at the same time, be coherent with the specificities of the Alpine region under analysis, as identified by the Alpine Convention (PSAC, 2017a). UNEP (2011) defines a green economy as one that results in:

- improved human well-being
- improved social equity
- significantly reduces environmental risks and ecological scarcities.

Table 2

Sector	Sub-sectors	Sector	Sub-sectors
	Biomass and waste	Agriculture and farming	Agriculture Livestock farming
Energy	Hydropower retrofitting and refurbishment	Forestry	Managed forest: silviculture
	Solar		Managed forest: other activities
	Wind		Sport activities
	Energy efficiency	Tourism	Cultural activities
Transport infrastructure management	Accommodation services		
Energy	Freight transport		Leisure activities

Furthermore, many studies have shown the complexity of themes treated in mountain regions and called for **integrative and holistic approaches**, such as addressing socio-economic and environmental factors (Rueff et al., 2015), especially in presence of **interlinkages between upstream and downstream areas** (Ariza et al., 2013). As introduced in Chapter 1, the need of a holistic approach for fostering mountains sustainable development has been recognized by several international and intergovernmental organizations (“Agenda 21”, UNCED 1992, WSSD 2002, UNCSD 2012). As a holistic approach is more suitable to address the green economy strategy issues in Alpine region, **the evaluation of the Green Economy is organized in three dimensions: economic, social and environmental**. For each of these three dimensions, a number of specific criteria were selected on the basis of Italian alpine socio-economic and environmental priorities. The 6th RSA for instance examined the following different dimensions: energy efficiency, resource efficiency, ecosystem services, quality of life and economic and social well-being. Furthermore, the GEAP has identified 5 action fields and 33 actions within them that represent processes that are manageable, realistic and impactful and that help to foster the transformation toward an Alpine green economy 2030. The action fields identified are (Palenberg et al., 2019): Greening finance and the financial support structures; Encouraging eco-innovation; Greening regional development; Valorizing ecosystems and biodiversity; Living and working in a green economy. Based on the review conducted, **12 criteria were selected in total for the three dimensions identified**. Table 3 shows the different dimensions and criteria and relates each of them to the framework identified by the Alpine Convention (RSA6, Alpine Climate Target System - ACTS, GEAP Actions) and by the Agenda 2030 SDGs, in order to underscore how the MCA evaluation relates to the Alpine context specificities and to the international sustainable development framework.

Table 3

Dimension	Criteria	Alpine Convention	Agenda 2030
Economic	Workforce	RSA6 ch. 2.4.1 GEAP Act. 5.2-5.3	SDG 1, SDG 8
	Value added	GEAP Act. 1.1-1.7 and 5.1-5.7	SDG 8
	Long term economic sustainability/stable contribution to economic development	GEAP Act. 1.1-1.7 and 5.1-5.7	SDG 8, SDG 11
	Competitiveness of local economic area	RSA6 ch. 2.2 GEAP Act. 5.4	SDG 8, SDG 11
Social	Contribute to local culture identity	RSA6 ch. 1.1.2 ACTS: Principle 1	
	Social innovations	RSA6 ch. 2.5.1	SDG 10
	Contribution to human health and well-being	RSA6 ch. 2.5.3	SDG 3
	Contribution to education level/schooling/	RSA6 ch. 2.4.1	SDG 4

	technical capacity		
Environmental	Reduction of GHG and air pollutants emissions	RSA6 ch. 2.1.1; RSA6 ch. 2.5.3	SDG 7, SDG 13
	Land and soil conservation	RSA6 ch. 2.2.2	SDG 15
	Resource efficiency use and circularity	RSA6 ch. 2.2;	SDG 12
	Biodiversity conservation	RSA6 ch. 2.3.2 GEAP Act. 4.2	SDG 15

3.1.2. Scoring and weighting

The entries in the body of the matrix assess how well each sub-sector performs with respect to each of the criteria. The scores and weights are derived from a survey distributed to a large number of stakeholders and experts working in the field of the Alpine Green Economy (Box 4 describes in detail the development of the survey).

Box 4: the survey on the Green Economy in the Alps

A survey for the evaluation of the relative potential of the alpine economic sectors for the development of the Green Economy in the alpine region has been developed and distributed to a set of stakeholders and experts covering the following different working fields:

- European, National, Regional and Local institutions;
- NGOs;
- Parks;
- Academia;
- Labor Unions;
- Media and Culture;
- Alpine Convention Contact Points.

A total of 114 respondents were contacted, and 21 surveys were completed and analyzed for the study. The respondents were asked to indicate, with a value between 0 and 3, the relevance of the relative sub-sectors in terms of the potential contribution to each Green Economy criteria, by referring to the following values:

- 0 for “absent”;
- 1 for “not very relevant”;
- 2 for “relevant”;
- 3 for “very relevant”.

Each value assigned has therefore meaning only with respect to the other possible values: the statement that one particular sector is "relevant" as for one of the criteria makes sense only by having as reference the scale that goes from “absent” to “very relevant”. Furthermore, an important consideration related to the setting up of the survey is that the numerical values assigned needed to be consistent across sub-sectors, so that a comparison between sub-sectors is possible. Therefore, under such framework, the meaning of each value (from “absent” to “very relevant”) assigned to a sub-sector is only partially independent of the values assigned to the other sub-sectors.

In order to summarize the values obtained in a single index for each Green Economy dimension, equal weights were assigned to the group of criteria specific to a given dimension. The index allows to evaluate the relative performance of a sub-sector with respect to the others for the overall dimension. For instance, to calculate the relative contribution of the sub-sector “biomass and waste” to the “Economic” dimension of the Green Economy, equal importance was given to its four criteria: Workforce; Value added; Long term economic sustainability/stable contribution to economic development; Competitiveness of local economic area. The following formula, specific to each sub-sector, is adopted in order to calculate a performance index ranging from 0 to 1 for each Green Economy dimension:

$$[(\sum_{i=1}^n v_i) / (\text{Max}(v) * n)]$$

Where v is the value assigned ranging from 0 to 3, i is the specific criteria and n is the number of criteria for each dimension.

3.1.3. Aggregation

Once the three dimension-specific indexes have been obtained for each sub-sector, a first ranking within each dimension can be performed, in order to assess which sub-sector results as the most relevant for the Green Economy in the Alps. Finally, an overall Green Economy index can be developed by aggregating the three dimensions' indexes. In this case, the weights assigned to each dimension, measuring the relative importance of the Economic, Environmental and Social spheres for the achievement of the Alpine Green Economy, were obtained through the survey. Respondents were asked to indicate with a value between 0 and 3 the contribution of each of the three dimensions to the development of the Green Economy. The average score was used to develop the weights of the overall index. The aggregation of the three dimensions' indexes to derive the Green Economy index can be based on different methods. The most relevant and simple options are a simple weighted sum method (WSM) or a weighted product method (WPM). The advantage of using a WSM is essentially the fact that it is a very simple aggregation operator. Nevertheless, the WSM can be successfully applied to a set of criteria only if all the criteria are mutually preference independent: it implies that the decrease in the performance of one criteria at any level is perfectly compensated by the increase in the performance of another criteria (Tofallis, 2014). In other words, WSM assumes a fixed trade-off between criteria (irrespective of their level). For instance, adopting a WSM in the context of the Green Economy index would imply that a very low score in the Environmental performance index could be compensated by a very high score in the Economic performance index. On the other hand, a WPM is applicable also when the criteria are not mutually preference independent, that is when there is a degree of synergy in the combination of them. Some substitutability is inherent in the definition of any index that increases with the values of its components. Yet, the WPM embodies imperfect substitutability across dimensions, so that a decrease in the Environmental index if the Environmental performance is relatively low can be compensated only by a large increase in either the Social or Economic indexes. The latter approach is commonly adopted when the overall index is based on the

aggregation of different socio-economic dimensions, as for instance the Human Development Index developed by the UNDP (2010). As mentioned in the previous paragraph, the approach adopted in the current MCA looks at the Green Economy as a holistic approach, where the Economic, Social and Environmental aspects cannot be compensated one-another but should co-occur and co-develop in a synergic way. For this reason, the weighted product method is adopted, and the Green Economy index is calculated as the weighted geometric mean of the three dimensions' indices:

$$\left(\prod_{i=1}^n I_i^{w_i} \right)^{1/\sum w_i}$$

where w are the weights assigned by the respondents of the survey, I is the dimension specific index and i is each of the three dimensions.

