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Deliverable 5.2

Greening Danube River Basin

Supporting upscaling of innovation in ecosystem

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Abbreviations and Acronyms

AI	Artificial Intelligence
ASAT	Agricultural Scalability Assessment
BMC	Business Model Canvas
CAP	Common Agricultural Policy
CBA	Cost-Benefit Analysis
CSA	Coordination and Support Actions
CSR	Corporate Social Responsibility
DLL	Danube Life Lines
DTP	Danube Transnational Programme
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agricultural Guarantee Fund
EBRD	European Bank for Reconstruction and Development
EEA	European Environment Agency
EEN	Enterprise Europe Network
EIB	European Investment Bank
EIT	European Institute of Innovation and Technology
ELP	Endangered Landscapes Programme
ERDF	European Regional Development Fund
ESA	European Space Agency
ESG	Environmental, Social and Governance (strategies)
EU	European Union
EUSDR	EU Strategy for the Danube Region
FD	Floods Directive
FFI	Fauna & Flora International
IA	Innovation Actions
ICPDR	International Commission for the Protection of the Danube River
IFAD	International Fund for Agricultural Development
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change

IPR	Intellectual Protection Rights
IT	Information Technology
MI	Market Intelligence
MS	Member States
NAS	Natural Assurance Schemes
NBS	Nature-Based Solutions
NGO	Non-Governmental Organization
OECD	Organization for Economic Cooperation and Development
PES	Payments for Ecosystem Services
PESTEL	Political, Economic, Social, Technological, Environmental, Legal (analysis)
R&D	Research and Development
SME	Small and Medium Enterprise
SWOT	Strengths, Weaknesses, Opportunities and Threats (analysis)
UK	United Kingdom
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
USAID	United States Agency for International Development
WFD	Water Framework Directive
WP	Work Package
WWF	World Wildlife Fund

Executive summary

This deliverable was developed as part of the EcoDaLLi project, and in particular of the Work Package 5 on Fostering a strong innovation ecosystem in the Danube river basin.

This deliverable:

- continues the work under Task 5.1, included in the deliverable D5.1, on the services supporting innovation, and
- initiates activities under Task 5.3 on Paving the way to upscaling, which will be continued in 2026 and as part of D5.3.

Overall, **this deliverable aims at supporting upscaling of innovation in ecosystem restoration in the Danube region**, and it does this in two ways:

1. By **supporting innovators, support organisations, and other key actors through the development of a guidebook providing actionable insight and practical guidance** on the types of available innovation support, and how to access them.

2. By **assessing the potential for upscaling of key innovation types** that were inventoried as part of Task 5.1 activities.

The guidebook addresses key areas such as financial support (including grants and venture capital), market intelligence, networking opportunities, regulatory procedures, expert mentoring, and business model training. These services are identified as essential for helping innovators enhance their strategies, improve market readiness, and scale their solutions.

The assessment of the potential for upscaling various innovation types was based on a stocktake of project results and the application of an adapted scalability assessment tool. Nine innovation types were evaluated, with Nature-Based Solutions (NBS) emerging as the most promising due to their strong policy alignment and maturity. Other high-potential innovations include payments for ecosystem services (PES), public participation mechanisms, knowledge-sharing programmes, and cross-sectoral partnerships. Technological and financial innovations such as remote sensing, AI-driven analysis, and green bonds also demonstrate significant potential, though they face technical and financial challenges.

The assessment highlights that effective upscaling often depends on combining multiple innovation types rather than focusing solely on the highest-scoring approaches. Key strengths for scaling innovation in the region include the relevance of the issues addressed, credibility, and supportive public sector environments. However, challenges remain regarding adoption, visibility of benefits, and attractiveness for investors. The sustainability of the innovation ecosystem hinges on addressing these weaknesses.

As a conclusion, this deliverable provides a wrap up of the main insights and key messages emerging from this deliverable, as well as an indication of the next steps to be taken in 2026 before the end of the project (by June 2026).

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1. Introduction

1.1. Background

The Danube River Basin is home to one of Europe's most dynamic socio-ecological systems. Stretching across 14 countries, it encompasses rich biodiversity, vibrant economies, and diverse cultural landscapes. However, the region also faces significant environmental challenges, including water pollution, habitat degradation, and declining ecosystem health. In response to these pressures, innovation plays a critical role in accelerating solutions that can restore and preserve the natural environment while fostering sustainable development.

At the European level, the EU Mission "Restore our Ocean and Waters" aims to protect and restore the health of Europe's marine and freshwater ecosystems through concrete, coordinated actions. It brings together research and innovation, governance and citizen engagement to deliver systemic change and measurable impact.

As part of this Mission, four Lighthouse areas have been established to pilot and scale up solutions in key river and sea basins. The Danube-Black Sea Lighthouse focuses on restoring the Danube River and Black Sea ecosystems and biodiversity.

Within this Lighthouse, the EcoDaLLi project serves as a Coordination and Support Action (CSA) that connects and enhances the work of four Innovation Actions (IAs). While the IAs test and implement solutions on the ground, EcoDaLLi ensures knowledge sharing, supports policy and governance alignment, and strengthens collaboration among stakeholders.

EcoDaLLi plays a central role in enabling long-term innovation by building a strong innovation ecosystem through a regional Living Lab System and a connected Digital Portal.

1.2. What you will find in this Deliverable

This deliverable was developed as part of the EcoDaLLi project, and in particular of the Work Package 5 on Fostering a strong innovation ecosystem in the Danube river basin.

This deliverable:

- continues the work under Task 5.1, included in the deliverable D5.1, on the services supporting innovation, and
- initiates activities under Task 5.3 on Paving the way to upscaling, which will be continued in 2026 and as part of D5.3.

Overall, **this deliverable aims at supporting upscaling of innovation in ecosystem restoration in the Danube region**, and it does this in two ways:

3. By **supporting innovators, support organisations, and other key actors through the development of a guidebook providing actionable insight and practical guidance** on the types of available innovation support, and how to access them. The guidebook was designed based on a survey with key actors which scoped their needs in terms of training and support, which is described in chapter 2 of this deliverable. The guidebook, in turn, is provided in chapter 3: it will help innovators access funding,

navigate regulatory procedures, strengthen their business models, and scale up their solutions. Later on, it will also be available as a pdf guidance document freely downloadable on the EcoDaLLi portal[1].

4. By **assessing the potential for upscaling of key innovation types** that were inventoried as part of Task 5.1 activities. The methodology is based on the innovation upscaling cycle developed by IFAD (2015) and on the innovation scalability assessment set up by USAID (2018), and it is described in chapter 4 of this deliverable. The results of innovation scalability assessment of nine promising innovation types are presented in chapter 5 of this deliverable, whereas the overall conclusions that can be drawn from this assessment constitute the main focus of chapter 6.

Chapter 7, in turn, provides a wrap up of the main insights and key messages emerging from this deliverable, as well as an indication of the next steps to be taken in 2026 before the end of the project (by June 2026).

[1] https://portal.ecodalli.eu/

2. The Guidebook – From concept to insight: methodology

2.1. Approach and analytical steps

This guidebook builds on a structured analytical process designed to capture both theoretical and practical perspectives on innovation support within the Danube region. A mixed-method approach was adopted, combining desk-based research with direct input from regional stakeholders, to ensure that the findings reflect both established knowledge and current on-the-ground realities – and in particular:

1. The process began with a **thorough review of existing literature**, project reports, policy frameworks, and relevant European initiatives. This phase aimed to map out key challenges related to innovation in the environmental and water-related sectors, identify common types of support mechanisms, and understand the enabling environment for innovators. Special attention was given to the role of innovation in the EU Mission "Restore our Ocean and Waters by 2030" and the contribution of the EcoDaLLi project as a Coordination and Support Action.
2. To complement this theoretical base, a d**edicated survey was carried out among stakeholders in the Danube region**. The survey targeted a broad range of actors—innovators, research institutions, businesses, NGOs, and public bodies — who are engaged in developing or supporting innovative solutions for ecosystem restoration. The goal was to better understand the challenges they face in accessing the support they need and to identify unmet needs that hinder the development or scaling up of their actions. The survey provided valuable insights into the types of innovation being developed (technological, social, governance-related), the sources of funding used, the kind of technical and legal support required, and perceptions about barriers and opportunities in the regional innovation ecosystem.
3. The insights gained from this research were then **consolidated into a practical and user-friendly structure**. The guidebook brings together an overview of innovation support needs, concrete guidance for addressing those needs. The result is a tool that is both grounded in empirical data and tailored to the real-world context of innovators in the Danube region.

2.2. Insights from desk research and literature review

A review of existing literature reveals the absence of unified and operational definitions for key concepts such as "innovation," "innovation upscaling," "innovation ecosystems," and "innovation support services" in the context of the Danube region. While sector-specific terms such as Nature-based Solutions (NBS) and blue NBS are frequently referenced (Waldenberger, 2024[2]; O'Leary et al., 2024[3]), conceptual ambiguity remains, particularly

[2] Waldenberger, L. (2024). Policy recommendations for NBS implementation. EcoDaLLi Project Deliverable 2.3. https://portal.ecodalli.eu/deliverables/D2.3.pdf
[3] O'Leary, B. C., Wood, L. E., Cornet, C., Roberts, C. M., & Fonseca, C. (2024). Practitioner insights on challenges and options for advancing blue Nature-based Solutions. Marine Policy, 163, 106104. https://doi.org/10.1016/j.marpol.2024.106104

regarding how innovation is defined, classified, and scaled across domains and geographies. For instance, Waldenberger (2024) notes that the lack of a universally accepted definition of NBS hinders coordinated implementation and alignment across policy sectors. Similarly, Stoffers et al. (2024)[4] underline the critical importance of definitional clarity for effective environmental policy, especially within frameworks such as the Nature Restoration Law, where concepts like free-flowing rivers[5] remain vaguely interpreted. Innovation support services are somewhat more concretely described in the work of Zaiter et al. (2025)[6], who offer a typology covering services such as capacity building, knowledge exchange, cross-border collaboration, and Research and Development (R&D) support. However, inconsistencies in terminology, coverage, and visibility of these services limit their accessibility and uptake among innovation actors in the region.

The literature identifies several recurring needs and challenges hindering the scaling-up of innovation in the Danube region (see Figure 1). The most frequently cited barriers include regulatory obstacles (mentioned in 7 sources), lack of funding (6), and insufficient knowledge or data (4), which collectively point to the need for stronger enabling policy frameworks, better access to finance, and improved data infrastructure. Limited stakeholder engagement (4), lack of infrastructure (3), and low awareness of economic benefits (3) further highlight the importance of inclusive governance, investment in support facilities, and more targeted communication strategies. In addition, the limited availability of human resources and technical expertise (each cited in 2 sources) underscores the need for capacity building and knowledge transfer mechanisms. While the majority of the reviewed sources are specific to the Danube region, some are from broader European or international contexts; nonetheless, they present challenges and needs that are highly consistent with those observed in the Danube literature, reinforcing the validity and relevance of the findings.

[4] Stoffers, T., Altermatt, F., Baldan, D., Bilous, O., Borgwardt, F., Buijse, A. D., Bondar-Kunze, E., Cid, N., Erős, T., Ferreira, M. T., Funk, A., Haidvogl, G., Hohensinner, S., Kowal, J., Nagelkerke, L. A. J., Neuburg, J., Peller, T., Schmutz, S., Singer, G. A., … Hein, T. (2024). Reviving Europe's rivers: Seven challenges in the implementation of the Nature Restoration Law to restore free-flowing rivers. WIREs Water, 11(3), e1717. https://doi.org/10.1002/wat2.1717

[5] Some attempts to better define free-flowing rivers are on going, such as for example the EU Free Flowing Rivers assessment methodology (https://publications.jrc.ec.europa.eu/repository/handle/JRC137919) or in the D4All project.

[6] Zaiter, Y., Wang, J., & De Paoli, G. (2025). Catalogue of services supporting innovation. EcoDaLLi Project Deliverable 5.1. https://portal.ecodalli.eu/deliverables/D5.1.pdf

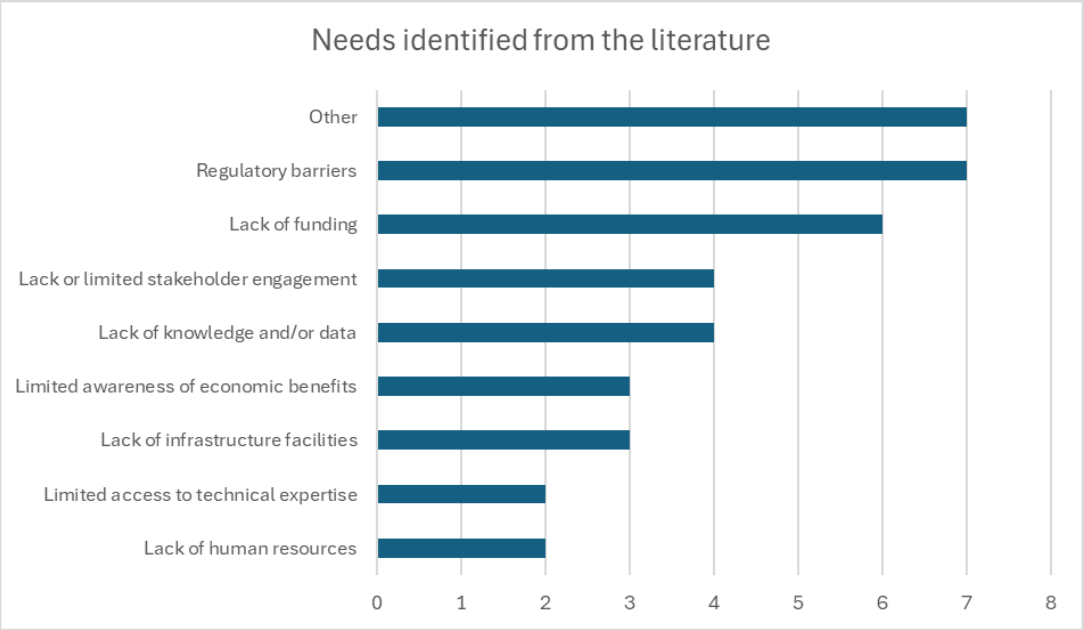

Figure 1 Needs identified from the literature.

Despite the wide recognition of these barriers, few studies systematically link identified needs to concrete innovation support services or tailor their recommendations to specific actor groups or ecosystem types. Our approach responds to this gap by offering a needs-based and actor-focused framework that integrates a harmonised typology of support services, a structured categorisation of challenges and enabling conditions, and a territorial and sectoral lens to identify where scaling potential is most feasible. In doing so, it contributes added value by moving beyond sectoral silos to provide a systemic overview of the innovation landscape in the Danube region—linking innovation ecosystems, governance dynamics, financing mechanisms, and community engagement. This integrative perspective lays a foundation for more coherent and effective support mechanisms and policy interventions across the region.

2.3. Survey design and implementation

An online survey was developed to collect comprehensive information on the needs and priorities of innovators in the Danube region. The primary objective was to gather insights that would inform the development of a guidebook designed to support innovation activities across the region.

The survey was constructed based on a preliminary desk-based literature review and analysis of existing project outputs, policy documents, and scientific studies addressing innovation in ecosystem restoration and NBS. This initial phase made it possible to identify recurring challenges, support gaps, and enabling factors reported in the literature. Building on this foundation, the survey was designed with the specific objective of filling remaining knowledge gaps by capturing context-specific evidence on the needs, priorities, and constraints faced by innovators operating in the Danube region.

The survey was implemented as a self-administered online survey using the EU Survey platform, which is commonly used in EU-funded projects and ensures compliance with data protection and ethical standards. Participation in the survey was voluntary and anonymous, and no personally identifiable information was collected. Respondents provided information at

the organisational level, which helped encourage open and transparent feedback. No interviews were conducted as part of this task; all inputs were collected exclusively through the online questionnaire.

The survey targeted a diverse group of stakeholders active in innovation related to ecosystem restoration in the Danube region, including startups, SMEs, large companies, research institutions, government agencies, and NGOs involved in sectors such as coastal and freshwater ecosystem restoration, sustainable fisheries and aquaculture, climate adaptation and NBS, circular economy, and digital and technological innovations for ecosystem restoration. It was disseminated through the EU Mission "Restore our Ocean and Waters" platform as well as through the networks and partners of the EcoDaLLi project, with the aim of reaching innovators and innovation projects across the basin.

The survey was structured into four key sections:

- **General Information**: To identify the type of organisation and the sectors in which they operate.
- **Innovation Needs and Barriers**: To understand the main challenges innovators face when developing or scaling their activities, such as funding, technical expertise, regulatory issues, market access, infrastructure, and collaboration networks.
- **Support Requirements**: To identify the types of assistance that would be most effective in overcoming these challenges, including financial support, mentoring, training, market and economic analysis, business model development, regulatory simplification, and infrastructure provision.
- **Future Engagement**: To gauge interest in participating in future workshops or training sessions aimed at refining innovation support strategies, along with space for additional comments or recommendations.

The survey was completed by **14 respondents**, providing targeted qualitative and quantitative data to better understand innovation dynamics within the region. While the limited sample size does not allow for statistical representativeness or generalisation across the entire Danube basin, the results are appropriate for the exploratory and needs-assessment purpose of this task and deliverable and were used in conjunction with the literature review to identify priority support areas.

The full survey questionnaire is included in Annex I.

2.4. Key findings from literature review and survey

The survey results reveal three main challenges hindering the development and scaling of innovation in the Danube region, particularly in ecosystem restoration and sustainability: lack of funding (identified by 78% of respondents), regulatory barriers (50%), and limited stakeholder engagement (50%). These challenges were perceived as major constraints to sustaining innovation over time (see Figure 2).

		Answers	Ratio
Lack of funding		11	78.57 %
Limited access to technical expertise		2	14.29 %
Regulatory barriers		7	50 %
Difficulty accessing markets		3	21.43 %
Lack of infrastructure or facilities		3	21.43 %
Weak collaboration networks		6	42.86 %
Lack or limited stakeholder engagement		7	50 %
Other (please specify)		0	0 %
No Answer		0	0 %

Figure 2 Main challenges for Danube Innovators.

