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# Towards Mediterranean Blue Valleys: Apulia Region as a model for skills, innovation and complex systems modelling

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**Abstract**

Blue Growth, introduced in 2012 by the European Commission, offers a pathway to reconnect coastal environments, communities and economies through integrated, place-based governance. This paper examines Apulia's #BlueVision2030 strategy as a model of blue governance that intertwines environmental planning, open innovation and cross-border collaboration. Results show that Apulia's model strengthens European Blue Growth and supports the design of Mediterranean Blue Valleys as transnational ecosystems for education, innovation and sustainability.
This framework provides insights for future policy reflection and leverages open-innovation methodologies to enhance stakeholder engagement, accelerate sustainable solutions and support policies for talent attraction, vocational education and the creation of dynamic innovation hubs.

**JEL Classification:** *Q56; Q57; O32; I25; R58; F55*

**Keywords:** *blue growth; complex systems engineering; marine sustainability; ecosystem planning; technical and vocational education and training (TVET); transnational cooperation.*

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# 1. Introduction

For centuries, the Mediterranean has been a crossroads of cultures and trade — a living laboratory of interdependence. Its status as a semi-enclosed sea, both densely humanised and exceptionally rich in biodiversity, makes it a context where human pressure and the impacts of climate change are particularly visible and acute (Puchol-Salort et al., 2020). Within this fragile balance, the key challenge lies in reconciling environmental protection with economic development through governance models able to address the inherent complexity of coastal and maritime systems.

The transition towards a sustainable Blue Economy requires genuinely integrated, multi-level governance that connects European, national and regional policies while fostering cooperation among research, industry and public institutions. This systemic approach, aligned with the *European Innovation Agenda* and initiatives such as the *Harnessing Talent Platform* (European Commission, 2023), seeks to overcome decision-making fragmentation and promote a shared vision that unites growth, innovation and environmental stewardship. From this standpoint, the Mediterranean Blue Economy fits coherently within the broader European framework for sustainable competitiveness.

These frameworks underpin regional strategies such as BlueVision2030, translating sustainable-competitiveness principles into territorial innovation. Yet the blue economies of the Mediterranean — while contributing substantially to growth and employment — face growing environmental and social pressures: biodiversity loss, pollution, coastal erosion and the fragility of production systems (Liu et al., 2015; Pace et al., 2023). The *Blue Growth* paradigm, introduced by the European Commission in 2012 (COM/2012/0494), was conceived precisely to balance economic development, social inclusion and ecological sustainability. However, its potential can only be fully realised through governance models that coordinate effectively across institutional and decision-making levels (Howard, 2018; Haapasaari & Van Tatenhove, 2022).

Within this framework, the Apulia Region (Puglia) represents a significant case. Its Blue Economy contributes 4.9 per cent to regional GDP and provides tens of thousands of jobs (Unioncamere, 2025), positioning Apulia as a key Mediterranean actor. According to the *Regional Innovation Scoreboard* (2023), the region ranks among the Moderate Innovators, showing progress in co-authored scientific publications and in the innovation capacity of SMEs, while still displaying weaknesses in lifelong learning and non-R&D investment. The regional labour market presents a mixed picture, with an employment rate of 51.2 per cent — still below the national average (ARPAL, 2025). These structural factors, combined with demographic decline and youth outmigration, highlight the urgency of integrated strategies for education, talent attraction and retention, consistent with European priorities for sustainable blue growth.

To address these challenges, the Region has developed the *#BlueVision2030* strategy (Regione Puglia, 2022; 2025), fully aligned with the *Smart Specialisation Strategy – S3* and supported by a dedicated governance framework. The strategy integrates policies, stakeholders and financial instruments, positioning Apulia as a Mediterranean laboratory for blue innovation and human-capital development, with the overarching aim of applying the principles of complex systems to territorial sustainability.

This paper analyses #BlueVision2030 as a regional governance strategy based on Blue Growth, complex-systems thinking and open innovation, outlining its implications for transnational cooperation across emerging *Mediterranean Blue Valleys*.