3.2. Results

A first relevant result derives from the weights assigned by the respondents of the survey, which point to the almost equal importance of the three green Economy dimensions: the following weighting factors are derived from the scores: 0.38 for the Environmental dimension, 0.32 for the Economy dimension and 0.30 for the Social dimension. The Green Economy Index is calculated as the geometric mean of the three dimensions' indices:

$$\text{Green Economy Index} = \text{Economic Index}^{0.32} * \text{Social Index}^{0.30} * \text{Environmental Index}^{0.38}$$

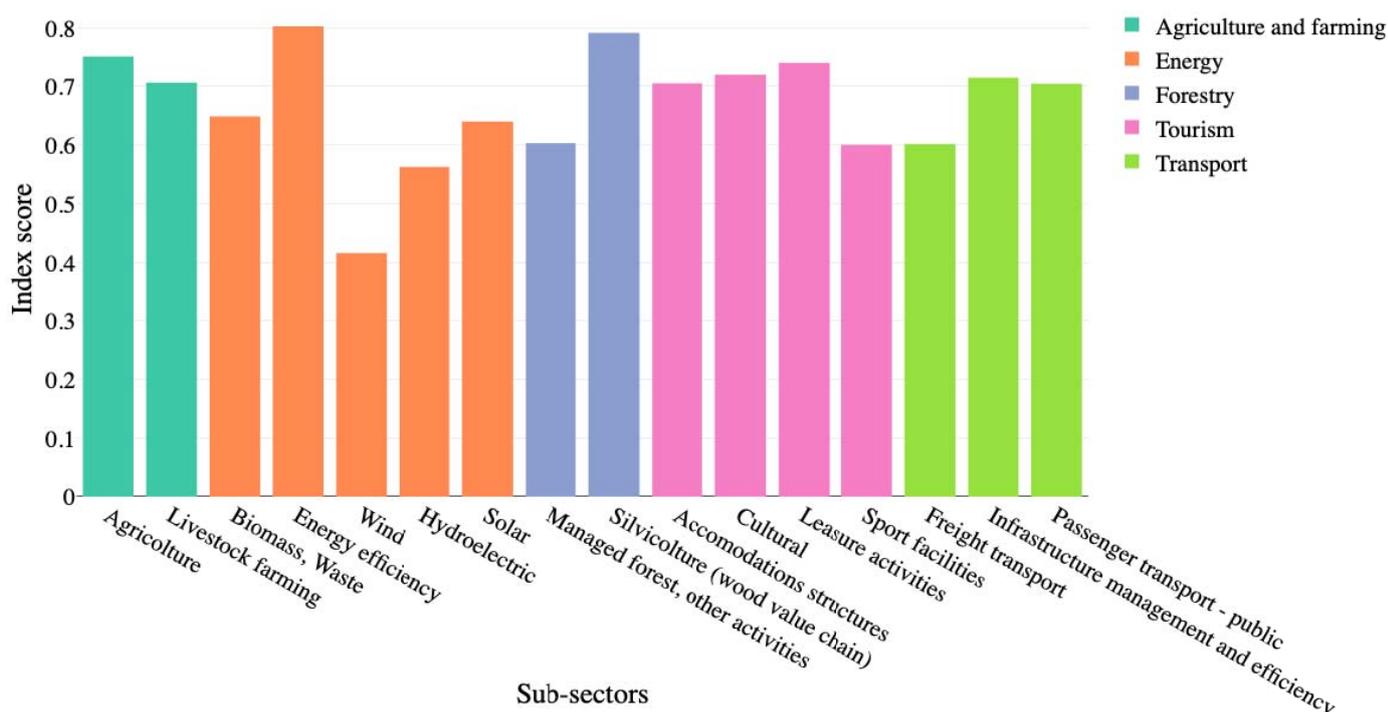
Table 4 presents the average scores obtained in the three different Green Economy dimensions by the aggregate sectors: the Tourism sector obtains the highest average scores as for the Economic dimension index (0.77), followed by the Agriculture and farming sector (0.74); The forestry sector obtains the highest average scores in the Environmental dimension index (0.72), followed by the Agriculture and farming sector (0.70); the Tourism and Agriculture and farming sectors both obtain the highest average scores in the Social dimension index (0.74). Overall, the **Agriculture and farming sector emerges as the most important across all dimensions** and therefore presents the highest score in the overall Green Economy Index (0.73), followed by the Forestry sector (0.70). The Tourism sector (0.69), the Transport sector (0.67) and the Energy sector (0.61) are ranked in third, fourth and fifth position respectively. The aggregated indexes underscore that all sectors have a **very relevant role in the transition towards a Green Economy in the Alpine region**, as the scores range from 0.58 to 0.77.

Table 4: Green Economy Indexes

Sector	Economic	Environmental	Social	Total
<i>Agriculture and farming</i>	0,74	0,70	0,74	0,73
<i>Energy</i>	0,61	0,67	0,57	0,61
<i>Forestry</i>	0,70	0,72	0,67	0,70
<i>Tourism</i>	0,77	0,58	0,74	0,69

Figure 1 reports the score of the total Green Economy Index for each sub-sector. **A large number of sub-sectors are identified as very relevant for the development of an alpine Green Economy:** the scores is lower than 0.6 in only two sub sectors: wind and hydroelectric; between 0.6 and 0.7 in eight sub-sectors: livestock farming, solar, biomass and waste, managed forests, sport facilities, accommodation structures, freight transport and passenger transport; between 0.7 and 0.8 in six sub-sectors: agriculture, energy efficiency, silviculture, cultural activities, leisure activities and infrastructure management and efficiency.

Figure 1: Green Economy Index scores



The next paragraphs report the detailed results of the Green Economy Index dimensions and criteria, for the different sectors and sub-sectors.

3.2.1. Energy

The energy sector is an area with significant potentials for the transition towards a Green Economy in the Italian alpine contest. Table 5 reports the scores obtained in each of the three Green Economy Dimensions (Economic, Environmental and Social) for each energy sub-sector, as well as the position in the overall ranking for each dimension. The survey's results underscore that **the most important area within the energy sector is energy efficiency**, ranked as the most important in the environmental contribution ranking, in third and fourth position respectively as for its social and economic potential contribution. The scores obtained in the three dimensions make energy efficiency the most important sub-sector in the aggregate Green Economy ranking.

The other energy sub-sectors score relatively low in the aggregate Green Economy ranking, as they are found in 10th, 11th, 15th and 16th position. **Biomass and waste and solar-based renewable energy** were ranked in **high positions as for the environmental contribution ranking** (third and fifth position respectively).

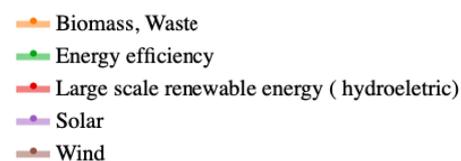
The standard deviations of the scores obtained by the sub-sectors are relatively high, as great heterogeneity between the positions of energy efficiency with respect to the other subsectors is evident, especially in the social and economic dimensions.

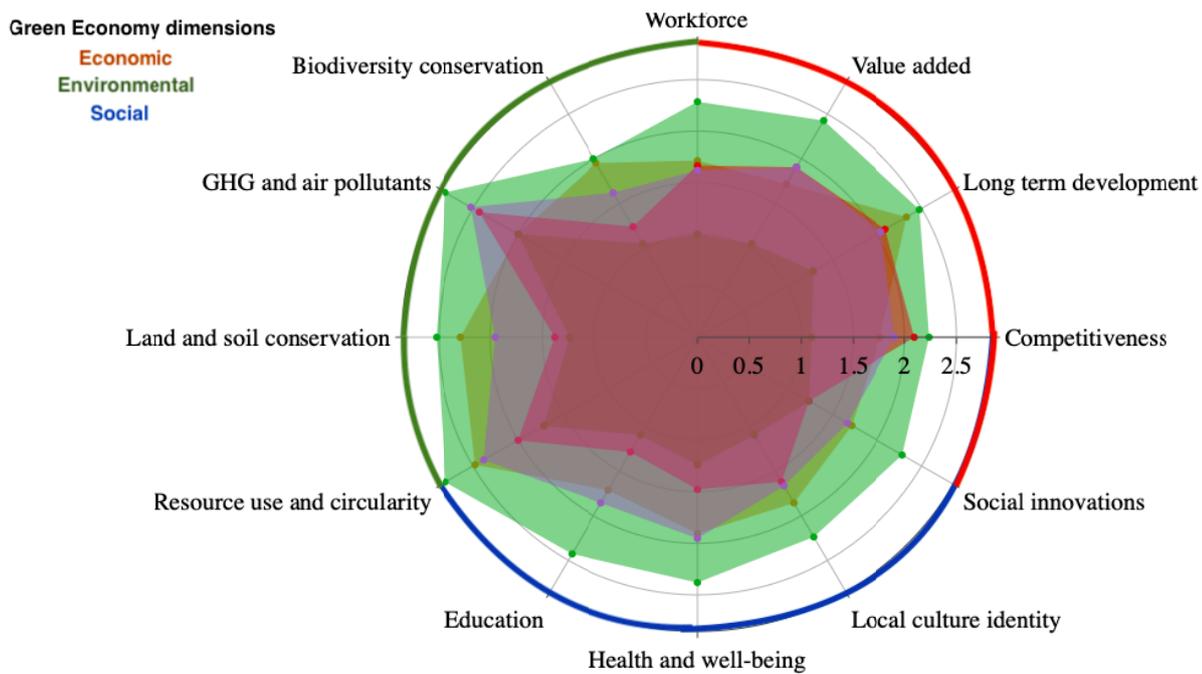
Table 5

	<i>Economic</i>		<i>Environmental</i>		<i>Social</i>		<i>Total</i>	
	Score	Ranking Position	Score	Ranking Position	Score	Ranking Position	Score	Ranking Position
Energy efficiency	0,79	4th	0,85	1st	0,78	3rd	0,80	1st
Biomass, Waste	0,63	13th	0,73	3rd	0,60	12th	0,65	10th
Solar	0,62	14th	0,71	5th	0,60	13th	0,64	11th
Hydroelectric and other large scale R.E.	0,65	12th	0,59	14th	0,47	15th	0,56	15th
Wind	0,37	16th	0,50	15th	0,39	16th	0,42	16th
Energy	0,61	-	0,67	-	0,57	-	0,61	-
(standard deviation of scores)	(0,15)		(0,13)		(0,15)		(0,14)	

Figure 2 shows the spider graph with the scores obtained in each specific criteria of the Green Economy by each sub-sector (the original scores of the survey ranged from 0 “absent” to 3 “very relevant”). The spider graph allows to identify through which criteria a given sub-sector has a relatively higher role in the contribution of the Green Economy.