A comparison with the literature confirms a strong alignment with these findings. Among the most frequently cited obstacles in the reviewed sources were regulatory barriers and lack of funding (each mentioned in 7 sources), followed by limited stakeholder engagement (4 sources). While most sources focused on the Danube region, some referenced broader European or international contexts. Nevertheless, the consistency of these findings reinforces their relevance to the Danube region and supports their prioritisation in future support strategies.

Survey participants also identified a broad range of support types needed to address these challenges. Financial support — such as grants, venture capital, or subsidies — was highlighted as the most urgent, cited by nearly all respondents (93%). This was followed by training on business models and commercialisation (64%) and simplified regulatory procedures (50%). Additional support needs cited by 29–43% of respondents included training on stakeholder engagement tools, guidance on business model development, consulting for economic and market analysis, access to market intelligence and networking opportunities, expert mentoring and coaching, and infrastructure such as labs and co-working spaces.

		Answers	Ratio
Financial support (grants, venture capital, subsidies)		13	92.86 %
Access to expert mentoring & coaching		4	28.57 %
Training on business models & commercialization		9	64.29 %
Market intelligence & networking opportunities		4	28.57 %
Market analysis (guidance/training)		1	7.14 %
Market analysis (consulting)		4	28.57 %
Economic analysis (guidance/training)		0	0 %
Economic analysis (consulting)		4	28.57 %
Business model development (guidance/training)		5	35.71 %
Business model development (consulting)		4	28.57 %
Simplified regulatory procedures		7	50 %
Infrastructure support (labs, co-working spaces, testbeds)		5	35.71 %
Training on stakeholder engagement techniques and tools		6	42.86 %
Other (please specify)		0	0 %
No Answer		0	0 %

Figure 3 Type of support identified.

A consolidated analysis of the survey responses highlights several key support needs that are considered priorities by innovation actors in the Danube region, which will be addressed in the next chapter of this deliverable.

3. What innovators need: a guidebook to support innovation in ecosystem restoration in the Danube region

This guidebook has been developed to support innovators, support organisations, and other key actors working to advance ecological restoration and sustainability in the Danube region. For instance, this guidebook could be beneficial for project developers and practitioners implementing NBS, start-ups and SMEs developing environmental technologies or services, research and innovation teams, public authorities and river basin organisation, NGOs, and intermediaries such as incubators, accelerators, and innovation hubs that support sustainable innovation.

The purpose of the Guidebook is to help users navigate innovation-related challenges and to identify practical support services that can accelerate the development, scaling, and implementation of innovative solutions.

The guidebook aims to:

- Provide actionable insights and practical guidance tailored to the specific needs of innovation actors in the region; and
- Assist in identifying and understanding the types of support available and how to access them.

This tool was developed in response to a clear need for more tailored, accessible, and targeted support, as revealed through a survey of stakeholders and a thorough review of existing literature. Findings highlighted common obstacles, such as lack of funding, regulatory complexity, and limited stakeholder engagement—all of which call for a strategic and user-friendly resource to support innovators.

What you will find in this guidebook:

The contents of the guidebook reflect the needs of key stakeholders in the Danube region with respect to innovation in ecosystem restoration, which were investigated as part of this task. In particular, the guidebook provides information and insights on the following topics:

- **Financial support** (grants, venture capital, subsidies), as this access to funding remains the most critical barrier to scaling innovation.
- **Market intelligence** and networking opportunities, responding to stakeholders' need for better access to market data, visibility, and collaboration platforms to foster connections and synergies within the regional innovation ecosystem.
- **Regulatory procedures**, addressing strong concern over complex or unclear regulations that can hinder or delay innovation processes, particularly in areas related to ecosystem restoration and sustainability.
- Access to **expert mentoring and coaching**, highlighting the importance of strategic guidance, experience-sharing, and individual support throughout different innovation stages.
- **Training on business models and commercialisation** and tailored consulting on business model design and market analysis, as these were recognised as valuable enablers.

These support services are seen as essential for helping innovators refine their strategies, improve market readiness, and successfully scale their solutions.

3.1. Financial support: the number one challenge for innovators in the region

Financial support is the number one identified need by stakeholders in the Danube region, reflecting the real difficulties innovators face in mobilising resources to fund and/or upscale their innovations for ecosystem restoration.

What you will find in this section:

- An overview of existing funding sources for NBS.
- Practical guidance for innovators: a four-step approach to find the right funding opportunities for innovative ecosystem restoration projects.

3.1.1. Existing funding sources for NBS

Funding for NBS: some figures

While NBS are gaining policy momentum, **most projects still depend heavily on public money and remain small in scale**: the UNEP-WCMC, FFI, and ELP (2020)[7] report on funding ecosystem restoration in Europe confirms that between 2010 and 2020, the majority of funding for restoration projects came from public institutions (e.g., EU programmes and national governments).

Across 1 364 EU/UK NBS projects, only 3% reported private finance covering more than 50% of costs, with the vast majority relying on EU or national public sources and average ticket sizes below €10 million.

Public funding: the backbone of NBS financing in Europe

At the European level, there are **several well-established sources that support NBS and ecosystem restoration**, which are shown in the table below. These funds are often grant-based, reducing financial risk for innovators, but they usually require co-financing and compliance with strict eligibility and reporting requirements.

[7] UNEP-WCMC, FFI and ELP (2020). Funding Ecosystem Restoration in Europe: A summary of funding trends and recommendations to inform practitioners, policymakers and funders. 24pp. https://resources.unep-wcmc.org/products/WCMC_RT286

Table 1 Sources of EU public funding and financing sources (adapted from MERLIN project, D3.5[8]).

Funding Source	Purpose	Relevance for NBS: funding provided for…	Eligible Beneficiaries	Budget (2021–2027)
LIFE Programme	Supports environmental and climate action projects	Ecosystem restoration at large, thus including NBS	EU-based public/private entities, international organisations	€5.43 billion
Horizon Europe	Research and innovation	NBS pilots and upscaling, as well as governance structures supporting ecosystem restoration	Public/private legal entities in eligible countries	€95.5 billion
Cohesion Fund & ERDF	Reduce regional disparities, promote cohesion -	Environmental infrastructure and climate adaptation measures	Regions and Member States, especially less developed	€392 billion
CAP (EAFRD & EAGF)	Sustainable agriculture, rural development	Agri-environmental and climate measures relevant for NBS in rural landscapes	Farmers, rural businesses, local authorities	€386.6 billion combined
Interreg Danube Transnational Programme	Cross-border and regional cooperation in the region	Green infrastructure and climate adaptation	Regional/local authorities, NGOs, research institutions	€8.05 billion
Just Transition Fund	Support green transition in carbon-intensive regions	Ecosystem restoration and NBS	Regions, workers, businesses	€19.32 billion
InvestEU	Stimulate sustainable investment	Funding landscape for ecosystem restoration	Public/private entities, NGOs	€372 billion (mobilised)

In addition to these EU-level instruments, many countries operate national environmental funds and climate adaptation programmes that can finance NBS.

In parallel, the European funding landscape is currently undergoing significant changes, which are expected to affect the availability and structure of public funding for NBS and ecosystem restoration in the coming years. The current Multiannual Financial Framework (MFF) 2021–2027 is approaching its final phase, and major research and innovation programmes such as Horizon Europe will gradually come to an end, with future EU funding frameworks expected to place stronger emphasis on strategic autonomy, competitiveness, security, and defence,

[8] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.-I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Diversifying Funding for Freshwater Restoration using Nature-Based Solutions: Lessons from the MERLIN project. MERLIN Deliverable 3.5. EU H2020 research and innovation project MERLIN deliverable 3.5. 55 pp. https://project-merlin.eu/outcomes/deliverables.html

alongside climate and biodiversity objectives[9][10]. Recent policy discussions at EU level also point to increasing budgetary constraints and a stronger focus on leveraging private investment and results-based financing, rather than relying solely on grant-based public support.

In this evolving context, continued reliance on public grants alone may limit the long-term sustainability and scalability of NBS. This reinforces the need to diversify revenue streams and financing models, combining public funding with private investment, innovative financial instruments, and market-based mechanisms. Developing robust business models and blended finance approaches is therefore increasingly critical to ensure the long-term viability and survival of ecosystem restoration initiatives beyond individual funding cycles[11][12].

Private funding remains limited, but it is increasingly recognised as essential for scaling up innovation in ecosystem restoration

Private funding includes the following sources:

- **Corporate investment**, where companies integrate NBS into their sustainability and Environmental, Social, and Governance (ESG) strategies to reduce operational risks, secure supply chains, and meet climate commitments.
- **Impact investors and green funds** seek projects that deliver both financial returns and measurable environmental and social benefits, but they require robust monitoring frameworks and clear governance structures.
- **The insurance sector** is also emerging as a key player, supporting NBS that reduce climate-related risks such as flooding or erosion, sometimes through co-financing or premium reductions.
- **Innovative financial instruments** such as green bonds, sustainability-linked loans, and carbon or biodiversity credits are gaining traction, although they demand strong verification systems and long-term performance guarantees.

Main barriers to the diversification of investment, and to accessing private finance

- Demonstrating predictable revenue streams, risk-sharing mechanisms, and clear exit strategies—conditions that many NBS projects struggle to meet due to their public-good nature and long payback periods.
- Language and knowledge gaps when engaging with financial actors.
- Limited awareness of existing funding and investment opportunities.
- Challenges in defining viable business models that can attract private capital.

9 https://commission.europa.eu/strategy-and-policy/eu-budget/long-term-eu-budget/eu-budget-2028-2034_en#protecting-europe

10 https://commission.europa.eu/strategy-and-policy/strategic-foresight/2025-strategic-foresight-report_en#areas-for-action

11 Breil, M., Castellani, C. Keestra S., Zimmer, D., Nieminen, H., Trozzo, C. & Galluccio, G. Economic enabling conditions for scaling of Nature Based Solutions. ETC CA Technical Paper published 2023 via European Topic Centre on Climate change adaptation and LULUCF, (ETC CA)

12 https://www.eib.org/en/press/all/2023-217-nature-based-solutions-eib-report-finds-scope-for-regulatory-and-subsidy-reforms-as-well-as-a-more-flexible-spectrum-of-financial-instruments

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Overcoming the barriers to diversifying investments: blended finance models

Blended finance models were identified as **one of the most efficient approaches to fund NBS**[13].

Private actors often perceive NBS as high-risk with uncertain or long-term returns, which discourages direct investment. Public authorities can play a critical role in de-risking these projects by providing grants, guarantees, or concessional loans, and by leveraging public budgets to attract private capital.

By combining public grants with private capital, these models can effectively:

- Reduce risk;
- Improve bankability of projects; and
- Create incentives for private sector participation.

In practice, blended finance can take the form of **layered capital structures, public-private partnerships, or co-investment schemes**, ensuring that public funds catalyse larger volumes of private investment while maintaining the environmental and social integrity of NBS projects. This approach not only mobilise additional resources but also fosters long-term sustainability by aligning public policy objectives with private sector innovation and efficiency[14].

Zoom on the Danube Region: existing funding mechanisms

A recent EcoDaLLi deliverable (D5.1) investigated funding opportunities for the Danube Region and found that access to finance is a vital factor for the **productivity and sustainability of the innovation ecosystem**. A resilient ecosystem depends on a diverse range of financial institutions that can provide resources across different stages of growth — from idea development to scale-up. These include **accelerators and incubators, angel investors, private foundations, impact investors, venture capital firms, crowdfunding platforms, public and semi-public funders, and banks**.

Several initiatives and proposals illustrate the breadth of mechanisms available in the region. These include:

- A cross-border **private equity fund** to address growth capital gaps;
- A proposed **hub** for mapping, comparing and pooling national recovery and restoration plans (as Member States prepare National Nature Restoration Plans and reflect restoration priorities in existing Recovery and Resilience Plans);
- A **fintech sandbox** to test regulatory compliance, digital platforms offering alternative funding channels; and

[13] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.-I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Diversifying Funding for Freshwater Restoration using Nature-Based Solutions: Lessons from the MERLIN project. MERLIN Deliverable 3.5. EU H2020 research and innovation project MERLIN deliverable 3.5. 55 pp. https://project-merlin.eu/outcomes/deliverables.html

[14] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.-I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Diversifying Funding for Freshwater Restoration using Nature-Based Solutions: Lessons from the MERLIN project. MERLIN Deliverable 3.5. EU H2020 research and innovation project MERLIN deliverable 3.5. 55 pp. https://project-merlin.eu/outcomes/deliverables.html

- **Structures** to promote green and ESG-linked bonds, improve transparency in capital markets, and strengthen financial literacy.

When it comes to ecosystem restoration innovation, however, the resources available are more restricted. Stakeholder consultations confirmed that **funding is primarily linked to governmental grants and public EU programmes** such as Horizon Europe, Interreg and LIFE.

In contrast, **private sector contributions remain very limited**, playing only a minor complementary role compared to public sources. This limited engagement is also linked to regulatory uncertainty, notably related to the ongoing development of National Nature Restoration Plans, and evolving EU sustainability and disclosure frameworks, which can reduce clarity for private investors. Overall, while the Danube Region has a broad mix of mechanisms to foster innovation in general, ecosystem restoration continues to rely heavily on public and EU funding.

3.1.2. Finding the right funding sources for innovation in ecosystem restoration: a four-step approach

When innovators need to find the right sources of funding to implement and upscale their innovative ecosystem restoration projects, we recommend following the four-step approach outlined below, which is based on the work carried out in the MERLIN project[15] and the Nature4Cities initiative[16].

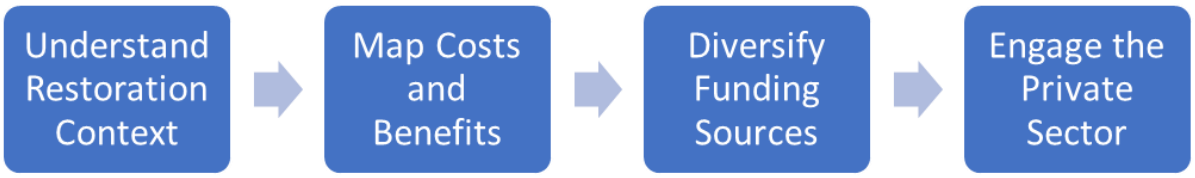

Figure 4 The four-step approach to find the right sources of funding for innovative ecosystem restoration projects.

The following sections provide practical elements on how to apply this four-step approach.

[15] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.-I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Diversifying Funding for Freshwater Restoration using Nature-Based Solutions: Lessons from the MERLIN project. MERLIN Deliverable 3.5. EU H2020 research and innovation project MERLIN deliverable 3.5. 55 pp. https://project-merlin.eu/outcomes/deliverables.html

[16] Egusquiza, A.; Arana-Bollar, M.; Sopelana, A.; Babí Almenar, J. Conceptual and Operational Integration of Governance, Financing, and Business Models for Urban Nature-Based Solutions. Sustainability **2021**, 13, 11931. https://doi.org/10.3390/su132111931

1 Understand the restoration context

In the early phases of an innovation project, it is essential for organisations and innovators to gain clear visibility on the activities they are undertaking. This clarity helps to refine their vision, set strategic priorities, and develop actionable plans that support growth and upscaling potential. This initial step lays the foundation for all subsequent decisions related to governance, financing, and implementation.

To support this process, the Nature4Cities initiative proposes a practical framework known as **WHAT–WHO–HOW**, which has been used to analyse governance strategies in sustainable innovation[17].

Figure 5 Understanding Restoration Context Framework.

More in detail:

- **WHAT** refers to the specific NBS project. It includes the type of solution being implemented—such as wetland restoration, floodplain reconnection, or riverbank reforestation—and the structural factors that define it, such as land ownership and spatial scale. These elements determine the ecological and social scope of the intervention.
- **WHO** identifies the initiating actors. These can be public authorities, private companies, community organisations, or hybrid partnerships. Understanding who is driving the project is crucial, as it influences the governance structure and the potential sources of funding.
- **HOW** describes the implementation model. It is shaped by contextual factors and user requirements, including regulatory frameworks, stakeholder engagement, and available resources. This dimension determines how the project will be executed, financed, and sustained over time.

By applying this framework, **innovators can systematically assess the feasibility and strategic alignment of their restoration initiative**. It also helps in identifying potential barriers and opportunities for scaling up, especially in complex regions like the Danube Basin where ecological, administrative, and socio-economic conditions vary widely.

[17] Egusquiza, A.; Arana-Bollar, M.; Sopelana, A.; Babí Almenar, J. Conceptual and Operational Integration of Governance, Financing, and Business Models for Urban Nature-Based Solutions. Sustainability **2021**, 13, 11931. https://doi.org/10.3390/su132111931

2 Map costs and benefits

Once the restoration context is clear, the next step is to ask **whether the proposed NBS truly creates value for society**. This means weighing its costs against the benefits it can deliver, not just to the environment but also to people and communities. Doing so helps justify the intervention, shape its design, and build a sound funding strategy. As highlighted in the MERLIN Financing Workflow[18], this step is a **cornerstone for strong financial planning** and effective stakeholder engagement, as it brings together several interconnected assessments that reveal the broader value of a project.

Four steps are recommended:

1. **Look at how restoration measures are likely to affect natural capital and the ecosystem services it provides**. Natural Capital Accounting offers a structured way to measure these changes, both in biophysical terms and in monetary value. It helps translate impacts on assets like soil, water, and biodiversity into tangible benefits such as flood protection, carbon storage, or recreation opportunities. This also makes it easier to identify who stands to benefit—or who may be affected—ensuring the project is designed in an inclusive and fair way[19].

2. **Conduct a social Cost-Benefit Analysis (CBA)**, which compares the project's costs with its impacts on human well-being. This analysis looks across scales and social groups, contrasting the outcomes of restoration with a baseline "do nothing" scenario. The CBA highlights trade-offs and synergies, helps fine-tune the restoration measures, and provides an initial estimate of budgetary needs. It also points to stakeholders who may be willing to contribute, financially or otherwise, based on the benefits they gain[20].

3. **Identify potential business opportunities**. While the main focus is on societal value, mapping private benefits—such as carbon credits, eco-tourism, or sustainable agriculture—can help flag services that might be monetised and attract private partners or investors. These opportunities will be explored more deeply in the next stage, when building the business case.