# 2. Theoretical Framework

Since its formulation, the idea of Blue Growth has taken on different meanings. Some scholars view it as a natural evolution of growth policies applied to maritime sectors to strengthen competitiveness and employment. Others see it as a transformative paradigm that redefines how economy, environment and society interact — aiming for a moving balance between development and sustainability (Eikeset et al., 2018).

In reality, Blue Growth is multidimensional. It includes both traditional sectors — fisheries, aquaculture, maritime transport — and emerging ones such as offshore renewable energy, marine biotechnology, sustainable coastal tourism and ecosystem conservation. Across these areas, cross-cutting issues have become central: human-capital development, participatory governance and international cooperation (Martínez-Vázquez et al., 2021; Noni et al., 2018; Sungkawati, 2024).

The Blue Economy, therefore, should not be understood as a sum of sectors but as a complex adaptive system in which outcomes arise from the interaction of economic, social and environmental variables (Sengupta & Sena, 2020; Russell & Smorodinskaya, 2018). This implies that strategies must go beyond sectoral logics and embrace a systemic vision that recognises interdependencies and feedback loops connecting multiple subsystems.

Within this perspective, complex-systems engineering provides both conceptual and practical tools for managing such interrelations. Modelling, simulation and risk-anticipation techniques help policymakers design flexible and resilient policies that adapt to change while guiding decisions through predictive evidence. In parallel, emerging work on Artificial Intelligence shows its potential to support sustainable industrial transitions within complex adaptive systems (Satornino, Du & Grewal, 2024). Together, these approaches allow a more holistic reading of socio-ecological dynamics, replacing linear causality with adaptive learning.

At the same time, open innovation serves as the cultural and organisational engine linking research, business and society (Chesbrough, 2003). By fostering collaboration and knowledge exchange, it strengthens shared learning ecosystems — particularly in regions where social capital and cooperation act as decisive levers for growth (Noni et al., 2018).

The integration of complex-systems thinking and open innovation thus defines a systemic paradigm where sustainability, skills and cooperation reinforce one another. #BlueVision2030 in Apulia builds precisely on this foundation, showing how complexity, collaboration and openness can translate into new forms of governance and regional resilience — turning the territory into a living laboratory of circular innovation and inclusion.

# 3. Data and Methods

The research follows a qualitative approach based on documentary analysis and comparative policy evaluation, articulated along three axes:

- **institutional and regulatory sources.** Key documents examined include the #BlueVision2030 Strategy (DGR 916/2022; DGR 817/2025), the Smart Specialisation Strategy (S3) (DGR 569/2022), the Regional Strategy for Sustainable Development – SRSvS (DGR 1670/2023) and the Governance Framework for the Blue Economy (DGR 1160/2023). These were complemented by regional laws — L.R. 4/2025 on Open Innovation and Artificial Intelligence, L.R. 28/2017 on participatory governance and L.R. 13/2025 on talent attraction, enhancement, circular mobility and retention. These materials define the institutional environment that enables blue innovation and human-capital development within Apulia's transnational cooperation context;

- **socio-economic and contextual sources.** Empirical and prospective data from ARPAL Puglia (2025) on labour-market dynamics, demographic trends, and skills mismatches link policy analysis to the regional socio-economic context. The Regional Innovation Scoreboard (RIS) 2023 situates

Apulia within the wider European landscape of innovation and competitiveness;

- **projects and networks.** Selected case studies include SKILLS – H-LEVEL Smart Skills (cross-border TVET), B-VISA 2030 (MoU with Albania and Montenegro), ARPAL–LinkedIn's digital labour-matching partnership, and participation in EUSAIR, CRPM, and MaSBBE networks.

Document selection followed explicit criteria of relevance, coherence and representativeness. Each source was chosen for its direct contribution to the BlueVision2030 governance framework and for its alignment with European and regional policy objectives. A thematic content analysis was then applied, combining manual coding and comparative interpretation to identify recurring policy patterns, gaps and synergies. This process allowed triangulation between documentary evidence, socio-economic data (ARPAL, Unioncamere 2025) and theoretical references, ensuring robustness and analytical transparency.
The analysis was guided by three questions focusing on consistency, complexity, and transferability of the Apulian experience:

1. What consistencies and discontinuities emerge among planning instruments?
2. How does Apulia's governance model reflect principles of complex systems?
3. What transferable elements can support Mediterranean cooperation models??