Figure 2: Scores obtained by the Energy sub-sectors





Energy efficiency is the sub-sector obtaining the highest scores in all dimension and is particularly relevant with respect to the Economic criteria “resource use and circularity” and “GHG and air pollutant reduction”. Other sub-sectors with a high score in these two criteria are solar energy and large-scale renewable energy (hydropower). The biomass and waste sectors instead reach a high score as for the contribution to “resource use and circularity”, “land and soil conservation”, “biodiversity conservation” and “long term development”. The “wind” sub-sector obtains the lowest scores across all criteria but is considered relatively important as for the “resource use and circularity” and “GHG and air pollutants” emissions’ reductions.

The results of the energy efficiency subsector are motivated by multiple reasons. First of all, mountain-specific climatic and environmental aspects make energy efficiency extremely relevant in the Alpine area. For instance, harsher climatic conditions result in higher heating requirements of households, tourist accommodations and businesses compared to the lowlands, making **insulation and energy-efficient buildings key strategies for reducing energy consumption** (PSAC, 2017a). As fossil-bases as well as renewable energies can results in higher and ecologically not desirable land take for power generation, efforts towards energy saving and increased energy efficiency are essential for an energy transformation in the Alps and have important implications for the future of our society.

Energy efficiency is in fact a key component of several policy documents developed within and outside the Alpine Convention. The Energy Protocol of the Alpine Convention underlined at first article that: “*The Contracting Parties shall commit themselves to creating framework conditions and adopting measures for **energy saving, production, transport, distribution and utilization within the territorial scope of the Alpine Convention in order to establish sustainable development in the energy sector which is compatible with the Alpine region’s specific tolerance limits***” (Alpine Convention, 2005). The EUSALP framework includes one special action group for the promotion of energy efficiency and sustainable production of renewable energy (EUSALP, 2019). Furthermore, the European Union has recognized the importance of the low-carbon economy in

the Alps by creating a specific priority axis in the 2014 Alpine Space Programme (Alpine Space, 2014). To support the development of energy efficiency measures and small-scale solar energy in the Alps, the national subsidy schemes, and in particular the Conto Termico 2.0 scheme, can play an important role. The scheme, in force since May 31st 2016, strengthens and simplifies the support mechanism already introduced in 2012 (Conto Termico), which encourages measures to increase energy efficiency and the production of thermal energy from renewable energy (GSE, 2019). Two categories of projects are eligible to benefit from the scheme (GSE, 2019): energy efficiency improvements in an existing building and small-scale projects concerning systems producing thermal energy from renewable and high-efficiency system.

The survey's results underscore that the production and use of **biomass is a second very relevant sub-sector to foster the Alpine Green Economy**. In the Italian Alps thermal and electrical biomass account together for a power generation capacity of around 70-100 TWh per year, while small and large scale solar and wind sources account for around 10-20 TWh per year and hydropower from 100-150 TWh per year⁵ (Recharge Green, 2015). As for the adoption of biomass based renewable energy, it is important to respect sustainable management practices (PSAC, 2017a). Impacts of forest biomass use are positive as for the provisioning of carbon sequestration and protection from hazards, since forest biomass use can be a tool for preserving landscape and ecosystem services (Grilli et al, 2015). In some areas of the Italian Alps, furthermore, growing unmanaged forests cover grassland and pastures, with a consequent loss in biodiversity and problems related to the presence of trees closer and closer to villages (Grilli et al, 2015). The use of wood for biomass therefore could represent an **opportunity to combine the recovery of landscape areas with the management of growing forest**. This potential is reflected by the scores obtained by the sub-sector as for the "land and soil conservation" and "biodiversity conservation" criteria. On the other hand, the use of forest biomass can harm habitat quality and biodiversity of deadwood-dependent organisms if the removal of wood residues is conducted in an unsustainable way (Grilli et al, 2014). Furthermore, small scale biomass energy may be successfully adopted within agricultural facilities. Hydropower, due to limited additional capacities, does not emerge as a particularly relevant sector for the alpine Green Economy. Nevertheless, it is important to adopt a sustainable management approach and **balance energy production and the preservation of particularly small pristine rivers** with high ecological values (Hastik et al. 2015). As for wind energy, the relatively low relevance derives from the natural characteristics of mountain areas, where large wind power facilities may not be compatible, as well as considerations related to Alpine landscapes preservation (Hastik et al. 2015). Finally, it is important to underscore that the Alpine region is a key area where innovation and research on the energy sector should take place. Alpine areas will be characterized by the need to balance an increasing production and use of renewable energy sources, requiring a stronger and more extended electric grid capable of dealing with high levels of remote power generation, based for instance on Virtual Power Systems (VPS), load management, storage and demand management systems (AlpEnergy 2013).

⁵ the lower range corresponds to data collected at NUTS level 3 while the higher level to data collected at NUTS 2 level.

3.2.2. Transport

Table 6 reports the scores obtained in each of the three Green Economy Dimensions (Economic, Environmental and Social) for each transport sub-sector, as well as the position in the overall ranking for each dimension. The **sound management and the efficiency in the use of transport infrastructure emerges as the most promising driver for fostering the Green Economy in the Alps**. The sub-sector “transport management and efficiency” in fact is ranked 6th in the general and in the economic dimension, 7th in the environmental dimension and 8th in the social dimension. Passenger transport is ranked similarly in the middle-high positions of the ranking for all the dimensions, while freight transport is ranked in relatively lower positions, especially as for its social contribution to the Green Economy. Overall, the transport sector emerges as a quite balanced area, as the standard deviations of the scores obtained by the sub-sectors is very low. Figure 3 shows the spider graph with the scores obtained in each specific criteria of the Green Economy by each transport sub-sector (the original scores of the survey ranged from 0 “absent” to 3 “very relevant”). The sub-sectors “Infrastructure management and efficiency” and “Passenger transport” both obtain high scores in many criteria, and in particular in the Economic criteria “Long term development” and “Competitiveness”, in the Environmental criteria “GHG and air pollutants emissions’ reduction” and in the Social criteria “Social innovations”. The “freight transport” sub-sector obtains lower scores than the other sub-sectors but is considered very relevant as for the “Long term development” of the Green Economy and for the “Competitiveness” of the alpine area.

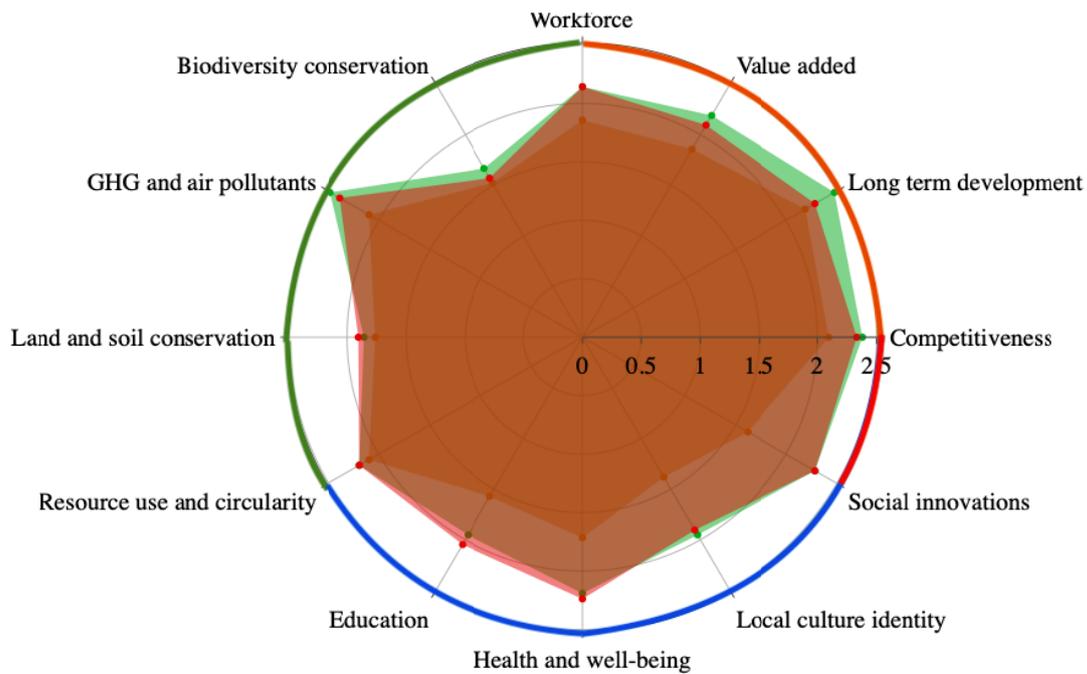
Table 6

	Economic		Environmental		Social		Total	
	Score	Ranking Position						
Infrastructure management and efficiency	0,77	6th	0,68	7th	0,70	8th	0,71	6th
Passenger transport (including public)	0,74	7th	0,67	8th	0,71	7th	0,70	9th
Freight transport	0,67	11th	0,62	10th	0,52	14th	0,60	13th
Transport (standard deviation)	0,72 (0,05)	-	0,66 (0,03)	-	0,64 (0,10)	-	0,67 (0,06)	-

Figure 3: Scores obtained by the Transport sub-sectors

Green Economy dimensions
■ Economic
■ Environmental
■ Social

■ Freight transport
■ Infrastructure management/ efficiency
■ Passenger transport - public



The protocol of the Alpine Convention on Transport provides a key guideline for the future developments of the sector, as it declares the intention to pursue “*a sustainable transport policy which will: reduce the negative effects of and risks posed by intra-Alpine and transalpine transport to a level which is not harmful to people, flora and fauna and their environments and habitats, inter alia, by transferring an increasing amount of transport, especially freight transport, to the railways, in particular by creating appropriate infrastructures and incentives in line with market principles... contribute to the sustainable development of the habitats and economic areas... help to reduce and, as far as possible, avoid any impact which might endanger the role and natural resources of the Alpine region... ensure the movement of intra-Alpine and transalpine transport... ensure fair competition between modes of transport*”(Alpine Convention, 2007).