4. **A realistic estimate of both capital and operational costs is** crucial. This includes upfront expenses, like infrastructure and permits, as well as long-term commitments,

[18] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Deliverable D3.5 Diversifying Funding Freshwater Restoration using Nature-Based Solutions: Lessons Learned from the MERLIN project - ANNEXES. EU H2020 research and innovation project MERLIN deliverable 3.5. 81 pp. https://projectmerlin.eu/outcomes/deliverables.html

[19] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Deliverable D3.5 Diversifying Funding Freshwater Restoration using Nature-Based Solutions: Lessons Learned from the MERLIN project - ANNEXES. EU H2020 research and innovation project MERLIN deliverable 3.5. 81 pp. https://projectmerlin.eu/outcomes/deliverables.html

[20] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Deliverable D3.5 Diversifying Funding Freshwater Restoration using Nature-Based Solutions: Lessons Learned from the MERLIN project - ANNEXES. EU H2020 research and innovation project MERLIN deliverable 3.5. 81 pp. https://projectmerlin.eu/outcomes/deliverables.html

such as maintenance and monitoring. Clear and accurate budgeting ensures that the project can align its financial needs with the right funding sources.

Together, **these assessments paint a full picture of the project's societal value and financial requirements**. They also create the conditions for meaningful stakeholder engagement and diversified funding, while providing a baseline against which project performance can be monitored and assumptions revisited over time, acknowledging the adaptive and context specific nature of NBS.

By integrating Natural Capital Accounting and CBA into the planning process, innovators can more effectively communicate the public value of their projects, reduce perceived risks, and secure broader support. In turn, this strengthens decision-making and increases the chances that restoration efforts will succeed and remain sustainable over the long term.

3 Diversify funding sources

Once the societal benefits and financial needs of a restoration project are clear, the next step is to **identify and diversify funding sources that can support both its implementation and long-term sustainability**.

In the Danube Basin and across Europe, many innovators struggle to secure stable financing, especially when relying only on public grants or subsidies. To address this, the MERLIN project promotes a **comprehensive approach to funding diversification**, encouraging innovators to combine different financial instruments and partnerships[21].

Section 3.1.1 showed that **public funding remains a central pillar**, with instruments such as EU grants (e.g. LIFE[22], Horizon Europe), national subsidies, and local government support (see above section). These are typically non-repayable and can cover a large share of costs. However, they often come with **strict eligibility rules, demanding reporting requirements, and limited renewal prospects**.

Private funding is playing a growing role in scaling up restoration. Several options are available, and in particular:

- This can take the form of **donations** from philanthropic foundations, corporate social responsibility (CSR) programmes, or crowdfunding campaigns. These sources tend to be more flexible and can align closely with branding or reputational goals.

- Beyond donations, **projects can be designed to generate their own revenue streams**. Payments for ecosystem services (PES) are one option—for example, water utilities paying upstream landowners for natural water purification, or municipalities funding wetland restoration to reduce flood risks. Environmental markets also provide

[21] Rouillard, J., Anzaldua, G., Meier, J., Scholl, L, Carmen, E., Waylen, K., Kok, S., Malveira Cavalcanti, V., Grondard, N., Lenz, M.I., Demus, Y., Andrez, P., Saviak, V., Birk, S., 2025. Deliverable D3.5 Diversifying Funding Freshwater Restoration using Nature-Based Solutions: Lessons Learned from the MERLIN project - ANNEXES. EU H2020 research and innovation project MERLIN deliverable 3.5. 81 pp. https://projectmerlin.eu/outcomes/deliverables.html

[22] To be noted that this grant requires a high contribution rate from beneficiaries, which might limit its use.

opportunities: projects that sequester carbon or restore habitats can generate tradable credits through carbon or biodiversity markets, creating ongoing income streams.

- **Some restoration projects can also support commercial activities**, such as ecotourism, sustainable farming, or the sale of natural materials like gravel from restored floodplains. These activities can generate direct revenues or attract private investors, particularly when embedded in larger value chains.

To make the most of these opportunities, innovators should **craft a funding strategy that matches the project's timeline, risk profile, and stakeholders**. This means identifying which sources are best suited for upfront capital needs (e.g. grants, loans), which can sustain ongoing operations (e.g. PES, service revenues), and which can be mobilised through partnerships or co-governance arrangements.

By diversifying funding sources, restoration projects become more resilient, less dependent on any single stream, and better positioned to innovate and collaborate. It also sets the stage for deeper engagement with private sector partners and for building a strong business case—covered in the next step.

4 Engage the private sector

NBS offer an effective way to tackle environmental, social, and economic challenges, yet their uptake is often limited by concerns around financial viability and the lack of scalable investment models. To move beyond these barriers, **innovators and project developers need to build strong business cases that clearly show how NBS can create both ecological and financial value**. Practical guidance is available in the section on business model training, which introduces tools such as the Business Model Canvas (BMC) to help structure and communicate a project's value proposition, customer segments, cost structure, and revenue streams.

The European Investment Bank (EIB)[23] has identified several **approaches to unlock private sector investment in NBS and help projects move toward financial independence**. These approaches focus on mobilising diverse sources of revenue and embedding them into viable business models. A key precondition for accessing these mechanisms is the ability to clearly identify and, where possible, quantify the multiple co-benefits delivered by NBS – such as avoided costs, risk reduction, and environmental and social gains – which strengthens the overall value proposition for private investors. Some of the most promising mechanisms include:

- **Credits**: Generating income through the sale of carbon, biodiversity, or wetland mitigation credits, as well as emerging instruments like blue credits—especially relevant for forestry, agriculture, and coastal restoration.
- **Insurance-linked models**: Using NBS to reduce risks such as flooding or drought, which can lower insurance premiums. Parametric and community insurance schemes are already being piloted to monetise these benefits.

[23] European Investment Bank, 2023. Investing in nature-based solutions. State-of-play and way forward for public and private financial measures in Europe. 10.2867/031133

- **Cost reduction**: Cutting operational and maintenance costs for utilities and companies—for instance, through natural water filtration that reduces reliance on expensive treatment infrastructure.
- **Product and commodity sales**: Creating revenues from sustainable forestry, regenerative agriculture, ecotourism, or other markets that combine ecological integrity with economic opportunity.
- **Ecosystem service taxes**: Leveraging tax incentives, direct payments, or cap-and-trade systems that reward ecosystem stewardship.
- **Innovative financial instruments**: Applying tools such as concessional loans, guarantees, sustainability-linked bonds, or blended finance, particularly useful in the early phases when projects often struggle to access traditional financing.

Table 2 Examples of revenue mechanisms for NBS.

Revenue mechanism	Illustrative example
Credits	Carbon credits generated through afforestation, reforestation, and sustainable forest management; biodiversity and wetland mitigation credits linked to development compensation schemes; emerging blue credits associated with coastal and marine ecosystem restoration.
Insurance-linked models	Parametric insurance schemes supporting coral reef protection (e.g. insurer payouts triggered by extreme events); community insurance models where restored floodplains or green infrastructure reduce flood risk and insurance premiums (e.g. river flood barriers, green roofs).
Cost reduction	Floodplain restoration and natural water retention measures reducing flood damage and recovery costs; nature-based risk reduction lowering operational and maintenance costs for utilities and insurers.
Product and commodity sales	Revenue from sustainable forestry (timber production); regenerative agriculture producing food and fibre; nature-based tourism linked to restored landscapes.
Ecosystem service taxes	Municipal water and pollution levies financing ecosystem restoration measures, such as embankments and ponds, with revenues reinvested in water management and flood protection.
Innovative financial instruments	Blended finance under the Natural Capital Financing Facility (NCFF); sustainability-linked bonds financing restoration and forestry projects; portfolio aggregation funds pooling small-scale NBS projects; loans collateralised by future carbon credit revenues.

Beyond the financial mechanisms themselves, the way projects are framed and communicated plays a critical role in attracting private sector engagement. Tailoring project narratives to different stakeholders – such as investors, insurers, public authorities, or corporate partners – helps clarify how each actor benefits from the project. This includes highlighting indirect revenue streams, avoided costs, and risk reduction and supporting proposals with clear data, indicators and visualisations that strengthen credibility and reduce perceived investment risk.

By embedding these revenue streams into their business models, innovators can demonstrate that NBS are not only environmentally effective but also financially viable. This strengthens

their ability to attract funding from both public and private sources. The EIB's approach emphasises the need to tailor financial structures to each project's context, ensuring that ecological impact goes hand in hand with long-term economic sustainability.

3.2. Market intelligence: performing research to gain insights for strategic decision making

Market intelligence (MI) is commonly described as the gathering, analysing, and disseminating of information regarding a company's external environment for the purposes of supporting strategic decision-making, and in particular on the following components:

- Customers;
- Competitors;
- Supply sources; and
- General trends in the market.

MI involves a looking-forward practice by which organisations gain further insight into their environment by gathering internal and external information for the purposes of solving strategic problem[24]. MI also strongly corresponds with market research but with a special emphasis on actionable intelligence supporting market entry, development, and competitive advantage[25].

For ecosystem restoration and NBS, market intelligence is important for innovators to understand the requirements of stakeholders, investment opportunities, trends for the regulatory environment, and competing initiatives. Market intelligence makes it possible for project developers to identify opportunities for investment, predict risk, and match their business models with evolving market dynamics.

Application of market intelligence for NBS innovators involves more than technology viability and environmental impact. This involves the understanding of the beneficiary, value enjoyed, position of competitors for other such solutions, and trends shaping the green investment destiny. This also supports the development of tailored business models and financial plans required for scaling impact as well as private sector engagement.

What you will find in this section:

Market intelligence information can be gathered by an extensive array of means each used as a reference against many goals, resources, and project development phases. The practice and the literature characterise five broad classes for performing market intelligence, which are described in this section:

- Primary research;
- Secondary research;
- Competitor intelligence;

[24] Inha, E., & Bohlin, S. (2016). *Market Intelligence: A Literature Review*. Halmstad University. https://www.diva-portal.org/smash/get/diva2:1079212/FULLTEXT01.pdf

[25] Harrison, M., & Cupman, J. (2013). *Using Market Intelligence & Competitive Intelligence to Add Value to Your Business*. B2B International. https://www.b2binternational.com/wp-content/uploads/2013/06/market_intelligence.pdf

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- Customer-focused studies; and
- Knowledge management systems.

To be noted that the classes often supplement one another and ideally must be combined for a rounded view .

Insights gathered through MI research can then feed into the strategic analysis conducted by using business models, such as for example the Business Model Canvas (BMC). These tools help structure the notes from market intelligence into actionable strategies, which enable the innovators to define their value proposition, identify revenue streams, and develop investor-ready pitches: these will be described in section 3.3 of this guidebook.

3.2.1. Primary research (direct data collection)

Primary research compiles first-hand data directly from stakeholders through interviews, surveys, workshops, or focus groups[26]. This serves for collecting specific requirements, experiences and opinions.

The approaches for primary research include:

- **Buyer and customer interviews** – to understand demand for new products or services.
- **Supplier and competitor interviews** – to capture insights into production models, pricing, and strategies.
- **Expert interviews** – journalists, consultants, or NGOs provide a broader interpretation of market dynamics.
- **Participatory workshops** – bring diverse stakeholders together to identify opportunities and challenges.

3.2.2. Secondary research and environmental scanning

Desk research, or the secondary research, relies on the review of **existing data and information sources**. They include statistical databases, the reports from the industries, research publications, patents, policy and reports of legislations, company reports, and trade media.

Environmental scanning takes this further by monitoring external factors such as the emergence of regulations, technological innovations, the potential for funds, and societal trends. Analytical tools such as PESTEL analysis (Political, Economic, Social, Technological,

[26] Harrison, M., & Cupman, J. (2013). *Using Market Intelligence & Competitive Intelligence to Add Value to Your Business*. B2B International. https://www.b2binternational.com/wp-content/uploads/2013/06/market_intelligence.pdf

Environmental, Legal – see section 3.3) [27] or Porter's Five Forces tend to structure the outcomes[28].

3.2.3. Competitor intelligence

Competitor intelligence focuses on **understanding how other actors in the ecosystem – companies, NGOs, or institutions – operate, compete, and innovate**. This does not only mean analysing direct competitors, but also substitute solutions and alternative approaches.

Methods include[29]:

- **Press and media analysis** to track partnerships, financial performance, and sustainability commitments.
- **Pricing research** (benchmarking product and service costs or using advanced methods such as conjoint analysis to understand willingness to pay).
- **Customer feedback** on competitors to evaluate performance, trust, and reputation.
- **Company websites and online content** as a source of data on innovation pipelines, sustainability reporting, and technical specifications.

3.2.4. Customer-focused studies

Customer-focused studies **help organisations align with the needs and values of the market**[30]. They include:

- **Needs assessment studies** to identify unmet or emerging demands.
- **Segmentation studies** to divide actors into groups based on shared characteristics (e.g., attitudes, willingness to pay, innovation readiness).
- **Corporate positioning and branding studies** to analyse how organisations or initiatives are perceived relative to competitors.

[27] Inha, E., & Bohlin, S. (2016). *Market Intelligence: A Literature Review*. Halmstad University. https://www.diva-portal.org/smash/get/diva2:1079212/FULLTEXT01.pdf
[28] Harrison, M., & Cupman, J. (2013). *Using Market Intelligence & Competitive Intelligence to Add Value to Your Business*. B2B International. https://www.b2binternational.com/wp-content/uploads/2013/06/market_intelligence.pdf
[29] Harrison, M., & Cupman, J. (2013). *Using Market Intelligence & Competitive Intelligence to Add Value to Your Business*. B2B International. https://www.b2binternational.com/wp-content/uploads/2013/06/market_intelligence.pdf
[30] Harrison, M., & Cupman, J. (2013). *Using Market Intelligence & Competitive Intelligence to Add Value to Your Business*. B2B International. https://www.b2binternational.com/wp-content/uploads/2013/06/market_intelligence.pdf

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3.2.5. Knowledge management and IT systems

Once information is collected, effective systems are needed to **store, analyse, and share intelligence**. Knowledge management tools include databases, dashboards, data-mining tools, and collaborative platforms. These enable continuous monitoring and institutional learning.

3.2.6. Putting market intelligence into practice

For innovation practitioners who work in the ecosystem restoration and NBS area, market intelligence is not just about information collection—it involves **taking action based on insights that were gathered through research**. The real value lies in the use of intelligence for the formulation of superior business models, communication with stakeholders, and the anticipation of risk and opportunities in a changing market.

The following points give ideas for **the application of MI**:

- **Translate insights into strategy**: once the information is gathered, the innovators must systematically relate the information to their business model, which can be developed through the Business Model Canvas (section 3.3).

- **Use intelligence to build investor-ready cases**: MI is also a useful tool for commanding attention from funders and partners. Offering evidence of demand (through surveys, or interview), benchmarking against competitors' costs, and demonstrating evidence of policy trends awareness, makes the innovator well-prepared and believable. This reduces the risk of investment and increases the likelihood of obtaining finance.

- **Engage and comprehend stakeholders**: The customer studies and primary research help the innovator identify whom the restorers benefit and what value they attach. This helps communication strategies for involving stakeholders—municipalities, water utilities, companies, or communities. Needs and expectations mapping also helps frame restoration as a value-based solution with economic and social payback, not merely as an environmental intervention.

- **Anticipate risks and adapt**: MI anticipates, it lets the innovator see the early signals for change. As a case in point, monitoring increasing policies for biodiversity credits or new players into the voluntary carbon market gives the innovator a chance to change positioning before these trends alter the playing field. Innovators combine competitor intelligence with environmental scanning and build scenario-based strategies with the flexibility to remain agile.

- **Build up networks and share knowledge**: MI functions best as a component of a network of exchange. Innovators are encouraged to access industry associations, EU funding platforms, and local stakeholder groups so as to gain and share intelligence. Knowledge management systems could help projects prevent duplication, identify synergies, and generate mutual understanding of the market for ecosystem services.

3.3. Developing a solid business model to support and promote innovation in ecosystem restoration

Developing a solid business model is critical for innovators in ecosystem services. Evidence from the EcoDaLLi survey shows that 64% of respondents identified **training on business models and commercialisation as a priority need**.

Without clear strategies to capture value, secure revenue, and ensure long-term viability, many innovations risk remaining pilot projects rather than being scaled or mainstreamed. A structured business model also helps businesses in building credibility with funders, policymakers, and partners.

What you will find in this section:

This section is aimed to provide practical techniques for innovators to help them define and refine their business models. Four complementary tools are presented:

1. Business Model Canvas (BMC), adapted to NBS.
2. PESTEL analysis.
3. SWOT analysis.

These techniques provide innovators with a structured pathway to design, test, and adapt their commercialisation strategies.

3.3.1. Business model canvas (BMC)

The business model canvas adapted to NBS projects: an overview

The Business Model Canvas (BMC) is a widely used framework for describing how an initiative creates, delivers, and captures value[31]. In the context of innovation for ecosystem restoration, the traditional BMC has been adapted to form the **NBS-BMC** developed under the Connecting Nature project[32]. This adaptation increases its relevance by **integrating environmental, social, and economic value, as well as governance and cost reduction considerations specific to NBS** (see Figure 6).

The NBS-BMC provides a shared language for innovators, public authorities, businesses, and communities to articulate how their solution works and how it can scale. It enables structured discussion, supports co-creation among stakeholders, and improves the strategic understanding of an innovations' long-term sustainability.

[31] Zaiter Y, Lago M, Maund J, van Duinen R, Chouchane H, van den Burg SWK and Araujo A (2025) Investigating levies and barriers for the development of offshore multi-use platforms in European regional seas. *Front. Ocean Sustain.* 3:1542309. doi: 10.3389/focsu.2025.1542309

[32] McQuaid, S. (2019). *Nature-Based Solutions Business Model Canvas Guidebook*. Trinity College Dublin & Horizon Nua. Connecting Nature, Horizon 2020 Programme, Grant Agreement No. 730222. https://connectingnature.eu/sites/default/files/downloads/NBC-BMC-Booklet-Final-%28for-circulation%29.pdf

The NBS-BMC retains **nine building blocks**—Key Activities, Key Resources, Value Proposition, Key Partners, Key Beneficiaries, Governance, Cost Structure, Cost Reduction, and Capturing Value—removing the traditional 'Revenue Streams' block and instead adopting a broader focus on the different ways value can be generated and captured.