This approach strengthens the study's transparency and comparability. This methodological design allows a **multi-level interpretation** of BlueVision2030, linking documentary evidence, regional data and theoretical insights. The qualitative, multi-source approach supports a deep understanding of how policies interact with socio-economic contexts and how complex governance mechanisms translate abstract principles into practical action.
In this perspective, the Apulian case is treated not as an isolated experience but as a **policy ecosystem** where legislation, strategies and networks converge to form a coherent model of integrated governance. Emphasising soft variables — institutional learning, stakeholder participation and inter-organisational trust — helps explain factors that determine the long-term success of regional innovation policies.
By combining policy analysis with contextual and comparative perspectives, this approach provides a robust analytical basis for interpreting Apulia's Blue Economy as a dynamic and adaptive system, capable of learning from feedback and generating transnational value.

# 4. Results and Discussion

## 4.1. The Pillars of #BlueVision2030

The development of the #BlueVision2030 strategy stems from an institutional process initiated in 2022 and built through progressive, participatory phases. Following an extensive contextual analysis and mapping of both regional and European experiences — identifying more than fifty projects implemented between 2019 and 2022 — the Region conducted a comprehensive SWOT analysis to highlight the strengths and weaknesses of Apulia's blue system.

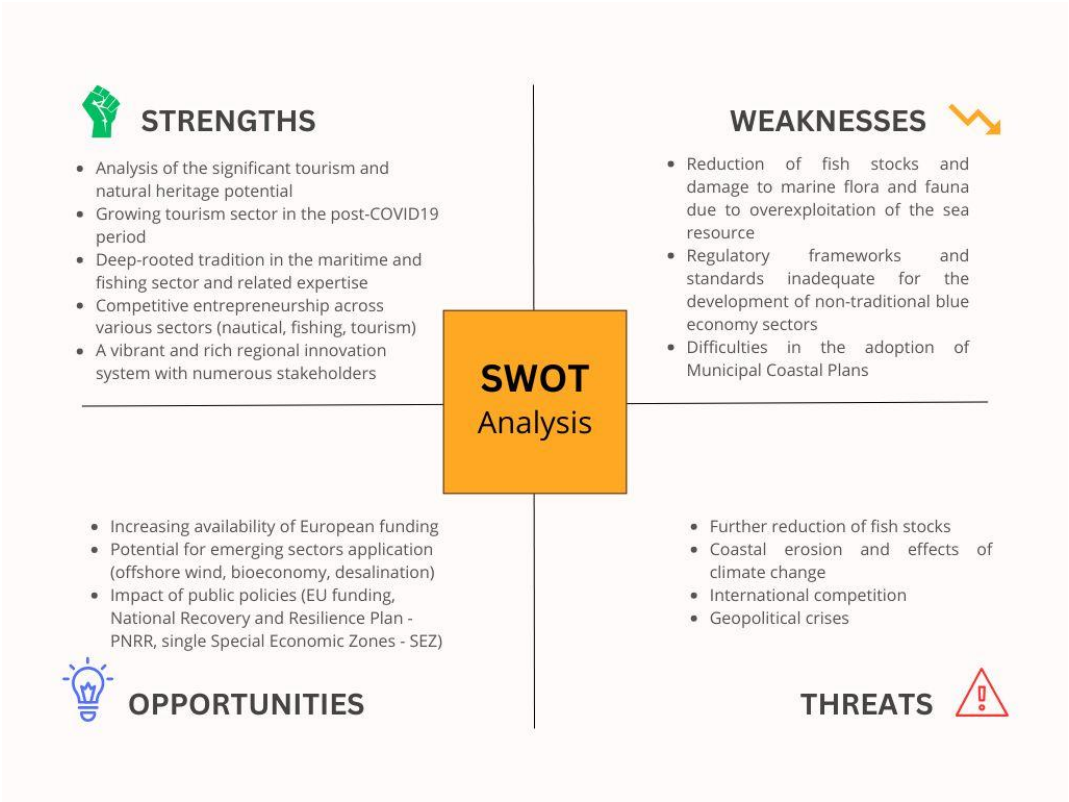


***Figure 1*** SWOT-analysis

On this analytical foundation, five strategic pillars were defined, consistent with the Smart Specialisation Strategy (S3) and supported by a multi-level governance model inspired by the quintuple helix framework. This structure involves steering committees, technical–scientific bodies and thematic working groups, accompanied by participatory consultation through the digital platform #PugliaPartecipa, ensuring active involvement of citizens and stakeholders in line with the regional law on participatory democracy.

This iterative and inclusive approach consolidated an integrated vision that combines ecosystem protection, cultural valorisation, decarbonisation, technological innovation and skills development — laying the groundwork for adaptive governance of the regional Blue Economy.

The #BlueVision2030 strategy emerged from a structured and participatory process that defined five strategic pillars, eighteen integrated objectives and over eighty concrete actions — symbolically represented by a *"five-armed starfish":*