The Italian alpine region has a fundamental role for the whole Alpine freight and passenger transport network, as it contains some of the most important "corridors": the Brenner, Gotthard, Ventimiglia and Fréjus – Mont Blanc. Furthermore, as socio-economic and demographic developments directly influence the mobility and transport needs, it is expected that passenger as well as freight transport will further increase in the future in Alpine area (PSAC, 2017a). For instance, **the share of individual motorized transport has steadily increased with the growing importance of tourism in the Alps**, as 84% of all tourists travel to their destination in the Alps by car (PSAC, 2007). Due to topographic features and limited accessibility of some regions in the Alps, high CO₂ emissions are caused by motorized road traffic, accounting for roughly 90% of the emissions of the sector in the Alpine regions (PSAC, 2017a). The relevance of the sector’s decarbonization is evident also at the national level, as the transport sector is the only one which experienced an increase of emissions over the 1990-2014 period (2.3% increase), as opposed to the energy, manufacturing and industrial sectors (ISPRA, 2016).

As underscored by the survey’s results, **transport infrastructure management is a core element affecting the functionality of a transport system** and is particularly relevant in the Alpine context as the major flows of goods and people are concentrated on a limited number of Alpine crossings. Alpine transport infrastructure is essential for the **formation of economic activities such as industry and trade** as well as for **guaranteeing that also remote areas can become tourist destinations**. As outlined in the Report on the State of the Alps focusing on Transport and Mobility, the Alpine transport network suffers from bottlenecks both in regard to road and to rail infrastructure (PSAC, 2007): the first is mostly generated by the constant increase in the traffic volumes, while the latter is linked to the prioritization of individual motorized transport infrastructure over the last decades and the lack of interoperability and intramodality of different national railway networks. In particular, **railway bottlenecks** in the Alps are created by an insufficient extension of the railway network, short access to rail for freight transport, deficient electrification and signal systems and single-track railways. A fundamental objective of the Transport Protocol of the Alpine Convention is in fact the modal **shift of freight and passenger transport from road to rail**. The issue is particularly relevant for the Italian Alps as Italy, together with France and Slovenia, is the Alpine country with the lowest values of density of railway lines per capita (0.36 km per 1000 inhabitants in Italy and 0.46 and 0.51 in Slovenia), while Switzerland and Austria have the highest (0.85 and 0.90 respectively) (PSAC, 2007). Transport by rail can be an important alternative to motorized passenger traffic and it is important for public transport at two levels: local and regional trains provide connections between core towns and their surroundings, while long distance trains offer national and international connections. Furthermore, **mobility demands in peripheral areas is characterized by specific needs**, and public service supplies play a greater role compared to other areas given the relatively lower share of population with private cars (PSAC, 2017a).

The transport sector’s ranking in the overall Green Economy Index underscores that addressing these elements could provide a substantial contribution to the development of the Green Economy in the Italian alps.

3.2.3. Agriculture and farming

Table 7 reports the scores obtained in each of the three Green Economy Dimensions (Economic, Environmental and Social) for the two sub-sectors, agriculture and livestock farming, as well as the position in the overall ranking for each dimension. Both agriculture and livestock farming are ranked in high and mid-high positions in all the dimensions of the Green Economy, and in particular in the environmental and social dimensions, where they are ranked 4th and 6th respectively. As a consequence, the sectoral the standard deviations of the scores obtained by the sub-sectors is very low. Agriculture results relatively more important than livestock farming in all the dimensions.

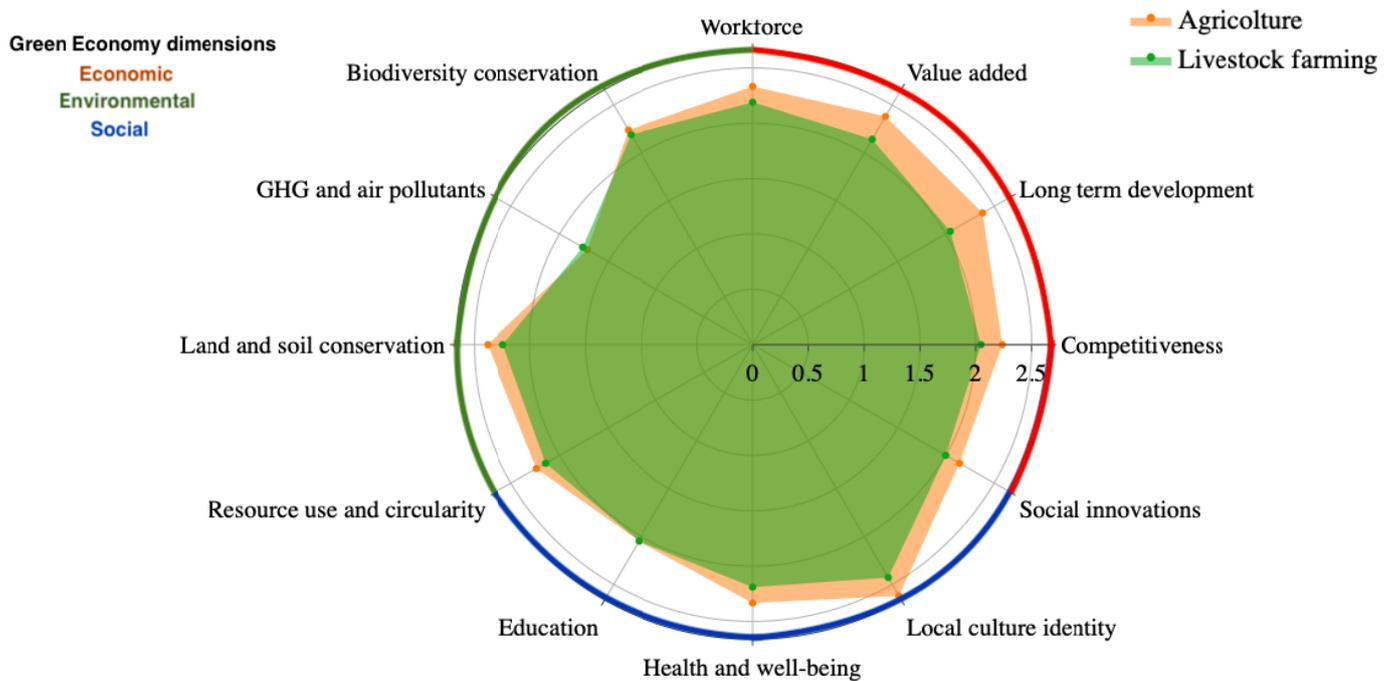
Table 7

Economic		Environmental		Social		Total	
Score	Ranking Position	Score	Ranking Position	Score	Ranking Position	Score	Ranking Position

<i>Agriculture</i>	0,78	5th	0,71	4th	0,76	4th	0,75	3rd
<i>Livestock farming</i>	0,70	10th	0,69	6th	0,72	6th	0,71	7th
<i>Agriculture and farming</i>	0,78	-	0,71	-	0,76	-	0,75	-
	(0,05)		(0,01)		(0,03)		(0,03)	

Figure 4 shows the spider graph with the scores obtained in each specific criteria of the Green Economy by each sub-sector (the original scores of the survey ranged from 0 “absent” to 3 “very relevant”).

Figure 4: Scores obtained by the Agriculture and farming sub-sectors



The two sub-sectors obtain similar results across the different criteria, despite agriculture is generally characterized by relatively higher scores. Particularly high scores are assigned to both sub-sectors in the Economic criteria “Value added” and “Workforce” and “Long term development”, in the Environmental criteria “Land and soil conservation”, “Biodiversity conservation” and “Resource use and circularity” and in the Social criteria “Local culture identity” and “Health and well-being”. The results confirm that **mountain agriculture is one of the key drivers of an Alpine green economy in all its dimensions**: promote regional economic development, improve the living conditions of the population, fostering local culture and ensuring ecological protection and environmental preservation.

The topic of mountain agriculture has been the focus of several Alpine Convention activities: from the approval of a Protocol on Mountain Agriculture, to the establishment of a dedicated Platform, to the adoption of the Declaration on Mountain Agriculture (PSAC, 2017b). The first article of the Mountain Farming Protocol underlines the importance of pursuing a sustainable development for agriculture in the Alps. In particular, it is affirmed that mountain agriculture and farming should: *“suit local conditions and is environmentally compatible; aim at recognizing and securing the continuity of its essential contribution to maintaining the population and safeguarding sustainable economic activities, particularly by means of producing typical high-quality produce,*

safeguarding the natural environment, preventing natural risks and conserving the beauty and recreational value of nature and the countryside and of cultural life in the Alpine region” (Alpine Convention, 2006).