The model is illustrated in the following page.

Business Model Canvas

Key Activities	Value Propositions	Key Partners	Key Beneficiaries
• Which essential activities must be undertaken (e.g. restoration work, monitoring, stakeholder engagement, capacity-building, governance tasks)? *Output: list of activities linked to value propositions.*	• What environmental, social, economic, or direct user benefits does the innovation provide (e.g. improved biodiversity, reduced pollution, climate resilience, cost savings)? • Why would beneficiaries value this solution? *Output: list of value propositions linked to beneficiaries*	• Which actors are essential for delivering or supporting the innovation (public authorities, research institutions, NGOs, communities, private partners)? *Output: defined list of strategic partners and roles.*	• Who benefits from the innovation (e.g. municipalities, NGOs, SMEs, citizens, communities)? • What needs, challenges, or societal issues does the innovation address? *Output: list of key beneficiaries and their needs.*

Key Resources	Capturing Value	Governance
• What critical resources are required to deliver the value (e.g. data, equipment, natural assets, expertise, partnerships, monitoring systems)? *Output: list of resources linked to key activities.*	• How is value captured to support the innovation over time? This includes financial (e.g. grants, contracts, partnerships) and non-financial value (e.g. environmental indicators, social benefits, health improvements, avoided costs). *Output: description of how value is measured and leveraged.*	• How will the innovation be managed and operated over time (e.g. municipal management, co-governance with communities, public–private collaboration)? • What governance arrangements enable effective implementation and long-term sustainability? *Output: description of governance model.*

Cost Structure	Cost Reduction
• What are the main categories of ongoing and operational costs (e.g. staff, maintenance, monitoring, equipment)? • Which costs are fixed and which are variable? *Output: breakdown of cost categories.*	• What strategies can reduce operational or maintenance costs (e.g. volunteer engagement, community co-management, efficient planting or monitoring techniques)? *Output: list of cost-optimisation opportunities.*

Figure 6 Business model canvas matrix and building blocks.

The NBS-BMC provides significant added value: **it helps innovators understand the full logic of their solution, identify missing elements, and adapt to the diverse contexts and challenges they face**. The building blocks offer a clear and shared framework to summarise the essence of an innovation, highlight connections between its key components, and support the refinement of implementation and upscaling strategies. This insight allows them to develop tailored strategies based on their upscaling potential, such as market growth, market entry, or commercialisation approaches.

Completing the NBS-BMC helps in identifying gaps in the business plan of the innovation and bring additional clarity to the innovators on how to upscale the innovation. The type of information that needs to be collected in this exercise is mainly qualitative information on the different nine building blocks and should be resumed in the matrix of the BMC (see Figure 6).

The application of the NBS- BMC could be done following a three-step approach (see Figure 7):

- **Step 1: Preparation**: Collect relevant information on the innovation such as project documents, funding applications, or technical studies, and decide on the scope of the BMC to be developed.

- **Step 2**: **Application**: Fill in the nine building blocks of the canvas, using available information to describe customer segments, value propositions, resources, activities, partners, costs, and revenues in a clear and structured way. In this step, the innovator might need to brainstorm with external stakeholders (e.g. project team, municipalities, NGOs, funding organisations) to gather their views on the different nine building blocks and enrich the analysis in later steps.

- **Step 3: Analysis**: Review the completed canvas to identify gaps, inconsistencies, or opportunities, and summarise the results into a clean template that can guide further development and commercialisation.

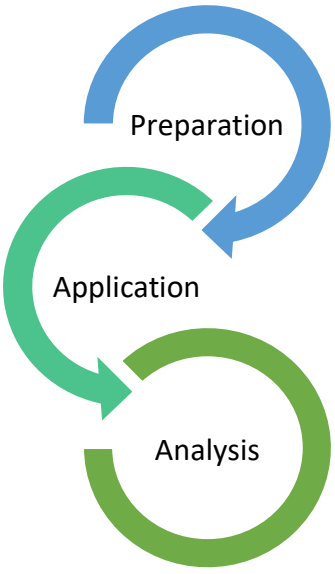

Figure 7 Steps to apply the BMC.

Additionally, **a deeper understanding of the innovation's scaling potential enhances the innovator's ability to negotiate with funding organisations**. In this way, the BMC not only clarifies the business model but also strengthens credibility, increasing the likelihood that funders and investors will support the innovation.

Applying the NBS-BMC is most effective when carried **out as a collaborative exercise rather than an individual task**. Innovators are encouraged to work with a diverse group of stakeholders who hold complementary knowledge about the innovation and its context. This typically includes the core project team, local or regional authorities, technical experts, NGOs, community representatives, and potential beneficiaries. Engaging these actors helps ensure that all dimensions of the canvas—particularly governance, cost structure, cost reduction, and value capture—are accurately understood and realistically described. Workshops, co-creation sessions, and facilitated discussions can be used to jointly populate the canvas, validate assumptions, and identify blind spots. This collaborative approach also strengthens stakeholder ownership, supports alignment across institutions, and increases the credibility of the resulting business model when presented to funders, policymakers, or potential partners.

Some additional practical applications of the BMC-NBS are the followings:

- **Workshop tool:** The NBS-BMC is often used in multi-stakeholder workshops (city planners, NGOs, funders, community reps) to co-create and visualise who benefits, what value is delivered (ecosystem services), who pays, and implementation roles — helping convert pilots into replicable models[33].
- **Linking to finance:** BMC outputs are used to identify feasible revenue streams for NBS (service contracts, PES, carbon credits, blended finance, public procurement) and to align cost structure with funding windows (EU funds, municipalities, private investors)[34].
- **Research & classification:** Academic studies have applied BMC-style templates to classify and cluster NBS business models across cases, showing repeatable archetypes and constraints (governance, scale, revenue)[35]. MDPI+1

[33] https://connectingnature.eu/sites/default/files/downloads/NBC-BMC-Booklet-Final-%28for-circulation%29.pdf and https://progireg.eu/resources/nbs-business-models/

[34] https://gogreenroutes.eu/fileadmin/user_upload/Del_4.3_Concept_to_Innovation_Guidebook_Final.pdf and https://unepccc.org/wp-content/uploads/2025/02/24442-unepccc-business-models-v09-au-pages-hq.pdf

[35] Stork, S., Polling, B., Lorleberg, W., Morgenstern, R., 2023. Clustering Business Models of Heterogeneous Nature-Based Solutions Implementing Innovative Governance and Financing Concepts. Land 2023, 12(12). https://www.mdpi.com/2073-445X/12/12/2116 - and
Stork, S., Morgenstern, R., Polling, B., Feil, J., 2023. Holistic Business Model Conceptualisation—Capturing Sustainability Contributions Illustrated by Nature-Based Solutions. Sustainability 2023, 15(19). https://www.mdpi.com/2071-1050/15/19/14091

Applying the BMC to NBS: some practical examples

1	Connecting Nature: Genk, Glasgow, Poznań and others[36]

What happened: Connecting Nature (Horizon 2020) developed an *NBS Business Model Canvas* and a guidebook, piloted the canvas with front-runner cities (Genk, Glasgow, Poznań) and used it in facilitated workshops to co-design city NBS business models. The canvas was used to: (a) make the NBS "story" accessible to non-technical stakeholders, (b) map partners and governance, and (c) identify revenue/funding pathways and service beneficiaries.

How it helped: cities used the canvas to surface new partners (e.g., tourism, utilities), test possible revenue mixes (contracts + grants + pilot PES), and create communication materials for municipal decision-makers. The project published a downloadable BMC guidebook and templates that can be reused.

2	UNaLab – Front-runner city case studies: Genoa, Eindhoven, Tampere[37]

What happened: UNaLab documented business models for specific urban NBS (e.g., permeable pavements in Genoa; river restoration in Eindhoven; green roofs in Tampere). They explicitly mapped cost drivers, partners, and funding pathways using BMC-style templates to show how an NBS moves from demonstration to procurement or maintenance contracts.

How it helped: the canvas clarified who pays for installation vs. long-term maintenance, revealed where municipal procurement could absorb costs, and helped structure pilot data (performance evidence) required to secure recurring payments / service contracts.

3	Natural Assurance Schemes: Lower Danube (floodplain restoration)[38]

What happened: For large river basin NBS (Lower Danube floodplain restoration), researchers and projects have applied NAS/NBS canvases (Natural Assurance Schemes / NAS Canvas) to map who captures value from restored floodplains, which actors should fund (public agencies, insurers, landowners) and how mixed public–private funding can work across borders. The NAS canvas has been applied in demo cases including the Lower Danube to explore feasible business/assurance models for large-scale restoration. In this case, the proposed BMC includes 14 building blocks (as compared to the 9 building blocks proposed as part of this Guidebook): this is illustrated in the table below.

How it helped: the canvas made explicit the differing roles of national water agencies, local communities and EU programmes in implementing and financing river restoration — a crucial step for scaling cross-border interventions in the Danube basin.

[36] https://connectingnature.eu/sites/default/files/downloads/NBC-BMC-Booklet-Final-%28for-circulation%29.pdf

[37] https://unalab.eu/en/business-models-nbs

[38] Mayor, B., Lopez Gunn, E., Zorrilla-Miras, P., Dartée, K., Biffin, T., Pena, K., 2023. NAS Canvas: Identifying Business Models to Support Implementation of Natural Assurance Schemes. Part of the book series: Water Security in a New World (WSEC), https://link.springer.com/chapter/10.1007/978-3-031-25308-9_8 and https://connectingnature.eu/sites/default/files/downloads/NBC-BMC-Booklet-Final-%28for-circulation%29.pdf

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Table 3 NAS/BMC canvas developed for floodplain restoration in the Lower Danube. (Source: Mayor et al, 2023)

Section	Guiding Questions (Danube context)	Example Content for a Floodplain Restoration NbS
1. Problem / Need	What environmental or social problem are you solving? Who is affected by it?	Frequent flooding, biodiversity loss, degraded wetlands, reduced water retention, and loss of ecosystem services for downstream communities.
2. Ecosystem Services / Core Value	What ecosystem services or natural benefits does your NbS provide?	Flood mitigation, water purification, carbon sequestration, recreation, biodiversity enhancement.
3. Beneficiaries / Customer Segments	Who benefits directly or indirectly from your NbS?	Local residents, municipalities, farmers, insurers, water agencies, tourists, conservation NGOs.
4. Value Proposition (Impact Promise)	What value or impact do you deliver to these groups?	Reduced flood risk, new recreational areas, increased tourism, improved habitats, enhanced climate resilience.
5. Co-Benefits & Social Value	Beyond your main goal, what secondary social or cultural values emerge?	Education, community identity, eco-tourism jobs, improved well-being.
6. Key Activities	What must be done to create and sustain these values?	Wetland restoration, levee reconnection, vegetation planting, monitoring, stakeholder engagement, communication.
7. Key Resources	Which physical, human, financial, and knowledge assets are essential?	Land area, hydrological data, ecological expertise, restoration machinery, funding, partnerships.
8. Key Partners & Governance	Who are your implementation and governance partners? What's their role?	Ministries (environment, water), local governments, research institutes, NGOs (WWF, ICPDR), EU projects, communities.
9. Delivery Channels	How do you reach, engage, and communicate with beneficiaries and funders?	Project platforms, stakeholder workshops, EU reporting tools, local meetings, communication campaigns, eco-tourism info boards.
10. Cost Structure	What are your main cost categories? Which are one-off vs. ongoing?	Land acquisition, construction, monitoring, staff, communication, maintenance.
11. Revenue Streams / Funding Sources	How is your NbS financed or sustained over time?	EU LIFE/Interreg funding, municipal budgets, corporate social responsibility (CSR), payments for ecosystem services, carbon credits, tourism fees.
12. Enabling Conditions / Policies	What legal, regulatory, or policy conditions support or hinder you?	EU Water Framework Directive, Floods Directive, national restoration strategies,

Section	Guiding Questions (Danube context)	Example Content for a Floodplain Restoration NbS
		spatial planning laws, cross-border agreements.
13. Risk & Barriers	What are the key risks, and how can they be mitigated?	Policy changes, lack of long-term financing, stakeholder conflicts, maintenance gaps, climate uncertainty.
14. Monitoring & Value Evidence	How will you measure performance and communicate success?	Indicators: area restored (ha), flood reduction data, biodiversity indices, visitor numbers, community satisfaction surveys.

3.3.2. PESTEL Analysis

The PESTEL framework is a tool that **helps innovators understand the external environment in which their innovation will operate**. It structures the analysis into six dimensions, as also shown in the table below:

- **P**olitical factors (e.g. public policies, governance structures, political stability);
- **E**conomic factors (such as market trends, investment flows, and economic incentives);
- **S**ocial factors (including demographic trends, public awareness, and societal expectations);
- **T**echnological factors (like innovation dynamics, digital infrastructure, and R&D capacity);
- **E**nvironmental factors (such as climate policies, resource availability, and ecological constraints); and
- **L**egal factors (including regulatory standards, compliance requirements, and intellectual property frameworks).

By systematically reviewing these factors, **innovators can anticipate risks, identify opportunities, and adapt their strategies accordingly**.

Traditionally, PESTEL is widely used in strategic planning to map market and regulatory contexts. In the context of **ecosystem services innovations**, it is especially useful for highlighting policy drivers (e.g. the EU Biodiversity Strategy), funding opportunities, societal acceptance, and legal barriers such as permitting or liability. Studies on innovation in marine and freshwater systems (Zaiter et al., 2025)[39] have shown that external political and regulatory conditions are often decisive in determining whether an innovation can move from pilot to commercialisation.

[39] Zaiter Y, Lago M, Maund J, van Duinen R, Chouchane H, van den Burg SWK and Araujo A (2025) Investigating levies and barriers for the development of offshore multi-use platforms in European regional seas. *Front. Ocean Sustain.* 3:1542309. doi: 10.3389/focsu.2025.1542309

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The PESTEL analysis could be **implemented by following three different steps** (see Figure 8).

Figure 8 Steps to apply PESTEL analysis.

In particular:

1. **Mapping existing information to build a comprehensive understanding of the broader context** in which the innovation is being developed. This involves collecting and reviewing relevant policy documents, funding programmes, market studies, and regulatory frameworks at the local, national, and European levels. The objective is to identify the external factors that may influence the innovation, whether directly or indirectly. Useful sources include EU legislation and strategies (e.g., the EU Green Deal, Water Framework Directive), national policy documents, regional development plans, databases of funding programmes (e.g., LIFE, Interreg, Horizon Europe), market studies from research institutes, and regulatory guidance from competent authorities.

2. **Analysing and interpreting the collected data**. At this stage, innovators are encouraged to identify the key drivers and barriers under each of the six PESTEL categories. Each factor should be assessed in terms of its potential impact on the innovation's development and implementation, and whether it represents an opportunity or a risk. This step helps prioritise the most influential external elements and provides a structured view of the external environment. Data for this analysis can be gathered from statistical portals (Eurostat, national statistical offices), sector reports (OECD, EEA, ICPDR), scientific publications, stakeholder interviews, and consultation feedback, which provide detailed insights into economic trends, social perceptions, technological maturity, and environmental pressures.

3. **Drawing conclusions and integrating the insights into the innovation strategy**. This includes reviewing the completed PESTEL overview to identify the most critical external factors, understanding how they interact, and summarising the findings in a concise and actionable format. The information can be then organised into a PESTEL matrix (see Figure 10), which provides a clear visual representation of the opportunities and risks across the six dimensions. This matrix serves as a practical tool to support strategic decision-making, guide stakeholder engagement, and ensure alignment with broader policy and market dynamics.

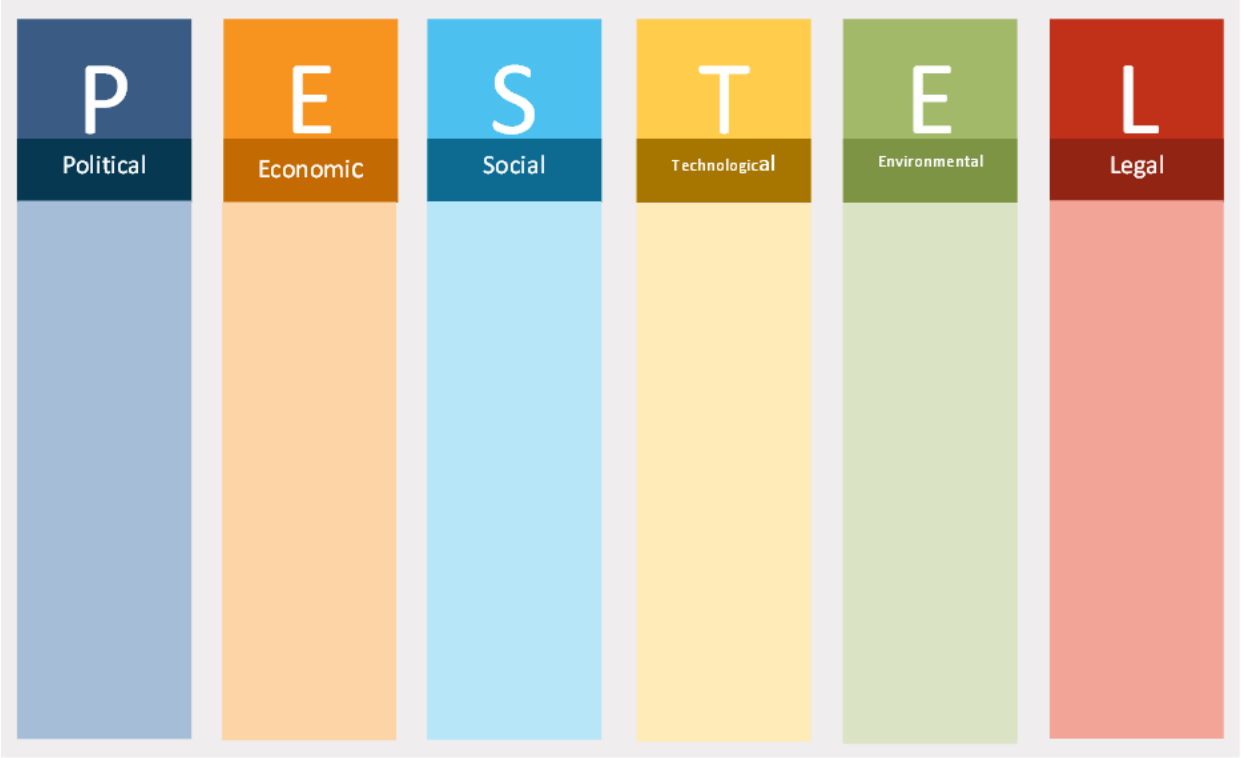

Figure 9 PESTEL matrix.