**blue innovation.** This pillar aims to position Apulia as a Mediterranean hub for blue innovation. Actions include digitalising the fisheries value chain, applying Artificial Intelligence (AI) and the Internet of Things (IoT) to marine resource management, and launching acceleration programmes for start-ups. These initiatives align with the trajectories outlined in the *Smart Specialisation Strategy (S3)* (*DGR 569/2022*) and with Apulia's participation in the *Regional Innovation Valleys (RIV)* initiative. Regional Law 4/2025 strengthens collaboration between public and private actors, fostering innovation ecosystems through inter-sectoral networks and technology transfer (*Elston et al., 2024; Sarpong et al., 2022; Russell & Smorodinskaya, 2018*);

**blue–green integration.** The second pillar emphasises the interlinkages between blue and green economies, focusing on port and transport decarbonisation, circular economy practices — such as the reuse of fishery by-products — and offshore renewable energy. This trajectory supports the *Green Deal* and the *digital transition*, and interacts with *#H2Puglia2030* (the regional hydrogen

strategy). Diversification towards bio-blue and knowledge-intensive value chains enhances resilience and adaptive capacity (*Pace et al., 2023; Ali et al., 2024; Bonfiglio, 2024*). Within this framework, the European project *BEYOND – Blue Economy Synergies for Sustainable Development* (Interreg Italy–Croatia 2021–2027) plays a pivotal role, testing the compatibility between climate goals, environmental protection and emerging maritime industries;

**integrated planning.** The third pillar tackles long-standing issues in coastal management, such as delayed municipal coastal plans and limited designated aquaculture areas (Aree a destinazione Zootecnica Acquacoltura – AZA). Planned actions promote coexistence among tourism, fisheries and new economic activities in line with the Marine Strategy Framework Directive and the Maritime Spatial Planning Directive (2008/56/EC; 2014/89/EU). Integrated planning and blue–green urban design approaches have proven to reduce use conflicts and enhance socio-ecological resilience (Haapasaari & Van Tatenhove, 2022; Puchol-Salort et al., 2020);

**transnational cooperation.** The fourth pillar frames the Mediterranean as a shared space for collaboration. Apulia participates in networks such as *EUSAIR* (EU Strategy for the Adriatic–Ionian Region), *CRPM* (Conference of Peripheral Maritime Regions) and *MaSBBE* (Marine and Maritime Sustainable Blue Bioeconomy). The *B-VISA 2030* initiative, financed by *Interreg IPA South Adriatic* and formalised through a *Memorandum of Understanding* with Albania and Montenegro (2025), represents a milestone in building a cross-border innovation ecosystem. As noted in the literature, transnational cooperation is essential for implementing transition pathways in regional maritime areas (*Kelly et al., 2022; Guerreiro, 2021; Boschen-Rose et al., 2020*);

**human capital and skills.** Human capital represents the true "blue infrastructure" of Apulia's strategy. The BlueVision2030 framework identifies three interlinked objectives: (1) upskilling and reskilling blue-economy professionals; (2) strengthening transversal and technical competences; and (3) improving labour-market matching between skill supply and demand.