The agricultural sector in the Alps has key characteristics that have progressively contributed to the creation of different pressures and radical changes. In the last 25 years, the agricultural population has decreased by over 40 percent and today around 4% of the population in the Alpine area still live on agriculture (PSAC, 2017b). This decrease has been particularly sharp in Italy, which experienced a 46% decline in agricultural activities between 1980 and 2000, with the greatest decreases in the eastern part of the Italian alps (Streifeneder et al. 2007). At the same time, throughout the Alps, **farms are becoming larger and the overall cultivated land is only slightly decreasing** (out of more than four million hectares, and as a result traditional Alpine agriculture is playing an increasingly smaller role in some alpine areas. Furthermore, agricultural activities have been particularly affected by land take from settlement, infrastructure and economic activities. Although agriculture and forestry can shift to some extent to steep land and land in higher altitudes, natural land use restrictions and harsher climate conditions reduce land productivity and limit the extent of such transition. The conversion of agricultural land affects in fact mainly valley bottoms where soil productivity is generally higher than in higher altitudes and on steeper slopes (PSAC, 2017b). At the same time, as soil and land are particularly scarce resources important for an Alpine-wide resource-efficient approach, an **efficient and prudent use of land in the Alps** is envisaged by the Protocol on Spatial Planning and sustainable development. In fact, the Protocol on Soil Conservation focuses on soil quality and highlights how the impacts on soil of economic activities such as agriculture and forestry should be carefully managed and minimized (Alpine Convention, 2005).

A number of **key actions can enable the agricultural and farming sectors to overcome such pressures and develop sustainably according to a Green Economy framework**. The Permanent Secretariat of the Alpine Convention has identified a number of actions that match with the different green Economy criteria identified in the current study. First of all, the “Workforce” criteria can be achieved with the creation and strengthening of favorable conditions for the **functioning and profitability of farms** (PSAC, 2017b). The “Long term development” criteria can be reached by the development of **new products and services** to ensure diversification and thus obtain more added value and employment. The “Competitiveness” criteria is linked to the expansion of the **production and marketing of labelled high quality regional products** and by structuring and strengthening of the role of mountain agriculture within the **regional value chains** (PSAC, 2017b).

As for the Environmental criteria, the sustainable and effective management of resources emerges as the key cross-cutting principle for ensuring the “Biodiversity conservation” and “Land and soil conservation”, which can be achieved in particular by **safeguarding water resources and soil fertility**. Ensuring the provision of ecosystem services in mountain regions can be achieved by the transfer of the necessary know-how and technologies as well as by safeguarding farms through the creation of favorable conditions for their functioning and profitability. Key actions in this regard are: the creation and **maintenance of targeted incentive systems** and strengthening and intensification of the **cooperation and partnerships** with other sectors, such as environmental protection, environment and water management, tourism, gastronomy, trade and traditional crafts.

The survey's results underscore that the contribution of agriculture and livestock farming on the Social dimension of the Green Economy is as important as the Economic and Environmental dimensions. In particular, the "Local culture identity" criteria can be sustained by strengthening of the **awareness and understanding of the role of mountain agriculture**, both as a source of local identity and as of learning for society (PSAC, 2017b). As for the "social innovation" criteria, and important element is raising awareness on the active contribution of farmers to sustainable development and their ability to provide services to society. Furthermore, in order to fight depopulation, a "green" agricultural system enables the maintenance of decentralized structures that can in turn provide an **occupation to the local population and ensure the long-run development of rural living spaces**. Other aspects specific to both mountain farming and agriculture are the conservation and maintenance of nature and the countryside through the restoration and use of the **traditional components** (woodland, wooded boundaries, and Alpine pastures and products) as well as the conservation of **traditional farm buildings and rural architecture** (adopting traditional building materials and methods). Finally, the relevance of agriculture as for the "Health and well-being" criteria it is also underscored by the importance of producing of **safe and varied food**.

3.2.4. Forestry

Table 8 reports the scores obtained in each of the three Green Economy Dimensions (Economic, Environmental and Social) for the two sub-sectors, silviculture (wood value chain) and other activities concerning the management of forests, as well as the position in the overall ranking for each dimension.

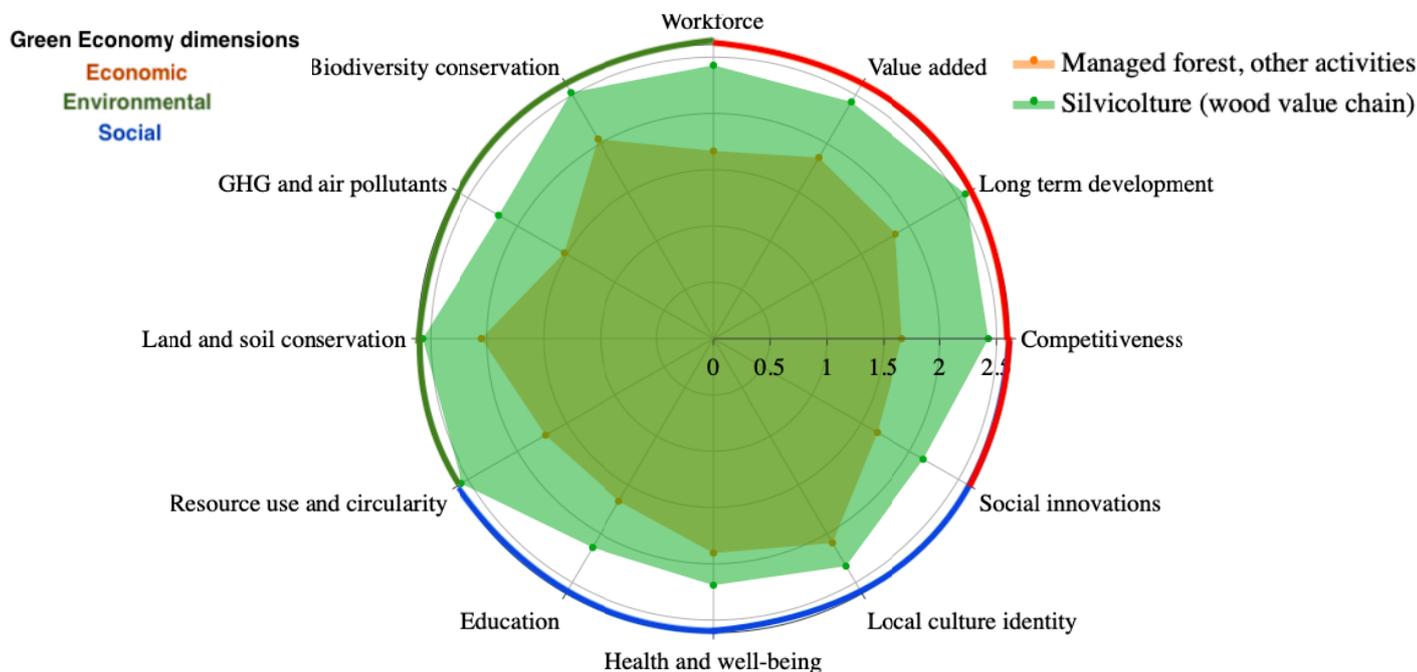
Silviculture is ranked in high positions in all the dimensions of the Green Economy, and in particular in the economic, environmental dimensions and in the overall ranking (second position). The sub-sector grouping all other activities concerning managed forests obtains lower scores in the dimensions and is 12th in the final overall ranking. As a consequence, the sectoral the standard deviations of the scores obtained by the sub-sectors is relatively high.

Table 8

	<i>Economic</i>		<i>Environmental</i>		<i>Social</i>		<i>Total</i>	
	Score	Ranking Position						
Silviculture (wood value chain)	0,82	2nd	0,82	2nd	0,73	5th	0,79	2nd
Managed forest, other activities	0,59	15th	0,61	11th	0,61	11th	0,60	12th
Forestry	0,70 (0,17)	-	0,72 (0,15)	-	0,67 (0,09)	-	0,70 (0,13)	-

Figure 5 shows the spider graph with the scores obtained in each specific criteria of the Green Economy by each sub-sector (the original scores of the survey ranged from 0 “absent” to 3 “very relevant”).

Figure 5: Scores obtained by the Forestry sub-sectors



The **silviculture sub-sector is more relevant than other activities in all criteria**, and scores particularly high in the Economic criteria “Long term development”, in the Environmental criteria “Resource use and circularity”, “Land and soil conservation” and “Biodiversity conservation”. The criteria in which the sub-sector concerning the other activities of forest management obtains the highest scores are the Environmental criteria “Biodiversity conservation”, “Land and soil conservation” but also the Social criteria “Local culture identity”.

The results underscore that the Alpine forest sector is characterized by a great potential to contribute to the development of a Green Economy in the region. The Alpine forest sector is clearly a key component of the Alpine environment and economy: forests cover 47% of the Alpine area and are expanding at an average of 0.5% per year in the Alpine convention area (Dellagiacomma et al., 2016). Furthermore, Alpine forests are not only expanding their area but also their biomass: the total wood volume of Alpine forests is 2,000 million m³, the annual increment is 50 million m³, while the annual cutting is 28.5 million m³ (Dellagiacomma et al., 2016). The issue is particularly relevant in the Green Economy context as the **growth/felling ratio has been increasing in recent years due to the abandonment of marginal agricultural areas** (EEA, 2010). In the northern part of the Alps such trends have been avoided thanks to the a considerable **wood mobilization**, which has helped to guarantee a growth/felling ratio of around 90%, while on the other hand, in the southern part of the Alps, a considerable accumulation of biomass has taken place (Dellagiacomma et al., 2016). Given this situation, the potentials for an increase of sustainable wood harvesting are very large in the latter areas of the Alps. The Alpine sustainable forest

management is based on the **paradigm of multi-functionality**, as forests provide not only wood-production, but a full set of ecosystem services such as protection from natural hazards, biodiversity and wildlife conservation, protection of water supply, landscape and recreation (PSAC, 2014).