3.3.3. SWOT Analysis

In complement to the PESTEL analysis, a SWOT analysis offers a **strategic framework to assess internal and external factors that may influence the development and deployment of innovation for ecosystem restoration**. While PESTEL focuses on the external environment, SWOT helps innovators reflect on their own capacities and positioning within that environment.

The SWOT analysis is structured around four dimensions (see Figure 11):

- **Strengths**: internal assets, capabilities, or resources that give the innovation a competitive advantage. These may include technical expertise, stakeholder support, access to funding, or alignment with policy priorities.
- **Weaknesses**: internal limitations or gaps that may hinder progress, such as lack of visibility, limited scalability, or insufficient market knowledge.
- **Opportunities**: external conditions that could be leveraged to accelerate innovation, including emerging market needs, supportive regulations, or synergies with other initiatives.
- **Threats**: external risks or challenges that could negatively impact the innovation, such as regulatory uncertainty, competing solutions, or resistance from key actors.

By systematically identifying and evaluating these four dimensions, innovators can better understand their strategic position, anticipate challenges, and align their development efforts with both internal strengths and external opportunities. The SWOT analysis can also serve as a basis for refining business models, stakeholder engagement strategies, and investment planning.

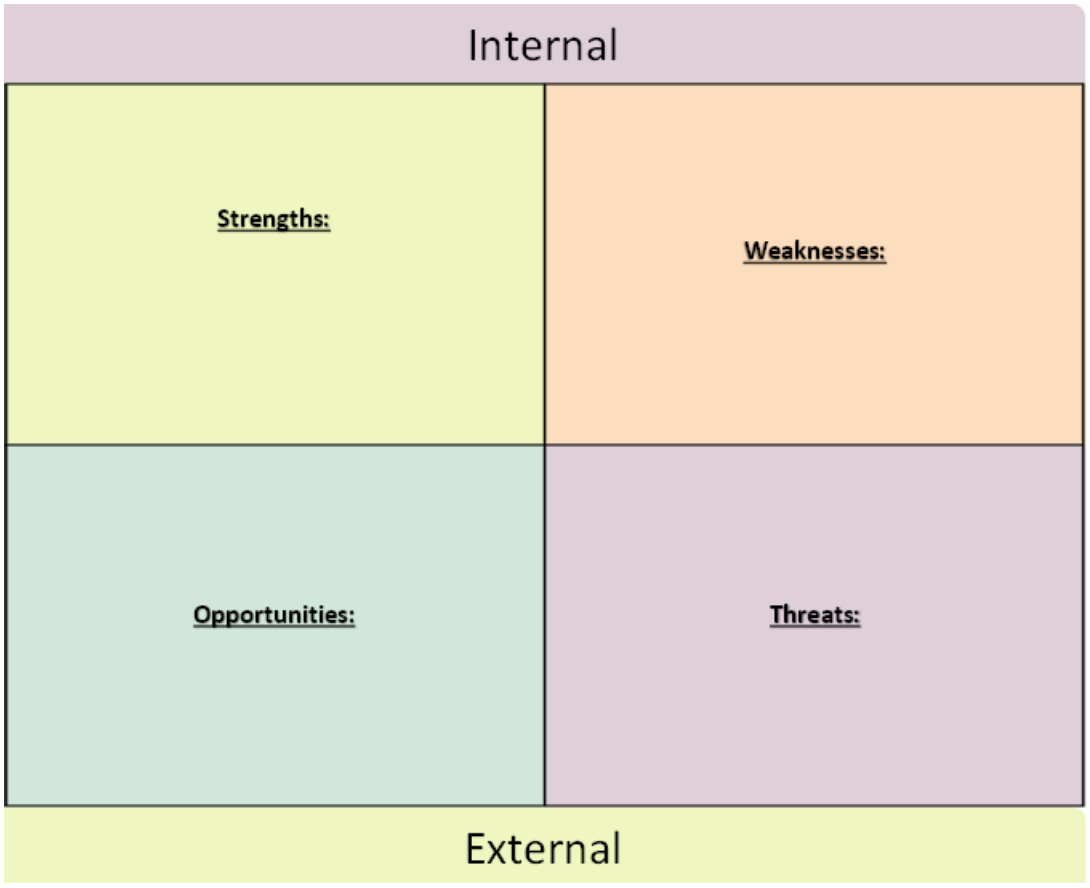

Figure 10 SWOT matrix.

As for the BMC, most of the information needed for the SWOT analysis – particularly regarding internal factors – cannot be found in the literature. Therefore, to carry out the analysis, the innovators should complete the information during internal meetings or workshops on the innovation activity. The same strategy as for BMC applies to the SWOT analysis.

The SWOT analysis can be applied through a structured three-phase approach that supports strategic reflection and planning, and namely:

1. **Preparation**: **gathering relevant information about the innovation and its context**. This includes reviewing project documentation, technical studies, stakeholder feedback, and market or policy insights. The goal is to build a solid foundation of knowledge that will inform the SWOT analysis. During this phase, innovators should also define the scope of the analysis—whether it focuses on the innovation as a whole, a specific component, or a particular stage of development. This ensures that the exercise remains targeted and relevant.

2. **Application**: **populating the SWOT matrix with insights across the four dimensions**: strengths, weaknesses, opportunities, and threats. Strengths and weaknesses refer to internal factors—such as technical expertise, partnerships, funding, or operational limitations—while opportunities and threats relate to external conditions, including policy developments, market trends, environmental risks, or competitive pressures. This phase may involve engaging with external stakeholders to gather diverse perspectives and enrich the analysis. Their input can help validate

assumptions and ensure that the matrix reflects a realistic and comprehensive view of the innovation's strategic environment.

3. **Analysis**: **review of the completed SWOT matrix to identify strategic priorities and inform decision-making**. Innovators should assess how internal strengths can be leveraged to seize external opportunities, and how weaknesses might expose the innovation to threats. This phase also involves identifying gaps, inconsistencies, or areas for improvement, and summarising the results into a clear and actionable format. The insights gained from this analysis can guide future development, scaling strategies, and stakeholder engagement, ultimately strengthening the innovation's resilience and impact.

3.4. Dealing with regulatory procedures

Simplified regulatory procedures are a key enabler for innovation in the Danube region. According to the EcoDaLLi stakeholder survey, nearly 50% of respondents identified the need for simplified regulatory procedures as a critical condition for advancing their future work in innovation related to NBS and ecosystem restoration. This finding highlights that **administrative complexity and uncertainty remain major barriers for innovators** seeking to develop and implement new approaches in the region.

Simplified regulatory procedures refer to **clear, efficient, and proportional administrative processes** that facilitate the approval, testing, and scaling of innovative solutions while maintaining compliance with environmental and safety standards. In the context of NBS and ecosystem restoration, such procedures can include streamlined permitting processes, easy access to funding mechanisms, and harmonised requirements across sectors.

The importance of simplified regulatory procedures also lies in its **ability to shorten innovative project timelines** (from implementation to scaling-up innovation) for innovators. Lengthy and complicated regulatory procedures can discourage innovation development (due to increased times in allocating budget to the project, increased time to getting the right permits, etc.). This would result in the delay of innovation deployment that may deliver significant environmental and social benefits. By contrast, a transparent and innovation-friendly regulatory environment can accelerate the procedure, foster cross-border cooperation and strengthen the regional capacity to respond to climate and biodiversity challenges.

What you will find in this section:

- An overview of current regulatory frameworks for NBS and ecosystem restoration innovation.
- An overview of regulatory challenges for innovation in ecosystem restoration.
- Recommendations to overcome current regulatory challenges.

3.4.1. Regulatory framework for NBS and ecosystem restoration innovation

EU-Level Framework

At the European level, several legislative instruments shape the regulatory environment for NBS and ecosystem restoration. These frameworks are designed to safeguard environmental integrity and ensure coherent action across MS. However, these legislative instruments could introduce administrative complexity for innovators.

A cornerstone of the EU policy landscape is the **Nature Restoration Law** which sets legally binding targets to restore at least 20% of the EU's degraded ecosystems by 2030 and all ecosystems in need of restoration by 2050[40]. The law calls for integrated planning and multi-level governance, but its implementation will require clear guidance on permitting and compliance mechanisms to ensure that innovation in restoration is not hindered by procedural uncertainty[41].

Complementary regulations such as the **Water Framework Directive (WFD)[42] and the Floods Directive (FD)**[43] also play a major role in defining regulatory pathways for restoration projects, particularly in river basins like the Danube. These directives require MS to achieve good ecological status of water bodies and to manage flood risks through integrated plans. However, innovators often face challenges in aligning restoration projects with multiple planning instruments, which can lead to delays or conflicting administrative requirements.

Moreover, other EU directives exist. The **Habitats Directive[44]and Birds Directive**[45] set the legal basis for biodiversity conservation in the EU. While these directives ensure environmental safeguards, they can also make the approval of pilot projects complex.

Beyond environmental legislation, **EU innovation and research policies**—such as the EU Research and Innovation Policy on NBS[46]—encourage the testing and scaling of NBS through funding programmes like *Horizon Europe*. However, project coordinators often report that national-level authorisation processes lag behind the flexibility promoted by EU innovation instruments. Thus, there remains a gap between the EU's policy ambition to promote NBS and the administrative reality experienced by innovators on the ground[47].

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[40] https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-regulation_en

[41] European Commission (2024). *Regulation (EU) 2024/1991 of the European Parliament and of the Council on nature restoration*. Official Journal of the European Union (http://data.europa.eu/eli/reg/2024/1991/oj)

[42] European Commission (2000). *Directive 2000/60/EC establishing a framework for Community action in the field of water policy (Water Framework Directive)* (http://data.europa.eu/eli/dir/2000/60/oj)

[43] European Commission (2007). *Directive 2007/60/EC on the assessment and management of flood risks (Floods Directive)* (http://data.europa.eu/eli/dir/2007/60/oj)

[44] European Commission (1992). *Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) (http://data.europa.eu/eli/dir/1992/43/oj)*

[45] European Commission (2009). *Directive 2009/147/EC on the conservation of wild birds (Birds Directive) (http://data.europa.eu/eli/dir/2009/147/oj)*

[46] https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions/research-policy_en

[47] ESG frameworks are increasingly relevat for corporate sustainability reporting and investment decisions related to NBS. However, these framework do not directly regulate permitting, planning or autorisation procedures for restoration projects, which are primarily governed by environmental legislation such as the Nature Restoration Law, the WFD, and the HBD.

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In the Danube macro-region, the **EU Strategy for the Danube Region (EUSDR)**[48] provides an important coordination framework. Priority Area 5 (Environmental Risks) and Priority Area 6 "Biodiversity, Landscapes, Quality of Air and Soils) promote transnational cooperation on ecosystem restoration, water management, and the application of NBS.

National frameworks

At the national and subnational levels, **Danube countries translate EU directives into domestic legislation governing land use, water management, and environmental protection**. Although the overall policy objectives are aligned, the complexity and fragmentation of administrative structures vary widely across countries, affecting how quickly innovative projects can move from concept to implementation.

In the **Slovak Republic**, for instance, restoration, nature conservation and landscape protection are regulated under Act No. 543/2002 on Nature and Landscape Protection (Slovak Republic)[49]. The Act establishes five levels of territorial protection and sets the basis for the protected-areas network, species protection, and ecosystem management. The law has undergone amendments aimed at streamlining certain processes (e.g., sanitary logging, forest interventions) in 202[50]. Nevertheless, the procedural requirements for restoration or innovative NBS pilots remain aligned with general conservation and infrastructure laws rather than tailored to innovation pathways, which can lead to delays.

In **Hungary**, the European Commission's *Environmental Implementation Review 2022: Country Report*[51] *– Hungary* flagged that despite comprehensive legislation, further efforts are needed to comply with EU laws, notably the WFD. In particular, the MS is encouraged to reduce unnecessary administrative burdens and accelerate decision-making. For innovators, this means that even though national frameworks exist, administrative complexity and unclear innovation-specific mechanisms can hamper the deployment of new NBS solutions.

Although the regulatory frameworks in EU MS of the Danube region provide the environmental safeguards and strategic direction needed, they often impose **complex, fragmented, and time-consuming procedures**. This might act as a barrier to innovation in NBS and ecosystem restoration.

3.4.2. Regulatory challenges for innovation in ecosystem restoration

Innovators working on ecosystem restoration and NBS face a number of regulatory and governance-related obstacles that impede timely development, testing and scaling of innovations. The following points present key challenges that are relevant for EU-wide and Danube context.

- **Complexity, overlap and fragmentation of permitting frameworks**. Many restoration and NBS projects require multiple approvals across environmental, water, biodiversity, and spatial-planning authorities, which are often distributed across

[48] https://danube-region.eu/implementation-funding-and-initiatives/danube-strategy-flagships/
[49] https://www.enviroportal.sk/uploads/report/04-nature.pdf
[50] https://rm.coe.int/49-slovak-republic-poloniny-national-park/1680a52b75?
[51] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0259

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different ministries with no single lead body responsible for coordinating a comprehensive NBS strategy. This leads to lengthy timelines. For instance, the EEA notes that scaling up NBS is held back in Europe by governance and coordination challenges including fragmented institutional responsibilities[52]. Another study found that even where EU policy supports NBS, the actual regulatory environment remains complex and inconsistent[53]. In the context of the Danube region, this means innovators may have to navigate separate national, regional and local authorities, each with its own procedural steps, which slows the pace of innovation.

- **Lack of tailored regulatory pathways for innovation and pilot interventions**. Standard environmental and restoration frameworks are often designed for established infrastructure or conventional restoration projects, not experimental or novel NBS pilots. As such, innovators find no clear expedited or flexible permitting route for testing new methods. A policy brief highlights that current policies and regulations still favour grey-measures or traditional approaches, and that many regulations are not adapted to the adaptive, iterative nature of NBS innovation[54].

- **Inconsistent implementation and cross-border divergence.** Even within EU MS, translation of EU-level directives into national law leads to variation in regulatory detail, interpretation and enforcement. The consequence is that innovators in cross-border basins like the Danube Basin face different regulatory regimes depending on the country, complicating multinational innovation projects. Research on EU policies for ponds found that many ecosystems fall outside established policies and thus face greater regulatory uncertainty[55]. Harmonising regulatory procedures across Danube region remains a challenge and a barrier to seamless innovation.

- **Regulatory uncertainty and investment risk**. Uncertainty about how regulatory frameworks will apply to innovative restoration or NBS projects increases perceived risk for innovators and investors. For example, the European Investment Bank pointed out that regulatory hurdles are among the barriers to greater uptake of NBS in Europe[56]. Another study also discusses how private investment in biodiversity and restoration is hindered by political, ecological and reputational risks in regulatory environments[57]. In the Danube region such regulatory ambiguity may deter innovators with limited capital from entering the field.

[52] https://www.eea.europa.eu/en/analysis/publications/scaling-nature-based-solutions

[53] Ryfisch, S., Seeger, I., McDonald, H., Lago, M., & Blicharska, M. (2023). *Opportunities and limitations for Nature-Based Solutions in EU policies — assessed with a focus on ponds and pondscapes. Land Use Policy*, **139**, 106957. https://doi.org/10.1016/j.landusepol.2023.106957

[54] IIASA (2023). *Policy and finance innovation for nature-based solutions* (IIASA Policy Brief #38). International Institute for Applied Systems Analysis. https://iiasa.ac.at/sites/default/files/2023-10/PB38_web.pdf

[55] Ryfisch, S., Seeger, I., McDonald, H., Lago, M., & Blicharska, M. (2023). *Opportunities and limitations for Nature-Based Solutions in EU policies — assessed with a focus on ponds and pondscapes. Land Use Policy*, **139**, 106957. https://doi.org/10.1016/j.landusepol.2023.106957

[56] https://www.eib.org/en/press/all/2023-217-nature-based-solutions-eib-report-finds-scope-for-regulatory-and-subsidy-reforms-as-well-as-a-more-flexible-spectrum-of-financial-instruments

[57] Zu Ermgassen, S. O. S. E., Hawkins, I., Lundhede, T., Liu, Q., Thorsen, B. J., & Bull, J. W. (2025). *The current state, opportunities and challenges for upscaling private investment in biodiversity in Europe. Nature Ecology & Evolution, 9*, 515-524. https://doi.org/10.1038/s41559-024-02632-0

3.4.3. Overcoming regulatory challenges: some recommendations to support innovators

To overcome the regulatory challenges and foster innovation in ecosystem restoration across the Danube region, innovators can consider the following recommendations:

- **Engage early with permitting authorities**. Establish contact with relevant agencies at the project design stage to clarify procedural requirements and timelines.
- **Map and anticipate regulatory requirements**. Innovators should consider developing a clear overview of applicable permits and compliance obligations before project implementation.
- **Design adaptive and evidence-based projects**. Incorporate monitoring and evaluation mechanisms that demonstrate the environmental benefits and safety of innovative approaches.
- **Build partnerships with public and private stakeholders**. Collaborate with ministries, basin authorities, municipalities, and research institutions to co-develop solutions aligned with regulatory goals.
- **Advocate for simplified and flexible procedures**. Share lessons learned from pilot projects with policymakers and regulatory bodies to promote the establishment of innovation-friendly pathways.
- **Participate in regional policy and knowledge platforms**. Use networks such as the EUSDR and the ICPDR to exchange experiences, support harmonisation, and foster a collective push for regulatory simplification.

3.5. Expert mentoring and coaching: bridging the gap between science, practice and entrepreneurship

Expert mentoring and coaching provide **tailored guidance to innovators**, helping them strengthen technical, business, and collaborative aspects of their projects[58]. They create opportunities for personalised learning and knowledge transfer through direct interaction with experienced professionals. **In the context of ecosystem restoration and NBS, mentoring and coaching are essential to bridge gaps between science, practice and entrepreneurship**.