i. Cross-border TVET initiatives, such as the *SKILLS – H-LEVEL Smart Skills* project, promote joint technical and vocational training programmes within the Adriatic basin, strengthening cooperation with Albania and Montenegro and aligning curricula with the emerging needs of the Blue Economy.

ii. *Regional Law 13/2025* on Talent Attraction and Circular Mobility acts as the cornerstone for education, training, and innovation policies. Its implementation through the PR Puglia ERDF–ESF+ 2021–2027 and Interreg IPA South Adriatic enables upskilling and reskilling pathways for maritime, tourism, renewable-energy, and logistics operators;

iii. A central role is also played by Future4Puglia, an initiative defined by ARTI and the Apulia Region as "a foresight platform for identifying future development trajectories of strategic value chains and co-designing policies capable of making them concrete" In synergy with Future4Puglia and ITS Academies, the Region promotes lifelong learning, dual training and digital competence development, aligning curricula with emerging blue-sector profiles. This approach translates the principles of BlueVision2030 into concrete educational transformation: it fosters cooperation between industry and training providers, introduces competence frameworks for blue and green jobs, and embeds lifelong learning as a structural pillar of regional competitiveness.

iv. Within the *ARPAL–LinkedIn* strategy, the integrated use of digital tools such as *LinkedIn Recruiter* (for identifying specialised profiles, including within the diaspora), *Talent Insights* (for mapping labour needs and skill shortages) and *Job Slots* (for targeted vacancy promotion via the "Lavoro per Te Puglia" platform) enhances the matching between demand and supply in key blue economy segments — sustainable aquaculture, marine energy, digital port management and marine biotechnologies. The result is more efficient matching,

targeted reskilling and greater labour market resilience, consolidating Apulia's role as a Mediterranean hub for blue skills and human-centred innovation.

v. Finally, the *Territorial Pacts for Advanced Enterprise Education*, promoted by Apulia's five universities, integrate STEM disciplines with the social and human sciences to train highly specialised and interdisciplinary professionals, aligning education supply with production system needs.

Overall, BlueVision2030 represents not only a policy framework but a systemic transformation of Apulia's education and training architecture. By linking innovation, skills and territorial development, it moves beyond sectoral initiatives to create an integrated skills ecosystem. Curricula are co-designed with enterprises and training institutions to incorporate blue and green competences, while competence frameworks ensure consistency across vocational, higher and lifelong learning. Digital and foresight tools — from the ARPAL–LinkedIn platform to the Future4Puglia initiative — enable continuous skill mapping and adaptation to emerging needs. This integrated approach translates the principles of complex systems engineering and harmonic innovation into the human dimension, turning knowledge into capability and education into a driver of regional resilience.

The strategy is supported by a broad mix of European and national funds, including *ERDF*, *ESF+*, *FSC*, *EMFAF*, *PNRR*, *Interreg Programmes*, *Horizon Europe* and, notably, the *Just Transition Fund (JTF)*, which in Apulia focuses on the Taranto area. Here, the industrial transition from high-impact steel production to a sustainable economy finds in the Blue Economy a strategic axis of reconversion. The JTF finances initiatives for the revitalisation of shipbuilding, the development of sustainable port infrastructures and the creation of a maritime innovation cluster linked to energy decarbonisation and urban regeneration (Regione Puglia, 2022; 2023; 2025).

Overall, these actions define a *regional blue innovation ecosystem* built on participatory foundations and oriented towards stable integration within European and Mediterranean networks. In this way, Apulia aims to consolidate its role not only as a frontier territory but also as a transnational innovation valley — an integral component of what we define here as the emerging *Mediterranean Blue Valleys***.**

## 4.2. Governance as a "Systemic Laboratory"

The governance of Apulia's Blue Economy functions as a genuine *systemic laboratory*, where coordination, participation and monitoring are tightly interlinked. The model comprises a Steering Committee, a Technical–Scientific Committee and several permanent thematic working groups, structured in accordance with *Regional Law 28/2017* on participatory governance.