Forests ecosystems perform a range of different regulation services that can be divided in the following categories (EEA 2013): natural hazard regulation (protective functions against erosion, flood, debris flows, avalanches, landslides and rock falls); water cycle regulation (water flows, run-off, groundwater, water filtering and quality); atmosphere components regulation (Alpine forests absorb every year 55 million t CO₂: approximately 50% of the total CO₂ emission of the alpine area (CIPRA, 2007)); habitat supporting services. Silviculture and other Green Economy forest activities have a connection with all these aspects. Wood production can be considered an important resource as for the Environmental categories “GHG and air pollution” and “Resource use and circularity” as, provided it is managed sustainably, it is a renewable source, low-energy intensive and no-waste producing. In fact, in sustainably managed forests in which trees are harvested before reaching their physiological age limit, the **ecosystem remains in a productive phase of the “succession cycle”** (UBA, 2014). Furthermore, the use of wood (e.g. in construction, furniture) continues to stock the carbon until the product life-cycle. Important positive environmental impacts in the two categories can also derive from the provision of raw materials for **renewable energy production** (firewood and biomass), as already underscored in the paragraph on the energy sector. Other relevant contributions on the Environmental dimension of the green Economy are related to the “Biodiversity conservation” and “Land and soil conservation” potentials: in this regard, it is important to promote the consolidation and specialization of **sustainable forest management practices** that aim to guarantee the supply ecosystem services. The increases in forested areas and biomass play an important role in preventing soil erosion, avalanches and landslides (EEA,2002). Furthermore, forests play a pivotal role for protection and nesting possibilities of species (Estreguil et al., 2012). It should be underscored that managed forests can enhance the effective performance and delivery of their multiple functions. In fact, an unsustainable removal of biomass can have **negative effects on biodiversity**, and hence a sound management is necessary to ensure all elements are in balance (PSAC, 2014).

To address the important role of mountain forests, the Alpine countries have agreed on a protocol of the Alpine Convention on mountain forests, and a working group has been established. Furthermore, during the XIII Alpine Conference held in Turin in 2014, the Statement on the Value of Alpine Forests that was adopted by the Alpine Ministers invites the Parties to promote sustainable forest management in line with national, EU and international law (PSAC, 2014). Furthermore, the 2013 European Forest Strategy has identified sustainable management, multi-functionality, forest protection, sustainable provision of goods and services as central topics for EU forests (EC, 2013). The Protocol on Mountain Forests emphasizes that relevant actions of sustainable wood productions are **ensuring the natural pace of reforestation**, using indigenous forest material and harvesting adequate tree species and **avoiding the creation of barriers** through infrastructures, land use changes or management measures (Alpine Convention, 1996). The latter element is relevant as another important function played by forests is the connectivity

between different habitats, and in particular between interior core habitats and semi-natural open habitats (e.g. meadows, pastures and heath lands). Specific measures to improve the forests' connecting function are for instance the creation of micro-habitats and fringe-habitats (PSAC, 2014). The design of innovative compensation and payment schemes or other market-based instruments can have an important contribution to the long-term provision of forests' ecosystem services. These mechanisms will be object of the analysis within the project Deliverable 3.2 "Innovative financial instruments: cases of successful implementation, scalability and replicability".

The Alpine forest sector can furthermore strongly contribute to the Economic dimension of the Green Economy. The results of the survey underscore that a key aspect in this regard is the potential contribution to the "Workforce" criteria, thanks to the **creation of green jobs**. In fact, in order to keep forests able to deliver their multiple functions, a long series of activities and job opportunities are necessary: from the construction of adequate infrastructure to the adoption of machineries and training of forest owners, contractors and foresters (PSAC, 2014). The "Long-run development" of the Alpine areas can be fostered through the **diversification forest-based activities**. In fact, an economic sector too much reliant on wood harvesting can be exposed to economic fluctuations reflected in the primary material's prices (PSAC, 2014).

The forestry based **economic activities are generally very reliant on the wood value chain**, as in the last two decades the non-wood income has been averaging roughly 13% of the total income from forest management (Sekot, 2014). Such historical reliance is underscored also by the survey's results, which point out that in the experts' view the wood value chain is more relevant than other forest management activities: the largest gap in the two sub-sectors' scores Green is found in all the Economic criteria and in the Environmental criteria "resource use and circularity". A transition towards the Green Economy can provide a number of new strategies for the creation new products and services in order to reduce such dependency. Activities as **estate renting, gravel and sand production and fishing** are among the auxiliary activities identified as more economically convenient than timber production (Sekot, 2014). Furthermore, the establishment of revenues from the **permits for mushrooms-picking** in Italy has been considered a good example of local-scale non-wood forest products (PSAC, 2014). Economic activities related to **recreational tourism and sports tourism are two key opportunities for the development of non-wood forest activities**. Protected areas, such as **national and regional parks and Natura 2000 parks** cover about 15% of the Alps (with the highest value in Slovenia, where the share is almost 50%). The demand for outdoor activities in well managed and at the same time pristine forests is a very relevant opportunity for the outdoor industry, both currently and even more in the future (PSAC, 2014). These opportunities are furthermore linked with the Social, "Culture identity" dimension of the Green Economy, as Alpine forests recreational services, often combining location-specific opportunities from sport to recreational activities, can be considered as a **part of the set of local cultural services offered**.

3.2.5. Tourism

Table 9 reports the scores obtained in each of the three Green Economy Dimensions (Economic, Environmental and Social) and the position in the overall ranking, for the four sub-sectors: accommodation structures, cultural activities, leisure activities and sport facilities.

The “Leisure activity” sub-sector is the one in the highest position within the tourist sector, as it is 4th in the general ranking, due to its potential contributions in the Social and Economic dimensions (2nd and 3rd positions in these rankings respectively). The “Cultural activities” sub-sector ranks first in the Social dimension, in relatively lower positions as for the Environmental and Economic dimension (13th and 8th respectively) and is 5th in the overall Green Economy ranking. The “Accommodation structures” sub-sector ranks first in the Economic dimension, but in relatively lower positions as for the environmental and social dimensions (12th and 9th respectively) and is 8th in the overall Green Economy ranking. The sport facilities management is the one obtaining the lowest scores among the tourism sub-sectors, but it ranks in middle positions as for the Economic dimension.

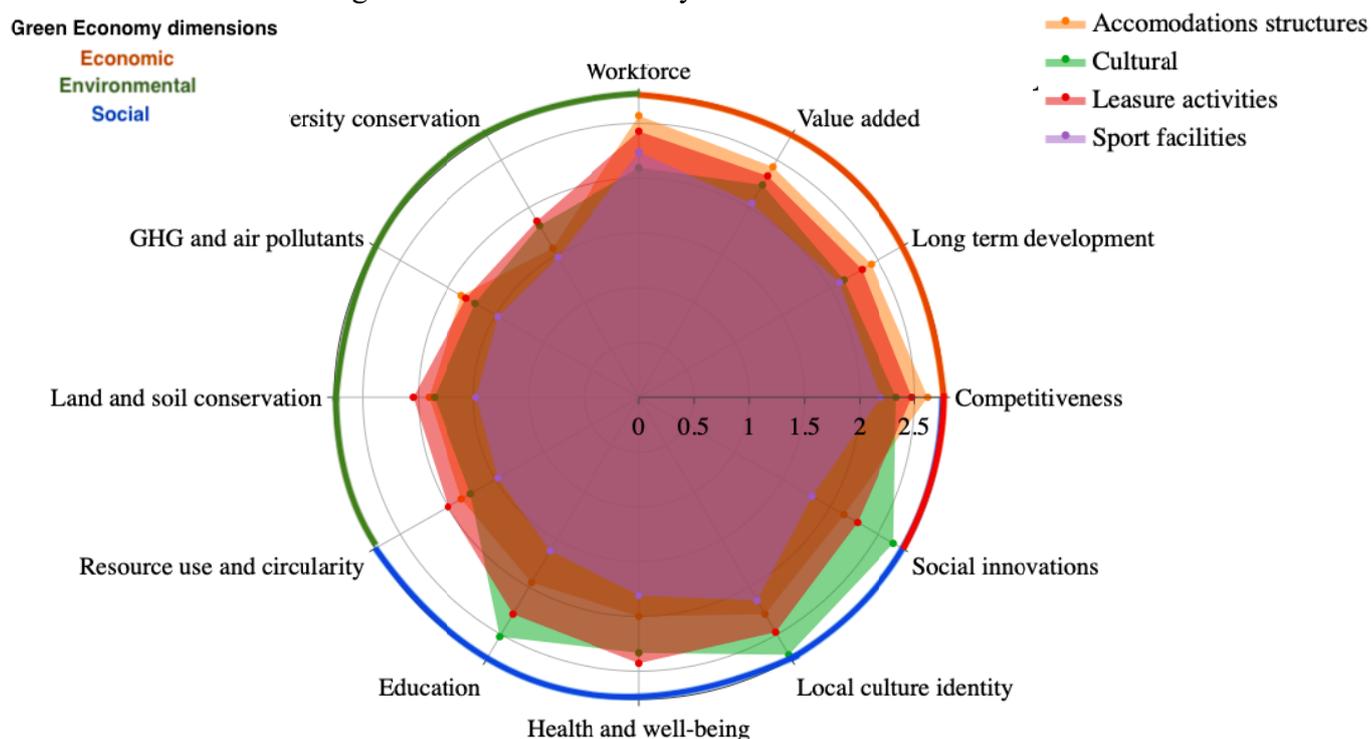
Table 9

	<i>Economic</i>		<i>Environmental</i>		<i>Social</i>		<i>Total</i>	
	Score	Ranking Position	Score	Ranking Position	Score	Ranking Position	Score	Ranking Position
Accommodations structures	0,84	1st	0,60	12th	0,70	9th	0,71	8th
Cultural	0,73	8th	0,60	13th	0,85	1st	0,72	5th
Leisure activities	0,80	3rd	0,64	9th	0,79	2nd	0,74	4th
Sport facilities	0,71	9th	0,49	16th	0,62	10th	0,60	14th
Tourism	0,77	-	0,58	-	0,74	-	0,69	-
	(0,06)		(0,06)		(0,10)		(0,06)	

Figure 6 shows a spider graph with the scores obtained in each specific criteria of the Green Economy by each sub-sector (the original scores of the survey ranged from 0 “absent” to 3 “very relevant”).