[58]Interreg Danube (2019). *FORESDA Project – Mutual Learning and Mentoring Workshops.* https://interreg-danube.eu/uploads/media/approved_project_output/0001/52/9bd4cd8ce39041c0617061f313897ed0ae61e756.pdf

Across the Danube region, several initiatives demonstrated the value of such support. Programmes like FORESDA (Interreg Danube)[59] and Restore4Life[60] have shown that mentoring plays a key role in accelerating innovation by fostering collaboration between innovators, SMEs and research institutions.

Building on previous experiences, mentoring and coaching emerge as strategic enablers within the innovation ecosystem of the Danube region. They not only support individual innovators but also strengthen connections across sectors and countries, contributing to a more integrated and collaborative environment for nature-based and restoration-driven innovation.

What you will find in this section:

- An overview of the existing mentoring and coaching programmes in the Danube region for innovation and ecosystem restoration
- A step-by-step guidance to help innovators in the region access and benefit from expert mentoring and coaching opportunities

3.5.1. Mentoring and coaching opportunities in the Danube region

Mentoring and coaching play a strategic role in strengthening innovation capacity and supporting the translation of ideas into practical, scalable solutions. They complement other forms of support such as training or funding by providing personalised, experience-based guidance that helps innovators navigate technical, managerial, and organisational challenges. Beyond individual skill development, mentoring and coaching contribute to building stronger networks, enhancing collaboration, and promoting knowledge transfer across the innovation ecosystem.

The examples presented further down in this section, along with the lessons drawn from the KnowING Intellectual Property Right (IPR) mentoring pilot[61], highlight **several dimensions of added value** that mentoring and coaching bring to the Danube innovation ecosystem:

- **Capacity building**: Strengthens the skills of researchers and entrepreneurs in areas such as IPR management, technology transfer, and business modelling, supported by EU advisory and technical assistance services (e.g. JASPERS[62], ELENA[63], InvestEU Advisory Hub[64]) for project preparation and capacity building.
- **Knowledge transfer**: Facilitates the exchange of expertise and good practices between more and less advanced institutions across the region. Sharing lessons learned and concrete case studies also builds capacity, demonstrates the viability of NBS, and encourages the replication of effective investment models across cities and

[59] Interreg Danube (2019). *FORESDA Project – Mutual Learning and Mentoring Workshops.* https://interreg-danube.eu/uploads/media/approved_project_output/0001/52/9bd4cd8ce39041c0617061f313897ed0ae61e756.pdf

[60] https://www.ceeweb.org/documents/news/9._Mihai_Adamescu_Ecosystem_services_Restore4Life.pdf

[61] Interreg Danube (2022) Fostering innovation in the Danube Region through knowledge engineering and IPR management. http://www.interreg-danube.eu/approved-projects/knowingipr

[62] https://www.eib.org/fr/products/advisory-services/jaspers/index

[63] https://www.eib.org/fr/products/advisory-services/elena/index

[64] https://investeu.europa.eu/investeu-programme/investeu-advisory-hub_en

regions, including through existing EU repositories such as the European Investment fund case studies.

- **Collaboration and networking**: Encourages cross-sector and cross-border partnerships, linking academia, SMEs, and public institutions.
- **Innovation readiness**: Enhances the ability of innovators to move from idea to market by providing targeted, practical advice.
- **Institutional development**: Supports the establishment of technology transfer offices (TTOs) and reinforces internal mechanisms for innovation management.
- **Regional cohesion**: Contributes to reducing disparities in innovation capacity and creating a more integrated and balanced regional ecosystem.

3.5.2. Five steps to accompany innovators through their mentoring journey

This step-by-step guidance is intended to help innovators in the Danube region access and benefit from expert mentoring and coaching opportunities that can strengthen their innovation capacity, accelerate project implementation, and enhance the impact of their work in ecosystem restoration and NBS. It builds on lessons from successful regional initiatives such as KnowING IPR and Danube Life Lines (DLL), which have demonstrated the effectiveness of structured and tailored mentoring schemes for innovators across different sectors.

The guidance is built around **five key steps that accompany innovators throughout their mentoring journey** – from identifying their needs to applying the lessons learned and sharing outcomes within the regional innovation community.

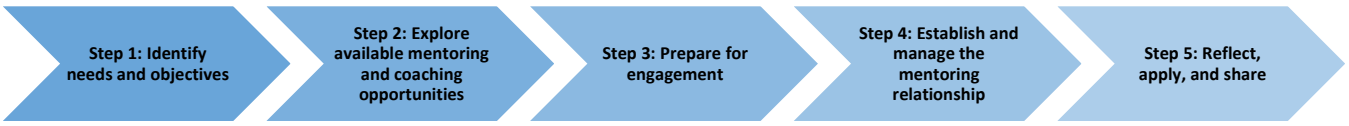

Figure 11 Step-by-step guidance for export mentoring and coaching.

1	Identify needs and objectives

The initial step involves **clarifying the purpose and expected outcomes** of mentoring or coaching. Three complementary areas typically emerge:

- **Technical mentoring**, oriented towards the design, implementation, and monitoring of NBS or restoration actions.
- **Business mentoring**, aimed at strengthening business models, financial planning, or market positioning.
- **Strategic or policy coaching**, supporting governance alignment, stakeholder engagement, and regulatory navigation.

Evidence from the KnowING IPR mentoring pilot shows that requiring participants to formulate their innovation challenges prior to mentor matching significantly improved the relevance and effectiveness of subsequent sessions[65]. This highlights the importance of a well-defined entry point and structured objective-setting at the onset of the mentoring process.

2 Identify existing mentoring and coaching opportunities

Mapping available opportunities within the region allows innovators to engage with established structures rather than operate in isolation. Notable **examples in the Danube region** include:

- The **FORESDA project** (Interreg Danube) implemented a series of mutual learning and mentoring workshops that connected research institutions, SMEs, and innovation support organisations in the wood-based bioeconomy sector. These exchanges facilitated cross-border transfer of good practices and improved the innovation capacities of less developed regions, highlighting the importance of mentoring for institutional learning and regional cohesion[66].

- The **KnowING IPR** project designed a structured mentoring programme to help SMEs and higher education institutions strengthen their skills in intellectual property management and technology transfer. Through tailored mentoring sessions and online learning tools, participating innovators improved their business-model readiness and competitiveness, illustrating how coaching can directly enhance innovation uptake[67].

- The **Rising Competencies** project further extended this approach by establishing a transnational mentor scheme for rural entrepreneurs and SMEs in less developed parts of the Danube basin. Its e-platform and peer-learning components enabled participants to gain practical knowledge and connect with experts beyond national boundaries, reducing regional disparities in innovation support[68].

- More recently, the **Danube Life Lines Business Club** has introduced one-on-one mentoring and coaching for green entrepreneurs and innovators developing NBS and ecosystem-restoration projects. This initiative demonstrates how mentoring can directly align environmental and business objectives, guiding innovators from concept to market while fostering sustainable economic opportunities in the region[69].

[65] Interreg Danube (2022) Fostering innovation in the Danube Region through knowledge engineering and IPR management. http://www.interreg-danube.eu/approved-projects/knowingipr
[66] Interreg Danube (2019). *FORESDA Project – Mutual Learning and Mentoring Workshops.* https://interreg-danube.eu/uploads/media/approved_project_output/0001/52/9bd4cd8ce39041c0617061f313897ed0ae61e756.pdf
[67] AGEPI (2021). *KnowING IPR Project – Partner Progress Report.* https://agepi.gov.md/sites/default/files/2022/02/Partner_Progress_Report_6_KnowING_IPR_20210527_090503.pdf
[68] https://keep.eu/projects/29479/Rising-competences-skills-i-EN/
[69] https://danubelifelines.eu/businessclub

These initiatives underline that mentoring frameworks in the Danube region are most effective when **embedded within broader innovation ecosystems, linking research, business, and public-sector actors across borders**.

Beyond these transnational programmes, innovators can also turn to **regional or national organisations participating in the EU Strategy for the Danube Region (EUSDR)**[70]. The EUSDR supports a range of thematic Priority Areas—such as innovation, environmental protection, and sustainable development—under which countries and institutions collaborate through National Contact Points, Priority Area Coordinators, and regional innovation agencies. These structures can provide access to mentoring, technical support, and networking opportunities.

Similarly, EU-funded initiatives like EcoDaLLi[71] contribute to this ecosystem by connecting innovators with experts and living labs that facilitate peer learning and knowledge exchange across the Danube basin.

3 Prepare for engagement

A critical determinant of success lies in **adequate preparation prior to entering the mentoring process**. Innovators that systematically assess their innovation maturity, internal resources, and knowledge gaps are better positioned to benefit from mentoring. Clear articulation of project objectives and constraints enables mentors to tailor advice to the specific context.

The FORESDA mentoring workshops demonstrated that **targeted preparation**—through short presentations and diagnostic sessions—**allowed participants to receive more relevant and technically grounded feedback**[72]. This finding points to the value of integrating diagnostic tools or self-assessment questionnaires as part of future mentoring schemes.

Preparation materials and templates for innovation maturity assessment or business readiness can often be accessed through regional or EU-funded platforms, including:

- Danube Transnational Programme (DTP) mentoring and training resources[73].
- EUSDR Priority Area 8 (Competitiveness of Enterprises), which provides tools for SMEs and innovation actors to evaluate business potential[74].
- Enterprise Europe Network (EEN) in the Danube countries, offering pre-mentoring business diagnostics and innovation audits[75].

[70] https://danube-region.eu/
[71] https://ecodalli.eu/
[72] Interreg Danube (2019). *FORESDA Project – Mutual Learning and Mentoring Workshops.* https://interreg-danube.eu/uploads/media/approved_project_output/0001/52/9bd4cd8ce39041c0617061f313897ed0ae61e756.pdf
[73] https://www.interreg-danube.eu
[74] https://danube-region.eu
[75] https://een.ec.europa.eu/about-enterprise-europe-network

4 Establish and manage the mentoring relationship

Effective mentoring depends on the establishment of a **structured relationship between mentors and mentees**, characterised by clear objectives, defined timeframes, and transparent communication channels.

Good practice emerging from the KnowING IPR pilot shows that continuous interaction—through regular online meetings and iterative feedback—was instrumental in **achieving measurable progress and maintaining engagement**[76]. The evaluation also pointed to common challenges such as limited mentor availability and varying levels of commitment among participants, suggesting the need for stronger institutional anchoring and resource planning.

Sustaining such structured relationships requires access to **platforms that facilitate communication, scheduling, and documentation**. Innovators can use or adapt **systems already operating in the Danube region**, such as:

- The Danube Life Lines Business Club, which provides a mentoring interface and community of practice for green entrepreneurship[77].
- The European Institute of Innovation and Technology (EIT) Climate-KIC Accelerator, which includes structured mentoring as part of its support packages for climate-related innovations[78].

5 Consolidate, apply and disseminate outcomes

The final step involves **evaluating the mentoring process, consolidating key insights, and translating them into practical improvements in project design or business operations**. The dissemination of lessons learned—through peer-learning events, innovation hubs, or living labs—ensures that mentoring benefits extend beyond individual participants.

Evidence from the Rising Competences project indicates that **peer-exchange mechanisms helped sustain collaboration among mentees and contributed to broader community capacity-building**[79]**.** Embedding mentoring outcomes into organisational routines and regional innovation platforms, such as the EcoDaLLi Living Labs[80], can further enhance knowledge circulation and institutional learning across the Danube basin.

Several **regional and EU-wide initiatives** provide frameworks and platforms intended to support reflection, dissemination, and community exchange with varying levels of activity and effectiveness across initiatives:

[76] Interreg Danube (2022) Fostering innovation in the Danube Region through knowledge engineering and IPR management. http://www.interreg-danube.eu/approved-projects/knowingipr https://danubelifelines.eu/businessclub
[77] https://danubelifelines.eu/businessclub
[78] https://www.climate-kic.org/programmes/accelerator
[79] https://keep.eu/projects/29479/Rising-competences-skills-i-EN/
[80] https://ecodalli.eu/

- **EcoDaLLi Living Labs:** designed to promote co-creation and mentoring among innovators, researchers, and policymakers in the Danube region.
- **EUSDR Priority Area 7** (Knowledge Society): supports transitional cooperation in education, research, and innovation and provides a strategic coordination framework at macro-regional level[81].
- **Interreg Danube Transnational Programme – Capitalisation Platform**: which aims to facilitate sharing of lessons learned from projects such as FORESDA or Rising Competences to support the uptake of good practices[82].

[81] https://danube-region.eu
[82] https://dtp.interreg-danube.eu/

4. Upscaling innovation in ecosystem restoration in the Danube region: the EcoDaLLi approach

4.1. Overall framework: the innovation upscaling cycle

The EcoDaLLi approach to upscaling is based on the innovation upscaling cycle developed by IFAD (2015)[83]. It is a process of developing new ideas from pilot projects to wider impact.

The innovation upscaling cycle involves four phases:

- **Innovation:** A new idea is developed to address challenges faced by rural communities.
- **Learning:** The idea is first tested in a pilot project and then fully evaluated to learn from the experience. This creates and disseminates knowledge about what works and what doesn't.
- **Leveraging:** The knowledge gained from the pilot phase is used to demonstrate the potential of the innovation, which can attract additional resources from governments, the private sector, and other partners. This could also lead to broader alliances and policy changes.
- **Scaling up:** The innovation is adapted, expanded, and replicated using IFAD's operational instruments, such as projects, policy dialogue, and knowledge sharing, to achieve a wider and more sustainable impact.

This is shown in the figure below.

[83] https://www.ifad.org/documents/d/new-ifad.org/ifad-s-operational-framework-for-scaling-up-results-pdf#:~:text=7.,projects%2C%20policy%20and%20knowledge). And https://www.ifad.org/documents/48415603/49789103/scalingup_results.pdf/9c619f49-3e4f-ec41-257c-b2ed8b3862b1?t=1726644497292#:~:text=Scaling%20up%20results%20is%20part,into%20new%20ideas%20and%20learning.

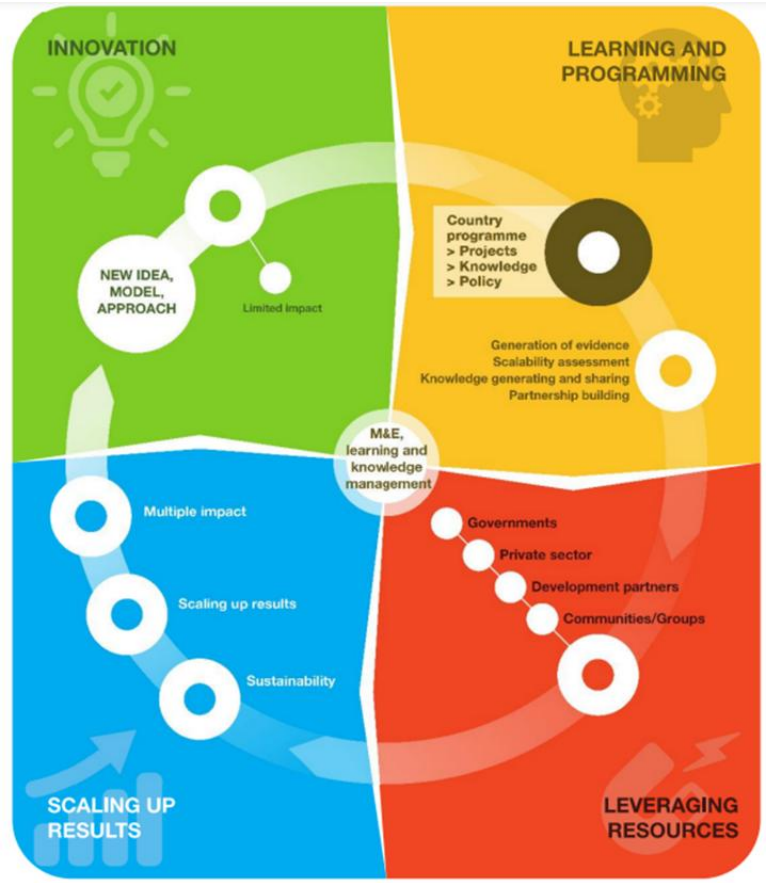

Figure 12 The IFAD innovation upscaling cycle[84].

The key aspects of the cycle are the followings:

- **Continuous process:** This cycle is a continuous feedback loop; the experience from scaling up feeds back into new ideas and further learning.
- **Adaptability:** The process requires flexibility and adaptability, especially in the face of shocks, to "course correct" and learn as programmes are executed.
- **Operational instruments:** IFAD uses its core operational instruments (projects, policy, and knowledge) to implement the scaling up model.
- **Knowledge and learning:** A strong emphasis is placed on knowledge and learning, which are essential for ensuring that any replication is based on a solid understanding of the innovation itself and the people it targets.

Although the EcoDaLLi project was not explicitly developed based on this framework, a closer look at project activities reveals how the upscaling cycle is in fact embedded in project activities: the figure below shows how EcoDaLLi WPs – and WP5 in particular – are operating across three of three of the four phased of the upscaling cycle. To be noted that the first phase, innovation, has been developed across Europe across the decades, including through

[84] https://www.ifad.org/documents/38714170/39155737/Scaling+up+in+agriculture_infographics.pdf

Innovation Actions, whereas EcoDaLLi is entering the process from the learning and programming phase up to the last phase, scaling up results.

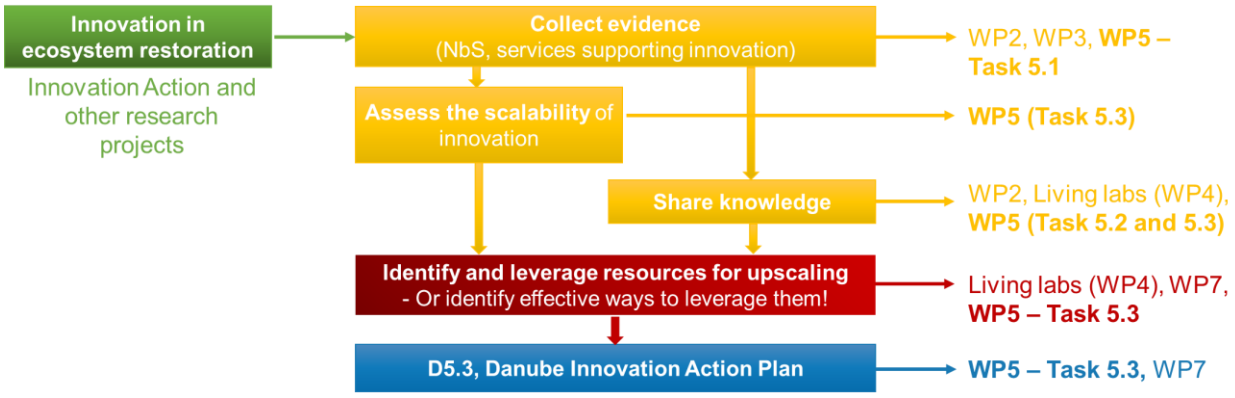

Figure 13 How EcoDaLLi WPs (and WP5 in particular) contribute to the innovation upscaling cycle.