This organisational architecture draws inspiration from the *quintuple helix* paradigm (Soma et al., 2018), recognising the interconnected roles of institutions, research, industry, civil society and the environment in driving innovation. It adopts a flexible, adaptive approach in which modelling, simulation and predictive tools support decision-making and policy design (Jamieson et al., 2021; Russell & Smorodinskaya, 2018). Early experimentation with territorial digital twins and integrated data platforms — implemented with ARTI and CMCC — marks a step towards anticipatory governance capable of mitigating risk and strengthening resilience (Lerario et al., 2025; Kumar et al., 2024).

Within this context, public administration assumes the role of *ecosystem orchestrator*, coordinating diverse actors and knowledge systems. *Regional Law 4/2025* provides the enabling framework for collaborative practice, while the forthcoming *Puglia Open Innovation Platform* offers a digital environment for co-design and knowledge sharing, reducing information asymmetries and fostering collective solutions.

Joint laboratories and public–private partnerships also contribute significantly by sharing infrastructure and expertise across universities, research organisations and enterprises. The promotion of open-

innovation and Corporate Venture Capital programmes further extends participation, enhancing competitiveness and the capacity to generate sustainable solutions on a Mediterranean scale.
The theoretical contribution of Iaione (2024) is particularly relevant: a just and sustainable transition, he argues, must rest on a balance between territorial justice, innovation, and sustainability. Applied to the Apulian case, *BlueVision2030* can be interpreted as a project of civic regeneration and territorial democracy, where the Blue Economy becomes both a common good and a driver of participatory development. From this standpoint, Apulia's model generates a cognitive and participatory infrastructure that transforms policy learning into practice — a model of *harmonic innovation* (Cicione, Filice & Marino, 2022), where technology, human capital and social responsibility evolve in balance.

### 4.3. Discussion: Strengths and Trade-offs

The analysis of *BlueVision2030* highlights several key strengths:

- **multi-scale coherence**, through alignment with the *European Green Deal*, the mission *Restore our Ocean and Waters by 2030* and *S3*;
- **inclusive governance**, which broadens participation and reinforces social legitimacy;
- **centrality of human capital**, supported by targeted policies on skills, TVET and talent attraction;
- **transnational dimension**, which strengthens Mediterranean cooperation and generates knowledge and technology spill-overs.

The Regional Innovation Scoreboard confirms strong foundations but highlights gaps in lifelong learning and non-R&D innovation.
Overall, challenges of governance and implementation persist (fragmentation, territorial inequalities, scattered data and risks of political discontinuity), which are explored in §5 together with the corresponding corrective measures (continuing training, *Regional Law 13/2025* and social and organisational innovation).

## 5. Challenges and Critical Issues in Implementation

The implementation of *BlueVision2030* confirms the vitality of Apulia's blue ecosystem but also highlights several critical challenges that need to be addressed to ensure long-term sustainability and impact:

- **institutional coordination.** Despite progress in interdepartmental collaboration, the persistence of fragmented competences and overlapping responsibilities continues to slow decision-making. The complexity of multi-level governance requires continuity and stable mechanisms for cooperation among regional, national and local administrations;
- **human capital and demographic trends.** The region still faces an ageing population, gender imbalances and youth outmigration. The employment rate (51.2% in 2024) remains below the national average (ARPAL, 2025). *Regional Law 13/2025* plays a central role in promoting talent attraction, lifelong learning and circular mobility, all essential to bridge the skills gap and sustain blue innovation;
- **dependence on european funds.** The range of programmes supporting *BlueVision2030* — *ERDF*, *ESF+*, *EMFAF*, *Interreg*, *Horizon Europe* and the *Just Transition Fund* — enables experimentation but also creates the risk of project fragmentation once funding cycles end. Consolidating these initiatives into stable, multiannual frameworks is key to ensuring continuity;
- **environmental and climate pressures.** The Mediterranean remains one of the most climate-sensitive regions, facing coastal erosion, rising sea levels and biodiversity loss. In response, Apulia is

developing *digital twins* and integrated data platforms (with *ARTI* and *CMCC*) to strengthen adaptive and predictive territorial planning;

- **cultural transformation.** The blue transition requires not only technical innovation but also new cooperative behaviours, shared trust and long-term vision. Building a culture of collaboration among institutions, enterprises and communities is crucial for transforming projects into systemic change.