The tourism sub-sectors are more heterogeneous than the other sectors in terms of the performances in the different dimensions and criteria. There is in fact **no single sub-sector performing relatively better than the others in all dimensions**. The “Accommodation structures” is particularly relevant as for the Economic criteria “Workforce”, “Value added” and “Long term development”. The “Cultural” sub-sector is the one with the highest scores as for the Social criteria “Education, Local culture identity” and “Social innovation”. The “Leisure activities” sub-sector is relatively more relevant than its counterparts as for the Environmental criteria “Land and soil conservation” and “Resource use and circularity”. The “Sport facilities” sub-sector, despite being less relevant than the others, obtains high scores as for the “Workforce”, “Competitiveness” and “Local culture identity” criteria.

Figure 6: Scores obtained by the Tourism sub-sectors



The **contributions of the tourism sub-sectors to the Environmental dimension of the green economy are multiple**. The Italian National Biodiversity Strategy recognizes that tourism as a sector that can strongly contribute to attaining sustainable development goals when a sustainable use of limited natural resources, consistent with their capacity to regenerate and to generate income and profits for the industry, is ensured (Blasi et al., 2009). The Strategy mentions as relevant actions for the promotion of sustainable tourism the **monitoring of tourism impacts** on biodiversity through a set of specific indicators and the **promotion of a protected areas network** for sharing experiences and enhancing cooperation. Within the “Accommodation structure” sub-sector important potential contributions are linked to the Environmental dimension of the Green Economy, as the sub-sector is particularly suitable for the **adoption of efficient technologies and green construction methods**. These elements both contribute to reducing the environmental impacts of the sector and increase its competitive position (first of all as energy savings can reduce operating costs, and secondly because of the impact on the quality of tourism services offered). The first Report on the State of the Alps (PSAC 2007) reports that 84% of all tourists travel to their destination in the Alps by car. Therefore, strong links exist as for the **development of the Green Economy in the passenger transport sector**. Another cross-cutting dimension is land take, as the **growing land demand of the tourism and leisure industry** in some regions, especially if coupled with **new transport infrastructure needs**, increases the risks of undermining the environmental stability of these local areas. Furthermore, tourism in some Alpine regions can increase the **pressure on waste management**. This issue is particularly relevant in small municipalities where the seasonal fluctuations in waste generation affect considerably the costs related to waste management. Alpine municipalities and provinces will therefore need to improve their **waste management and public transport systems** as well as promoting **circular**

economy approaches (PSAC, 2013). Actions to be taken by the private enterprises range from the implementation of **environmental management systems** in order to evaluate, manage and reduce their environmental impacts, to the **development of commercial activities and services** that engage the tourist and facilitate the adoption of sustainability-oriented behaviors. Reorienting travel choices so as to reduce reliance on motorized private transport is a central element as the percentage of visitors travelling to the destination by train in the entire Alpine area is about 9%, while in the Italian Alpine area is 2-3%. Italy relies more on coach and bus, that account for 10%, but the same transport mode account for 15%-20% in France, Germany and Switzerland. Reorientation of the transport modes coherently with the Green Economy can be achieved in multiple ways (PSAC, 2007): **introducing and/or developing new transport services, especially in the final part of the journey** so that tourists can switch from private cars to public transport; offering combined transport mode packages at reduced prices; invest in campaigns to raise the visitors' awareness on public transport and soft mobility options.

Guidelines for developing tourism contained in the fourth Report on the state of the Alps, focused on the sustainable development of tourism in the Alps are (PSAC, 2013) the **conservation of nature**, the **promotion of the countryside** and the **promotion of innovation and diversity** in tourism to make environmentally-friendly tourism more competitive. More specific actions for the promotion of the Green Economy are for instance the adaptation of existing tourist facilities and equipment to meet ecological requirements, and the development of new facilities conforming to such requirements. Furthermore, tourism can be promoted coherently with the green Economy principles by developing environmentally-friendly activities and promoting the natural and cultural heritage in local areas. **Linking tourism businesses and local organic farms** is for instance an example of successful implementation of such approach (PSAC, 2013). Various activities within the "leisure activities" sub-sector can be developed following this paradigm by offering nature and biodiversity experiences (e.g. herbal excursions or bird watching). **National parks** in particular should both serve for the **protection of the ecological integrity of ecosystems** but also offer opportunities for **recreation and tourism as primary goals**, especially in geographically marginalized local areas (Mayer, 2014).

Specific measures identified target the "Accommodation structures" sub-sector and include the control of tourist flows, particularly in protected areas, and when necessary establish designated quiet areas where no tourist facilities will be developed. More in general, **tourist flows** should be managed in a way that evenly disperse them (both in terms of time and location) in order to **reduce the pressures and ensure the sustainability of the local areas** (PSAC, 2013).

Sport facilities are characterized by a specific set of potentials for the development of the Green Economy. As for the Environmental dimension, an important activity that may generate some challenges is the **management of ski slopes**. First of all, ski slopes management should take into account the natural balances and biotope sensitivity in which the activities take place. More in detail the key elements to consider are the sustainable development, maintenance and use of ski slopes and the suitability of the artificial snow production with the hydrological, climatic and ecological conditions of the local area (76.9% of resorts in Italy in 2007 were equipped with artificial snowmaking facilities). The latter point is particularly relevant as in the short to medium term possible adaptation measures to climate change related water and snow scarcity may have to be developed in the Alpine area, both hard (technical) and soft (awareness raising) (OECD, 2007).

Measures that would contribute to the development of both the Environmental and Economic dimensions of the Green Economy in this regard are for instance (PSAC, 2013): slope design (landscaping) and grooming aimed at exploiting the topological characteristics of the ski area; snow farming, which implies the creation of snow deposits; concentration of ski areas at higher altitudes and glaciers and development of new cable-cars. It should be underscored that the concentration of ski areas at higher altitudes should be carefully evaluated as it entails higher costs of investments and maintenance, higher risk of natural hazards and higher impacts on the environment (Agrawala, 2007).

The relevance of the different tourism sub-sectors with respect to the Economic dimension of the Green Economy is straightforward, as in many regions of the Alpine area tourism accounts for more than 20% and up to 50% of the regional domestic product (PSAC, 2013). At the same time, **economic activities linked to tourism are not evenly spread throughout the Alpine region**, but tend to be concentrated in easily accessible valleys and basins: 37% of Alpine municipalities have no tourist beds and 46% of the beds are concentrated in 5% of the municipalities (Price et al., 2011). It is important to underscore that a healthy tourism sector **contributes to the development of many different local activities**, from accommodation to catering and food, agriculture, crafts and transport. At the same time, the Fourth Report on the State of the Alps recognizes that **mass tourism can generate trade-offs** as it may increase living expenses, land prices and additional taxes due to tourism infrastructures, that can hurt the socio-economic conditions of the residents, especially the ones with a lower income (PSAC, 2013). Therefore, the development of more sustainable forms of tourism can touch a wide range of sectors and can contribute not only to **involve local inhabitants and generate local income**, but also to **strengthening the competitiveness and the long run development of an area**. The positive economic impacts deriving from job creation in the tourism sector have in fact strong effects on the Social dimension of the Green Economy, as they bring improvements such as **better working conditions, provision of educational opportunities, incentives to improve the public services** to meet the expectations of visitors but affecting also the resident population. Furthermore, tourism can comprise a set of economic activities that valorize not only the natural but also the historical, cultural and social resources of the alpine regions. Agricultural tourism activities for instance has the following positive impacts on many economic and social dimensions: tourism is distributed more evenly in rural areas, visitors participate in the activities and lifestyles of local people, farmers receive the revenues directly and diversify their economic activities. An important element reinforcing the Social dimension of a green tourism sector is the development of activities that are adapted to the specific environment and available resources of the local area.

Box 6: the Green Economy in the large international sport events

Large international sport events as the World Ski Championship, the Alpine Ski World Cup and the Olympic Winter Games are an important aspect of the Alpine sport sector. These events can have both short-term and long-term impacts on the environment, the society and the economy (PSAC, 2013): short-

term economic impacts derive from the entrance fees and the consumption of goods and services by guests flows additional to the one that would have occurred; long-term economic impacts are due to improved infrastructure such as sport facilities and tourist attractions. At the same time, large events can generate strong pressures on the local resource consumption, especially of energy and water resources, and generate other negative environmental pressures such as waste generation, increase in the air and noise pollution due to passenger transport activities. Main critical environmental issues are: the management of environmental impacts related to the construction of infrastructure, the environmental pressures generated by the influx of visitors during the execution phase of the event (mobility, waste, water resources); the risk of an unbalanced distribution of investments in the territory; the over-dimensioning of the infrastructures. More in detail, short term pressures are related to water consumption during major sport events for sanitary facilities and to produce artificial snow, as well as to waste generation (Schmied et al., 2007). Longer term impacts are related to the infrastructural projects, affecting the landscape and land availability, on top of the resources used for the construction and renovation. Both renovation and construction activities can be related not only to the sport stadiums and related facilities, but also to more general projects of public interest as new transport facilities and water and sewage systems (PSAC, 2013). The development of new facilities that take into consideration of both economic and environmental sustainability issues, as for instance in the choice of construction materials, is a key component of the management of sport events according to the Green Economy principles. It is also important to fully exploit new and renovated infrastructure, ensuring the continuation of tourism activities after the event. The contribution to the social dimension of the Green Economy, despite being relatively difficult to measure, is very relevant and relates to a series of positive impacts on society and culture (Cornelissen et al., 2011): enhancement of the identity of local community; provision of new forms of cultural exchange and cohesion between different social groups; fostering of the civic pride and regional identity; enhancement of cultural traditions, values and attitudes.