More in detail, WP5 activities contribute as follows:

- **Collect evidence: Task 5.1** collected evidence on (i) the innovation ecosystem for NBS in the Danube regions; (ii) ecosystem restoration and innovation in the Danube region: types of innovation; and (iii) innovation support services for ecosystem restoration in the Danube region. The results of this exercise are presented in D5.1.
- **Share knowledge: Task 5.2** contributes to the promotion of innovation in the region by organising training session and developing training materials for stakeholders of the environmental restoration and innovation communities. In turn, **Task 5.3** has collected resources to **support innovators in the area**, which are collected in the **guidebook** presented in this deliverable.
- **Assess the scalability of innovation:** this is done as part of **Task 5.3,** and it is the focus of chapter 5 of this deliverable. More details on the scalability assessment are provided in section 4.3 below.
- **Identify and leverage resources for upscaling:** this will be done as part of **Task 5.3**, and it will be the main focus of D5.3 due in 2026.
- **Scaling up results:** EcoDaLLi will contribute to scaling up results in the Danube region through the Danube Innovation Action Plan developed as part of WP7. Task 5.3 findings, and in particular results which will be included in D5.3, will feed into the Innovation Action Plan.

This and the following chapter of this deliverable will thus focus on the **innovation scalability assessment of promising innovations in ecosystem restoration in the Danube region**. More in detail, this is done in two steps:

- **Listing of promising innovations** in the Danube basin: stocktaking of project results, including findings from WP3 and Task 5.1; and

- **Innovation scalability assessment of listed innovations**, applying an adapted version of the agricultural scalability assessment tool developed by USAID[85].

These two steps will lead to the **shortlisting to be scaled up in relevant IA projects in the Danube river basin.** Based on the information collected under the two steps, some first considerations on how to scale them up are also drawn.

The findings included in this deliverable will be the basis for further work on upscaling innovation in ecosystem restoration in the Danube region, which will be included in D5.3.

The next two sections provide:

- The list of promising innovations in the Danube basin; and
- The description of the innovation scalability assessment criteria against which promising innovations have been evaluated.

4.2. Case studies: Promising innovations in the Danube basin

The following is a list of innovative approaches to ecosystem restoration in the Danube region, based on findings from other EcoDaLLi deliverables[86].

1) Technological innovations
   - NBS
   - Biomimicry-based design
   - Remote sensing technologies
   - Artificial intelligence (AI)-driven analysis
2) Economic and financial innovations
   - Green bonds
   - Payment for Ecosystem Services (PES)
3) Social innovation
   - Public participation mechanisms
   - Knowledge sharing programmes
4) Policy and governance innovation
   - Cross-sectoral and cross-border partnerships.

4.3. Innovation scalability assessment

The Agricultural Scalability Assessment Toolkit (ASAT[87]) is designed to provide **a qualitative appraisal of an innovation's scalability**. While innovations do have intrinsic features that may make them more or less scalable in general, most of the factors affecting scaling potential

[85] USAID, 2018. GUIDE TO THE AGRICULTURAL SCALABILITY ASSESSMENT TOOL FOR ASSESSING AND IMPROVING THE SCALING POTENTIAL OF AGRICULTURAL TECHNOLOGIES. The document was downloaded in April 2025, and the link could not be retrieved at the moment of drafting this deliverable. A summary of the assessment tool can be found at: https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1015&context=scaleup

[86] Mainly Deliverable 5.1 Catalogue of services supporting innovation, which also drew from D3.1.

[87] USAID, 2018

Funded by the European Union

can only be assessed relative to a specific socio-economic context and the characteristics of target adopters. The ASAT provides **information on the strengths and weaknesses of the innovation relative to scalability, the most promising scaling up pathways** (i.e., commercial, public, or public-private partnerships), and **information on the extent to which target contexts** -- locations and populations – and **their market and public-sector capacity currently facilitate scaling**.

As part of EcoDaLLi Task 5.3, the scalability of promising innovations in ecosystem restoration implemented and tested in the Danube region was assessed. In fact, identifying innovative practices is only the first step: for long-term impact, it is essential that **these innovations are not confined to individual sites or pilot projects, but can be scaled up across the Danube basin and potentially beyond**. To determine whether innovations are suitable for upscaling, listed innovations from the Danube region were assessed against the scalability assessment criteria listed in the ASAT, which are illustrated in the table below.

Table 4 Scalability assessment criteria listed in the ASAT, and applied to promising innovations in ecosystem restoration in the Danube region (Source: USAID, 2018).

Innovation scalability assessment		
Criteria		**Assessment**
N°1	**Importance of the issue addressed**	How significant is the problem that the innovation seeks to solve?
N°2	**Credibility and visibility of the innovation**	Are the innovation's outcomes reliable, visible (/observable) and demonstrable to key stakeholders and potential adopters?
N°3	**Ease of adoption and implementation**	When scaling up, can the innovation be adopted and implemented effectively (for example with reasonable costs, technical requirements, and institutional capacity)?
N°4	**Benefits for adopters**	What potential benefits (for example cost savings, improved ecosystem services, enhanced resilience) does the innovation provide for those who implement it? Are the incentives sufficiently strong (for example profitability or efficiency gains) to encourage uptake?
N°5	**Business case for investors**	Is it possible to develop a viable investment model that makes the innovation attractive to investors (for example by offering measurable economic, environmental, or social returns)?
N°6	**Enabling public sector environment**	Do existing policies, regulations and institutional frameworks provide the necessary support to facilitate the scaling up of the innovation?

For each case study, the assessment of each criterion includes:

- A detailed qualitative assessment; and
- Based on the above, a qualitative score from 1 (low) to 5 (high) was assigned, to enable a quick comparison across all case studies.

Chapter 5 of this deliverable provides both the detailed analysis of each case study against these six criteria and the comparative table based on qualitative scores, with the aim of identifying the most promising innovations for upscaling.

5. Innovation in ecosystem restoration in the Danube region: the potential for upscaling of available case studies

In this section, the scalability of the previously identified innovations is evaluated against the six criteria. Each innovation is assessed individually, and following a critical analysis, a score from 1 to 5 is assigned to each criterion (with 1 representing the lowest performance and 5 the highest). The objective of this assessment is to establish a shortlist of innovations that show strong potential for upscaling. Detailed guidance on how these shortlisted innovations can be scaled in practice will be provided in the following section.

5.1. Technological innovation

These involve the use of new materials, equipment, or techniques that improve monitoring, assessment and implementation efforts in restoration. In simple terms, they represent the development and application of new solutions to tackle environmental challenges.

5.1.1. Case study: NBS

Context and overview

NBS are approaches that work with and enhance natural processes to address societal challenges such as climate change, biodiversity loss, water quality degradation, and disaster risk. Unlike traditional “grey” infrastructure, NBS aim to generate ecological, social and economic benefits, while contributing to long-term resilience.

In the Danube region, NBS have gained prominence as tools for ecosystem restoration. They are aligned with EU strategic frameworks such as the European Green Deal, the EU Biodiversity Strategy 2030, and the Mission “Restore our Ocean and Waters by 2030.” Internationally, both the IPCC and IPBES highlight NBS as essential to tackling the twin crises of climate change and biodiversity loss. At the basin level, projects funded under Horizon Europe, LIFE, and the Danube Transnational Programme have demonstrated the practical relevance of NBS for floodplain reconnection, wetland restoration, and sustainable river management.

Scalability assessment

The following table presents the scalability assessment of NBS in the Danube region against 6 criteria.

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Table 5 Innovation scalability assessment of NBS.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	NBS directly confront **pressing environmental and societal challenges** such as climate change, biodiversity loss, water quality degradation and disaster risk**,** across the Danube region, throughout Europe, and at the global level.	**5**
N°2	Credibility and visibility of the innovation	NBS are **internationally recognised** (e.g., by UN, IPBES, IPCC) and embedded in **EU strategies**. Numerous **EU-funded projects (Horizon Europe, LIFE, NetworkNature) provide demonstrable outcomes**, making them credible and observable to stakeholders. However, while the concept is becoming increasingly visible, there remains work to strengthen consistency: the EcoDaLLi Deliverable 2.3[88] pointed out the **need for more standardised definitions and metrics (to avoid ambiguity) and calls for better monitoring and evaluation frameworks** to ensure credibility	**4**
N°3	Ease of adoption and implementation	Compared to traditional infrastructure alternatives, NBS are **more flexible and cost-effective**, which gives them better implementation potential. However, implementation and scaling of NBS do face practical challenges. According to the EcoDaLLi Deliverable 2.3, key constraints include **knowledge gaps, institutional capacity limitations, technical complexity in adaptation to local contexts, and governance challenges** (e.g. coordination across jurisdictional boundaries).	**4**
N°4	Benefits for adopters	NBS provide **multiple benefits** such as improved ecosystem services, flood protection, carbon sequestration, and enhanced resilience. These incentives are strong, but their **full value is difficult to measure due to the lack of standardised impact assessment methods**. The **time** it takes for NBS to mature and consistently deliver benefits **varies by ecosystem and is often lengthy**. Even once established, **benefits may fluctuate**, as ecosystems develop in dynamic, non-linear ways. There are often **trade-offs between short and long-term ecological benefits of NBS** (Lehmann et al., 2025)[89]. Prioritising short-term gains can limit the long-term effectiveness of NBS, yet projects with short-term costs but long-term benefits often struggle to gain political and societal support.	**4**
N°5	Business case for investors	There is **growing recognition of NBS as investment opportunities**. However, monetising ecosystem services remains complex, and many benefits are nonmarket. Therefore, investors' confidence can be limited by uncertainty in benefits, lack of standard metrics, and risk of long-time horizons.	**4**

[88] D2.3 Policy recommendations for NBS implementation (https://portal.ecodalli.eu/deliverables/D2.3%20Policy%20Recommendations%20for%20NBS%20Implementation.pdf)

[89] Lehmann, I., Grosinger, J., Bauer, S., Rodríguez de Francisco, J. C., Negacz, K., & Hein, J. (2025). Time in and for nature-based solutions: No quick fix solutions for complex ecological and social processes. *Nature-Based Solutions, 7,* 100219. https://doi.org/10.1016/j.nbsj.2025.100219

N°6	Enabling public sector environment	The policy environment is **generally favourable**: NBS are embedded in EU strategic frameworks (Green Deal, Biodiversity Strategy, Mission "Restore our Ocean and Waters"), and many EU-level funding and governance instruments support their deployment. However, **national and local translation varies greatly**. Institutional inertia, rigid procurement rules, legal barriers, risk aversion, and fragmented governance can still limit scalability.	**4**

Challenges faced

The scalability assessment highlights several factors that may limit the wider uptake and replication of NBS in the Danube region:

- Conceptual clarity, monitoring and measurement gaps. The absence of consistent definitions, standardised metrics, robust monitoring results and evaluation frameworks can make it difficult to compare outcomes and demonstrate effectiveness consistently.
- Planning and implementation barriers. Adoption often requires technical expertise, cross-sector collaboration, and adaptation to local ecological and socio-economic conditions. In addition, the lack of comprehensive, river-stretch level planning strategies can hinder coherence across intervention, which may slow down replication.
- Economic and financial considerations. Many benefits of NBS are long-term or non-market, which can complicate the development of investment cases and reduce attractiveness for private financing. Benefits of NBS typically emerge gradually, and balancing short-term expectations with long-term ecological outcomes can pose challenges for decision-makers.
- Policy and governance practice alignment. Although EU-level frameworks strongly promote NBS, integration into national and local policies remains uneven, often limited by existing legal, institutional, or procurement processes. Unclear responsibilities and the absence of a clearly mandated leading body further complicate the planning, implementation, and monitoring processes.

Results

The scalability assessment shows that NBS score highly in terms of relevance, policy support, and societal benefits, confirming their strong potential as a cornerstone of ecosystem restoration in the Danube basin. However, challenges remain in ensuring credibility, financial viability, and ease of replication across diverse ecological and governance contexts. Overall, NBS received a score of 25 out of 30, making them a highly promising innovation to be further explored.

5.1.2. Case study: Biomimicry-based design

Context and overview

Biomimicry-based design is an innovative approach that draws inspiration from nature's structures, processes, and strategies to develop sustainable and resilient solutions for human

and environmental challenges[90]. While it is closely related to NBS, the two differ in focus and application. NBS primarily address societal challenges through the protection, restoration and sustainable management of ecosystems, whereas biomimicry-based design focuses on translating specific biological principles into products, materials or technological designs[91]. It is therefore analysed separately here to reflect these differences and its distinct support and upscaling needs.

In the Danube region, biomimicry has been applied in areas such as riverbank stabilisation, fish-friendly hydropower infrastructure, and restoration of wetland and floodplain habitats. By mimicking natural processes, these designs aim to deliver multiple ecological benefits while minimising the negative impacts often associated with conventional "grey" infrastructure.

Scalability assessment

The following table presents the scalability assessment of biomimicry-based design in the Danube region against 6 criteria.

Table 6 Innovation scalability assessment of biomimicry-based design.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	Biomimicry-based design addresses critical ecosystem restoration challenges in the Danube region. However, **not all restoration needs in the region are suitable for this approach**. In addition, most current applications are small-scale pilot projects.	**4**
N°2	Credibility and visibility of the innovation	**Some** pilot projects in the Danube (e.g. the restoration of the Johler Arm[92]) has demonstrated **observable benefits**. However, the outcomes of this approach in restoration are **not yet widely documented or standardised for replication**. Awareness among stakeholders and policymakers is limited, which reduces broader visibility.	**3**
N°3	Ease of adoption and implementation	While conceptually promising, biomimicry-based solutions often require **specialised technical knowledge, site-specific design, and monitoring**. **Costs can be higher** than conventional methods, and **institutional familiarity is limited**, making large-scale adoption challenging without training and guidance.	**2**
N°4	Benefits for adopters	Adopters can benefit from **long-term resilience and enhanced ecosystem services** as the goal is to imitate nature's design. However, the **upfront investment and design complexity** due to technical knowledge can limit immediate economic incentives for adoption.	**3**
N°5	Business case for investors	Direct economic returns are **difficult to quantify**, as benefits are primarily environmental and social rather than market based. Most initiatives rely on public funding or grants, and **private investment is limited** due to perceived technical risks and	**3**

[90] Lebdioui, A. (2022). Nature-inspired innovation policy: Biomimicry as a pathway to leverage biodiversity for economic development. Ecological Economics, 202, 107585 https://www.sciencedirect.com/science/article/pii/S0921800922002476
[91] https://www.learnbiomimicry.com/blog/nature-based-solutions-and-biomimicry
[92] https://www.viadonau.org/en/newsroom/news/detail/oekologische-ufersicherung-am-johler-arm

		uncertain returns. Nonetheless, **alignment with sustainability targets or corporate ESG goals** does offer some investment potential.	
N°6	Enabling public sector environment	**EU frameworks** (e.g. Water Framework Directive, Biodiversity Strategy, Natura 2000, etc.) and national policies **support NBS and ecosystem restoration solutions**, providing a favourable policy context. Yet, specific regulatory **guidance for biomimicry-based approaches is limited**, and institutional expertise needs strengthening to facilitate wider adoption.	**3**

Challenges faced

Key factors that may limit the wider uptake and replication of biomimicry-based design in the Danube region include:

- Technical complexity and specialised knowledge. Designing solutions that mimic natural processes requires expertise that is not yet widespread.
- High upfront costs and resource requirements. Implementation and monitoring can be more expensive than conventional approaches.
- Uncertain economic incentives. Benefits are mostly environmental and social, making it harder to attract private investment.
- Institutional and regulatory gaps. Existing frameworks support NBS broadly, but there are limited guidance or standardised protocols specific to biomimicry.

Results

The scalability assessment shows that biomimicry-based design is a highly innovative approach to ecosystem restoration in the Danube region, addressing critical environmental issues and offering long-term resilience benefits. Pilot applications demonstrate visible ecological improvements, but adoption is constrained by technical, financial, and institutional barriers. While policy frameworks are generally supportive, broader replication will require capacity-building, awareness-raising, and tailored funding mechanisms.

5.1.3. Case study: Remote sensing technologies

Context and overview

Remote sensing technologies refer to the usage of satellite, aerial drones, or sensors to collect data on natural resources and ecosystems. In the Danube region, these tools are increasingly used to monitor, map and model land use, water resources and ecosystem dynamics. For example, as noted by Popa et al. (2025)[93], remote sensing provides a broad perspective on sediment distribution and morphological changes along the Danube River, supporting the

[93] Popa, V.-I., Rusu, E., Chiroscă, A.-M., & Arseni, M. (2025). Danube River: Hydrological features and risk assessment with a focus on navigation and monitoring frameworks. Earth, 6(3), 70. https://doi.org/10.3390/earth6030070

monitoring of water levels, pollution, and ice formation. Similarly, Yanega et al. (2013)[94], demonstrated that high spatial resolution satellite images obtained via multi-sensor optical remote sensing allow for the study of turbidity patterns in the Danube Delta waters. The complexity and scale of the Danube Basin make satellite imagery particularly advantageous. Moreover, transnational initiatives such as GLOCAD[95], Danube Sediment[96] and GRENDEL[97] have employed remote sensing to improve data-driven river management and habitat restoration across the region.

Scalability assessment

The following table presents the scalability assessment of remote sensing technologies in the Danube region against 6 criteria.