# 6. Towards the Mediterranean Blue Valleys: conclusions and perspectives

The analysis confirms that Apulia stands as a paradigmatic and replicable case of Blue Growth — a region capable of integrating multi-level governance, systems thinking and open innovation into a coherent and adaptive framework. The main challenges identified — institutional fragmentation, sectoral inertia and limited data integration — reflect conditions common to many coastal regions, making the Apulian experience a valuable reference for building a shared transnational model.

The idea of the **Mediterranean Blue Valleys** naturally evolves from this experience: a network of transnational ecosystems for innovation and sustainability grounded on three interlinked pillars:

- **complex systems for evidence-based decision-making.** The use of modelling and simulation helps manage Mediterranean complexity through predictive, integrated tools (Qi, 2022; Liu et al., 2015);
- **open innovation and co-design.** Collaborative ecosystems enable shared solutions and the diffusion of sustainable practices across research, business and local communities. The forthcoming *Puglia Open Innovation Platform*, created under Regional Law 4/2025, will provide a digital environment for co-design and knowledge exchange, linking regional and transnational actors (Belussi et al., 2010; Russell & Smorodinskaya, 2018);
- **blue skills and talent mobility.** Cross-border training programmes, talent attraction measures (Regional Law 13/2025) and digital labour-matching tools such as *ARPAL–LinkedIn* support collaboration, mobility and the reduction of territorial disparities (Noni et al., 2018; Pinheiro et al., 2022).

The *B-VISA 2030* Memorandum of Understanding between Apulia, Albania and Montenegro illustrates how MBVs can serve as practical platforms for cooperation and cross-border spill-overs in technology, education and innovation (Kelly et al., 2022). Consistent with the European Green Deal, the Horizon Europe Mission *"Restore Our Ocean and Waters by 2030"* and the United Nations Sustainable Development Goals, the Mediterranean Blue Valleys are envisioned as living laboratories of sustainability and innovation — transforming the Mediterranean from a fragmented space into one of integration and shared learning.

Apulia's trajectory shows that its strength lies not only in strategic alignment — between S3 and RIV — but also in its capacity for institutional learning and collaboration between public and private actors. Regional Law 4/2025, digital data and innovation platforms and the *Territorial Pacts for Advanced Enterprise Education* have turned systemic complexity into a productive asset, building the region's adaptive capacity and resilience. As a result, Apulia emerges as an advanced territorial laboratory generating both vertical spill-overs — reinforcing value chains — and horizontal ones through transnational cooperation. Data from the *Regional Innovation Scoreboard* confirm this evolution: the regional strategy mirrors its innovation profile, leveraging strengths such as SME dynamism, scientific co-publications and digital infrastructure, while addressing persistent weaknesses in non-R&D innovation and lifelong learning.

Looking ahead, it will be crucial to adopt impact-assessment tools that go beyond traditional economic indicators. Metrics capable of capturing broader dimensions — patents, spin-offs, civic engagement and territorial impact — will allow a more comprehensive evaluation of blue-innovation outcomes. Future priorities should focus on:

- developing shared metrics for performance and impact;
- ensuring interoperable data-management systems;
- providing continuous training for policymakers and technical staff;
- strengthening transnational frameworks that integrate skills, value chains mand regulatory systems.

The experience of Apulia demonstrates how the Blue Economy can act as a bridge between research, innovation and territorial identity. The concept of Mediterranean Blue Valleys encapsulates this approach, showing how transnational collaboration can turn sustainability into a shared process of learning. Ultimately, Blue Growth is about human potential — the ability to innovate harmonically, bringing together ecological balance and social inclusion.

# 7. Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the author used *Consensus.app* to identify peer-reviewed literature and verify the reliability of research evidence, and *DeepL* to refine language and ensure stylistic consistency. After using these tools, the author carefully reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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