Frey et al., (2008) examined several factors of the territorial development of the last Alpine Winter Olympics, held in Torino in 2006. The study found that in order to exploit the Games as a tool of sustainable growth of the areas and guarantee a positive and durable legacy for the hosting areas and local community involved, a set of important conditions must be taken into account (Frey et al., 2008):

- a long-term strategy: for the Olympic Games to become an example of sustainability, they must be integrated as early as possible into long-term territorial planning policies based on principles of sustainable development.
- partnerships for sustainability: sustainability is a collective effort and, therefore, strong public-private partnerships are essential. Local stakeholders' involvement must be effective, as the organization of a wide-scale event clearly asks for a responsible governance framework, in order to guarantee that decisions really reflect the diverse interests of the different actors involved;
- use of monitoring and reporting tools: the Sustainability Report may be a valuable tool for Games organizers committed towards sustainable Olympics, as it may help analyze and maximize the potential social benefits, as well as identify risks and potential negative effects related with the events.
- leading by example: wide-scale events such as the Olympics are global events which benefit from high media attention and should therefore be used as an opportunity to encourage innovations and actual implementation in the sphere of sustainable development.

An important forthcoming international multi-sport event will be the 2026 Winter Olympics, scheduled to take place from in February 2026 in the Italian cities of Milan and Cortina d'Ampezzo. Given the aforementioned challenges and opportunities, it is important to underscore that sustainability and the Green Economy will have to be a fundamental pillar of future projects as the Milano-Cortina 2026. The Winter Olympics are an occasion to develop innovative solutions, aimed at guaranteeing long-term benefits and

enhancing the existing heritage by leveraging responsible, environmentally friendly and socially virtuous policies. The Milano-Cortina 2026 dossier identifies the sustainability approach and related criteria as core drivers in the entire life cycle of the event. An ad-hoc Sustainability and Legacy Department will be responsible for ensuring the following actions (CONI, 2019):

- the adoption of environmental and social criteria and standards within the entire organisation;
- the implementation of specific plans and programmes for the mitigation and/or compensation of environmental and social impacts and for maximising the value of the event;
- the development of an environmental communication strategy on the overall sustainability programme and stakeholder engagement along the event life-cycle;
- the certification of the management system, according to the standard adopted;
- the launch of awareness-raising initiatives on the Games sustainability good practices, after the end of the Games;
- the coordination with the Sustainability and Legacy Forum to share best practices and support the achievement of long-term legacies of the Games;
- the reuse and recycling of goods and material at the end of the event.

More in detail, the Milano Cortina 2026 organizing committee has committed to adopt a comprehensive Sustainability Programme that covers the following major elements (CONI, 2019):

- infrastructure and natural sites (actions include: avoid any possible impact on conservation of biodiversity and cultural heritage and take into consideration every potential loss of ecological value connected with the construction of the venues, quantifying the 'equivalent hectares' necessary to offset the loss)
- green sourcing and resource management (actions include: infrastructure design, green procurement, food and beverage systems, food recovery system, separate collection of wastes, games assets reuse and water footprint)
- mobility (actions include: offer various alternatives for people mobility, in particular an intermodal transport system based on rail and bus networks and development of electric mobility)
- workforce (actions include: ensure the legality and safety of the working environment and conditions as well as of the volunteers' activities; playing attention to gender issues and to the most vulnerable categories of workers)
- climate (actions include: application of the best energy-efficient solutions for permanent and temporary infrastructures; adoption of the LEED Protocol for new or deep refurbished buildings; 100% use of renewable energy (locally produced or purchased with a certified origin) to satisfy the overall energy demand during the event; outdoor lighting 100% LED; monitoring and disclosing GHG emissions associated with Games activities; implementing compensation measures to achieve carbon neutrality, including local projects and purchase of verified and registered carbon credits; fostering climate action through communication and enabling knowledge-sharing capacities to optimize the impact of collective effort on climate action).

A series of objectives, targets and output indicators pertaining to four different areas (Sport, Economic, Social and Environmental) are set and will be key for ensuring that the achievement of the predictions and commitments will be monitored and assessed.

4. Conclusions

This report has evaluated the potentials of a transition towards the Green Economy in the Alps, considered as a multidimensional process involving a wide range of criteria and related to different sectors. A multi criteria analysis (MCA) has been adopted with the aim of providing an-index based evaluation that could capture the broadness of the concept of the Green Economy as defined by UNEP (2011) and, at the same time, be coherent with the specificities of the Alpine region under analysis, as identified by the Alpine Convention (PSAC, 2017a). In total, the potential contribution of 16 sectors on the development of 12 Green Economy criteria has been evaluated based on experts' evaluations collected through an online survey. Firstly, three indexes ranging from 0 to 1 and measuring the potential contribution of each sub-sector in the three Green Economy dimensions have been developed. Secondly, the Green Economy Index has been calculated as the weighted geometric mean of the three dimensions' indexes.

A first relevant result derives from the weights assigned by the respondents of the survey to the Economic, Environmental and Social dimensions, which point to the almost **equal importance of the three dimensions on the Green Economy in the Alps**. Furthermore, the sectoral aggregation of the indexes underscores that **all sectors have a very relevant role in the transition towards a Green Economy** in the Alpine region. Nevertheless, some specific sectors are ranked relatively better than the others in the different Green Economy dimensions. The agriculture and farming sector obtain the highest score in the overall Green Economy Index. The forestry sector is the most important as for the Environmental dimension Index, while the tourism sector obtains the highest scores in the Economic dimension Index. Both the tourism and the agriculture and farming sectors obtain the highest scores in the Social dimension Index.

The scores obtained by the different sub-sectors have been analyzed in order to understand the **potential contribution of different economic activities** to the distinctive dimensions of the Green Economy, as well as on the **synergies and trade-offs** between them.

Agriculture and farming obtain similar results across the different criteria, despite the former is generally characterized by higher scores. Particularly high scores are assigned to both sub-sectors in the Economic criteria "Value added" and "Workforce" and "Long term development", in the Environmental criteria "Land and soil conservation", "Biodiversity conservation" and "Resource use and circularity" and in the Social criteria "Local culture identity" and "Health and well-being". The tourism sector's results as for the Economic dimension index are driven mainly by the "Accommodation structures" sub-sector, particularly relevant as for the Economic criteria "Workforce", "Value added" and "Long term development".

Both agriculture and livestock farming sub-sectors are very relevant in the Social dimension, together with the touristic cultural activities. The forestry sector's results on the Environmental dimension derive from the extremely relevant role that the "Silviculture" sub-sector can have across all Environmental dimensions, from "GHG and air pollution" to "Resource use and circularity", "Biodiversity conservation" and "Land and soil conservation".

As for the transport sector, the sub-sectors "Infrastructure management and efficiency" and "Passenger transport" both obtain high scores in the Economic criteria "Long term development" and "Competitiveness", in the Environmental criteria "GHG and air pollutants emissions' reduction" and in the Social criteria "Social innovations".

The results as for the energy sector show a high heterogeneity in the potential contribution of its sub-sectors to the Green Economy. Energy efficiency is particularly relevant with respect to the Economic criteria “resource use and circularity” and the Environmental criteria “GHG and air pollutant reduction”. In fact, **energy efficiency is the most important sub-sector across all sectors**, as it is ranked first in the environmental contribution ranking and in third and fourth position respectively as for its social and economic potential contribution. The results underscore that the Alpine climatic and environmental aspects make energy efficiency an extremely relevant strategy for reducing energy consumption in residential and commercial buildings, but also an important driver of economic development and of competitiveness for tourist accommodations. The biomass and waste sectors instead reach a high score as for the contribution to “resource use and circularity”, “land and soil conservation”, “biodiversity conservation” and “long term development”.

Combining the analysis of the survey’s results with the literature and, in particular, with the information and analysis included in the Reports on the State of the Alps (PSAC, 2007; 2009; 2011; 2014; 2017a; 2017b), a series of considerations on the **specific opportunities for the development of the Green Economy in the Alps** can be pointed out. Many opportunities to develop synergies in the implementation of the Green Economy in the Alps exist between sectors such as tourism, forestry, agriculture and farming. Agricultural tourism activities for instance have positive impacts on many economic and social dimensions: tourism is distributed more evenly in rural areas, visitors participate in the activities and lifestyles of local people, farmers receive the revenues directly and diversify their economic activities. An important element reinforcing the Social dimension of a green tourist sector is the development of activities that are adapted to the specific environment and available resources of the local area. As Alpine forests are part of the typical Alpine landscape, their role in the development the Green Economy in the tourism sector is very important, especially for leisure-time activities, recreation and welfare. The development of new touristic activities in forest areas furthermore can be identified as a solution to challenges such as land use, transformation of landscape, adaptation to climate change and the creation of job opportunities in remote areas. In fact, the forest management activities’ sub-sector obtains the highest scores in the “Biodiversity conservation”, “Land and soil conservation” and “Local culture identity” criteria. Forestry management can furthermore become an additional source of sideline revenue for farms, but at the same time it should be managed respecting and preserving the many environmental functions generated by the alpine forests.

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