Table 7 Innovation scalability assessment of remote sensing technologies.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	Remote sensing technologies provide spatial data to **address key challenges in the Danube region**, such as monitoring ecosystem degradation, sediment transport, and hydrological change.	**5**
N°2	Credibility and visibility of the innovation	The outcomes of remote sensing technologies are **widely visible, with open-access platforms**, such as the Copernicus Land Monitoring Service[98] and the ICPDR's DanubeGIS platform[99], making spatial data transparent and publicly accessible. These tools are now significant to ecosystem monitoring and restoration planning across the Danube Basin. However, the rapid increase of raw data alone does not automatically lead to improved outcomes, **as effective use and interpretation require specialised geospatial analytical skills**. Moreover, Chi et al. (2016) [100] stated that the field is currently experiencing a so-called "data deluge": an unprecedented **growth in the volume, velocity, and variety of available geospatial data**. While this enhances potential insight, it also increases the challenge of managing, standardising, and translating these data into actionable information for restoration practitioners and policymakers.	**4**

[94] Yanega, G. M., Gilmour, M. A., & Jones, C. J. (2013). Genome fragmentation and rearrangement in the fish-associated nematode Hysterothylacium aduncum (Nematoda: Anisakidae). Molecular Phylogenetics and Evolution, 67(3), 775-782 https://doi.org/10.1016/j.rse.2013.01.009

[95] https://www.icpdr.org/publications/global-change-atlas-danube-region-sharing-research-transboundary-solutions

[96] https://interreg-danube.eu/projects/danubesediment-q2

[97] https://dtp.interreg-danube.eu/approved-projects/grendel

[98] https://land.copernicus.eu/en

[99] https://www.danubegis.org/about

[100] Chi, M., Plaza, A., Benediktsson, J. A., Sun, Z., Shen, J., & Zhu, Y. (2016). Big data for remote sensing: Challenges and opportunities. Proceedings of the IEEE, 104(11), 2207-2219. https://doi.org/10.1109/JPROC.2016.2598228

N°3	Ease of adoption and implementation	The increasing availability of **open-source data and user-friendly tools** (such as Sentinel Hub[101] or Google Earth Engine[102]) has improved access to remote sensing technologies across the Danube region, as these platforms allow to monitor land and water systems at relatively low cost. However, specialised expertise is still required to translate remote sensing data into actionable policies and management strategies. In some occasions, **local authorities lack sufficient geospatial and analytical skills, relying on external partnerships** for implementation[103]. **Skills and technical capacity also vary among Danube countries**[104]. In this context, without investment in capacity-building and knowledge transfer, the scaling-up potential of remote sensing applications may remain limited despite their technological maturity.	**3**
N°4	Benefits for adopters	Remote sensing offers **clear benefits**: cost-efficient monitoring, broad spatial coverage, enhanced accuracy, and improved decision-making for restoration projects. However, the **benefits are not always immediately visible or quantifiable**. Datasets may be produced but not instantly applied, or used later for different analytical or policy purposes, which makes it difficult to quantify direct or short-term benefits for adopters.	**3**
N°5	Business case for investors	Apart from the **uncertain timeframe for economic returns**, the **initial setup costs** of remote sensing technologies can be relatively high, which may further reduce investor confidence. The current market remains **largely dominated by publicly funded projects and research consortia**, rather than self-sustaining private business models. However, with the rapidly increasing demand for environmental data and digital monitoring tools, the remote sensing services market is expected to **experience substantial growth in the foreseeable future**, particularly across Europe[105].	**3**
N°6	Enabling public sector environment	The EU environmental directives, such as the Water Framework Directive and the Habitats Directive, provide a highly **favourable policy environment** for programmes like Copernicus. However, the integration of these tools into national policy cycles remains uneven, with **gaps in data accessibility, compatibility and interoperability** at national and local levels[106].	**4**

Challenges faced

Despite their strong technical potential, remote sensing technologies face several challenges that may limit their wider uptake and replication in the Danube region.

[101] https://www.sentinel-hub.com/
[102] https://earthengine.google.com/
[103] https://wbc-rti.info/object/document/15360/attach/DRDSI-Danube_Net-D1-Serbia.pdf
[104] Trudić, B., Kuzmanović, B., Ivezić, A., Stojanović, N., Popović, T., Grčić, N., Tolimir, M., & Petrović, K. (2025). Geospatial Sensing and Data-Driven Technologies in the Western Balkan 6 (Agro)Forestry Region: A Strategic Science–Technology–Policy Nexus Analysis. *Forests*, *16*(8), 1329. https://doi.org/10.3390/f16081329
[105] https://www.futuremarketinsights.com/reports/remote-sensing-services-market
[106] https://www.icpdr.org/publications/filling-gap-between-science-and-policy

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- Limited technical and analytical capacity among local authorities and stakeholders, leading to reliance on external expertise.
- High initial setup costs and uncertain timeframe for economic returns, which constrain private investment.
- Uneven integration into national and subnational policy frameworks, with gaps in cross-sector coordination.
- Complexity and volume of data make effective management, standardisation, and translation into actionable policies challenging. Data accessibility, compatibility, and interoperability issues between institutions and countries.

Results

The scalability assessment shows that remote sensing technologies score highly in terms of relevance, credibility, and policy alignment, confirming their critical role in ecosystem monitoring and restoration across the Danube Basin. However, challenges remain regarding technical capacity, economic feasibility, and institutional integration, which can limit large-scale adoption and long-term sustainability. Overall, remote sensing technologies received a total score of 22 out of 30, highlighting them as a promising yet capacity-dependent innovation with strong future potential if supported by targeted investment and institutional coordination.

5.1.4. Case study: AI-driven analysis

Context and overview

AI-driven analysis refers to the usage of artificial intelligence and machine learning to support environmental monitoring, risk assessment, data management, and ecosystem restoration. Over the past decade, AI has gained increasing relevance in ecological restoration projects due to its ability to process large, complex datasets, and enhance predictive modelling, ultimately improving the precision and efficiency of decision-making[107]. Successful examples include the AZ Forest initiative[108], which applies advanced AI deep-learning algorithms to drone and satellite imagery to optimise reforestation planning and monitoring.

Scalability assessment

Table 8 Innovation scalability assessment of AI-driven analysis.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	AI technologies **address major challenges relevant to the Danube region**, such as complex hydrological dynamics, land-use change, and the need for faster and more accurate environmental assessments. AI provides timely and explicit	**5**

[107] Morante-Carballo, F., Arcentales-Rosado, M., Caicedo-Potosí, J., & Carrión-Mero, P. (2025). Artificial intelligence applications in hydrological studies and ecological restoration of watersheds: A systematic review. Watershed Ecology and the Environment, 7, Article 230. https://doi.org/10.1016/j.wsee.2025.05.004

[108] https://www.astrazeneca.com/sustainability/environmental-protection/az-forest.html

		interpretation that improves the decision-making process in restoration projects.	
N°2	Credibility and visibility of the innovation	AI applications are **well-established**, with strong credibility in environmental modelling and satellite data processing[109]. However, in the Danube region, most AI-driven environmental applications **remain project-based**, often within academic or EU-funded research networks, which may create a credibility gap between pilot success and widespread trust at the operational level.	**4**
N°3	Ease of adoption and implementation	AI-driven analysis can be scaled using **platforms** like Google Earth Engine[110] or ESA Regional Exploitation Platforms[111], which **allow processing of large datasets** without local high-performance computing. Moreover, **EU programmes** such as AI4Copernicus[112] or Destination Earth[113] **support capacity building and provide ready-to-use models**. However, adoption could be **constrained by uneven technical capacity, data management infrastructure, and varying institutional readiness** across Danube countries. Many environmental authorities, particularly in lower-income parts of the basin, lack staff trained in AI, and may rely on outdated data systems incompatible with AI workflows. Furthermore, cross-country differences in data quality and monitoring protocols make it difficult to deploy AI models consistently across the basin, limiting the effectiveness of scaling.	**3**
N°4	Benefits for adopters	AI-driven analysis offers **clear benefits**, including faster and more accurate environmental monitoring, improved decision-making, and enhanced planning for restoration interventions. However, **some benefits are indirect or long-term**: model outputs may require interpretation before informing actions, and quantifying immediate economic or ecosystem gains can be challenging, which may limit the perceived incentives for adoption. Furthermore, **implementation costs can be high**, especially for high-resolution imagery, and long-term maintenance of AI models.	**3**
N°5	Business case for investors	AI-driven analysis has strong **long-term potential**, as demand for predictive environmental data and digital monitoring tools is increasing across Europe. Investors can also **benefit indirectly through improved project efficiency and enhanced evidence-based decision-making**. However, the **business case is currently moderate**: high initial development costs, ongoing model maintenance, and long timeframes to translate environmental insights into measurable returns all limit immediate profitability. Additionally, **most AI applications in the Danube region remain publicly or grant-funded**, with few self-sustaining market models.	**3**
N°6	Enabling public sector environment	**EU frameworks** such as the Digital Europe Programme[114] create a **supportive environment** for AI adoption in environmental monitoring and restoration. However, **integration into public**	**4**

[109] Woodrich, S. T., & Pape, T. (2024). Ecological restoration and artificial intelligence: Whose values inform a project? Restoration Ecology, 32(4), Article e14128. https://doi.org/10.1111/rec.14128
[110] https://earthengine.google.com/
[111] https://eo4society.esa.int/projects/polar-tep/
[112] https://ai4copernicus-project.eu/
[113] https://destination-earth.eu/
[114] https://digital-strategy.ec.europa.eu/en/activities/digital-programme

		sector decision-making remains uneven: many institutions lack clear guidelines for AI procurement, ethical use, and long-term model maintenance. Coordination gaps, variable digital capacity, and limited institutional readiness across countries can also slow wider adoption and scaling.	

Challenges faced

AI-driven analysis in the Danube region faces several obstacles that may limit its wider adoption and scaling:

- Uneven technical capacity: Many local authorities and environmental agencies lack staff trained in AI, machine learning, or advanced geospatial analysis.
- Data quality and interoperability issues: Differences in data standards, monitoring protocols, and availability of high-resolution datasets across countries hinder consistent model deployment.
- High implementation costs: Initial setup, acquisition of high-resolution imagery, cloud processing, and long-term model maintenance can be expensive.
- Limited institutional readiness: Some institutions lack formal frameworks for AI procurement, ethical guidelines, and sustainable model integration.
- Uncertain financial returns: Benefits are often long-term, indirect, or non-monetary, making it challenging to attract private investment.

Results

The scalability assessment shows that AI-driven analysis has strong potential in the Danube basin, particularly in terms of relevance, benefits for adopters, and policy support. However, challenges remain in ensuring technical capacity, consistent data infrastructure, and financial sustainability, which may limit broader implementation. Overall, AI-driven analysis received a score of 22 out of 30, indicating it is a promising innovation that could significantly enhance ecosystem restoration if targeted capacity-building and data standardisation support are provided.

5.2. Economic and financial innovations

Equally important are novel approaches to funding and investment that secure long-term financing for restoration projects. 2 case studies are identified in this category.

5.2.1. Case study: Green bonds

Context and overview

Green bonds are financial instruments designed to fund activities or projects that support climate and environmental objectives. At the EU level, the market is supported by the EU's

Sustainable Finance Framework and the European Green Bond Standard, which enhance transparency and ensure alignment with the EU taxonomy[115].

In the Danube region, green bonds are increasingly viewed as a mechanism to attract socially responsible investors towards sustainability goals. For example, the European Bank for Reconstruction and Development (EBRD) invested €76 million in a green bond programme by VGP, supporting industrial and logistics assets in several Central and Southeastern European countries[116]. Similarly, the Integrated Green Bond Report of Hungary (2021) [117] provides detailed insights into the allocation and impact of the country's sovereign green bonds, demonstrating growing regional engagement in green finance. As these examples illustrate, the green bond market in the Danube Basin offers strong potential to fund nature-based and restoration-oriented investments aligned with EU environmental objectives.

Scalability assessment

The following table presents the scalability assessment of green bonds in the Danube region against 6 criteria.

Table 9 Innovation scalability assessment of green bonds.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	By definition, green bonds mobilise capital to finance investments that meet sustainability and climate objectives. Given the region's significant funding needs for ecosystem restoration and environmental infrastructure, green bonds represent a **highly relevant tool** for bridging the financing gap between policy ambition and on-the-ground implementation.	**5**
N°2	Credibility and visibility of the innovation	Green bonds are well-recognised financial instruments both globally and increasing in Europe. The introduction of the **European Green Bond Standard** strengthens credibility by aligning with the EU Sustainable Finance Framework and increasing transparency of green-labelled bonds. However, 13 EU Member States issued no green bonds in 2024, indicating **uneven market maturity across the region**[118].	**4**
N°3	Ease of adoption and implementation	Although the concept of green bonds is highly appealing, issuing one requires a **formal framework, robust monitoring and reporting systems, and typically an external review** to reassure investors, as shown in the guidance by IFC[119]. Romania's sovereign Green Bond Framework (Dec 2023)[120], prepared with technical support from the World Bank, illustrates how **national authorities can meet these requirements** but also underscores the **common reliance on international**	**3**

115 https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard-supporting-transition_en
116 https://www.ebrd.com/home/news-and-events/news/2025/ebrd-invests--76-million-in-vgp-green-bonds.html
117 https://akk.hu/download?path=631eea18-a51a-4084-866a-fbcee27e3625.pdf
118 https://www.eea.europa.eu/en/analysis/indicators/green-bonds-8th-eap
119 https://www.ifc.org/content/dam/ifc/doc/mgrt/202203-ifc-green-bond-handbook.pdf
120 https://thedocs.worldbank.org/en/doc/ee9ef873ff97db4156da749dc23abbd1-0340012024/original/Case-Study-Romania-green-bond-TA.pdf

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		expertise. However, in many Danube-region countries, **high transaction costs, limited domestic investor networks, and insufficient institutional capacity** remain important barriers to wider adoption.	
N°4	Benefits for adopters	Green bonds open **new financing avenues** for issuers, particularly **attracting ESG-oriented and impact investors** who typically do not engage with conventional debt instruments. In addition, they offer **reputational advantages** as investors increasingly prioritise sustainability credentials. However, ecosystem restoration projects typically deliver **benefits over long time horizons,** making it difficult to quantify financial returns or environmental impact within short reporting cycles. Furthermore, aligning bond-financed projects with measurable biodiversity or ecosystem outcomes remains complex due to **limited impact-tracking frameworks**[121]	**3**
N°5	Business case for investors	There is **growing investor demand and institutional appetite** for green bonds: by 2024, green bonds issued by corporations and governments across the EU accounted for 7% of total bonds, a significant rise from 4% in 2020[122]. However, the differences in investment needs and the lack of universally accepted green bond standards and definitions have resulted in **uneven development of green bond markets** across EU member states. Additionally, Cicchiello et al. (2022)[123] highlights that **issuer characteristics and corporate governance factors** (for example, current ratio, long debt, and independent director) might significantly affect the issuer's decision to opt for green bonds over conventional bonds.	**3**
N°6	Enabling public sector environment	The policy and regulatory environment in the EU provide **strong support for green bond development**. EU frameworks such as the European Green Bond Standard, the Sustainable Finance Disclosure Regulation, and the EU Taxonomy for Sustainable Activities enhance transparency and credibility in green bonds. At the national level, several coun**tries in the Danube region are beginning to establish frameworks and regulations to support green bonds**. For example, Romania's sovereign Green Bond Framework (2023) and Hungary's integrated green bond reporting (2021) demonstrate proactive government support for sustainable finance initiatives. However, the enabling environment is **not yet fully mature across all countries** in the region. Not all countries have adopted detailed green bond frameworks. And coordination gaps between ministries, regulators, and investors can slow adoption and create uncertainty for issuers. Sometimes, small governments or municipalities may lack the technical expertise or resources to develop credible green bond frameworks.	**4**

121 https://green-forum.ec.europa.eu/news/exploring-collaborative-finance-opportunities-connection-eu-nature-restoration-regulation-2025-06-02_en

122 https://www.eea.europa.eu/en/analysis/indicators/green-bonds-8th-eap

123 Cicchiello, A. F., Cotugno, M., Monferrà, S., & Perdichizzi, S. (2022). Which are the factors influencing green bonds issuance? Evidence from the European bonds market. *Finance Research Letters, 50*, 103190. https://doi.org/10.1016/j.frl.2022.103190

Challenges faced

Despite their strong potential, the wider uptake and replication of green bonds in the Danube region are limited by several structural, regulatory, and market-related factors:

- Regulatory and framework gaps: Not all countries have established detailed green bond guidelines or monitoring/reporting frameworks.
- Institutional capacity constraints: Smaller governments or municipalities may lack technical expertise, investor networks, or resources to design and issue green bonds independently.
- High transaction costs: Developing frameworks, obtaining external reviews, and ensuring ESG compliance can be costly, particularly for first-time issuers.
- Impact measurement challenges: Long-term ecosystem restoration benefits are difficult to quantify within short reporting cycles, and standardised metrics for environmental outcomes are not always available.
- Uneven market development: Differences in investment needs, governance structures, and corporate characteristics influence both issuer adoption and investor confidence, creating variation across the region.

Results

The scalability assessment shows that green bonds score highly in terms of relevance, policy support, and credibility, confirming their strong potential to mobilise capital for ecosystem restoration and sustainable infrastructure in the Danube region. However, challenges remain in ensuring widespread adoption, effective implementation, and reliable quantification of long-term environmental benefits. Overall, green bonds received a total score of 22 out of 30, reflecting a promising but still emerging innovation that could be further expanded with improved regulatory frameworks and market development.

5.2.2. Case study: PES

Context and overview

Payments for ecosystem services, also known as payments for environmental services, refers to arrangements through which the beneficiaries of environmental services reward those whose lands provide these services with subsidies or market-based payments, thereby creating financial incentives to maintain or restore ecosystems that deliver essential services[124].

In the Danube Basin region, PES has been promoted as a tool to support ecosystem restoration, conservation and sustainable land-use. For example, the WWF Danube-Carpathian Programme has implemented a project “Promoting Payments for Ecosystem Services and Related Sustainable Financing Schemes in the Danube Basin”, with the aim of demonstrating and promoting PES and other sustainable financing schemes in the Lower Danube river basin[125].

[124] https://environment.ec.europa.eu/economy-and-finance/ensuring-polluters-pay/payments-ecosystem-services_en
[125] https://www.icpdr.org/publications/promoting-payments-ecosystem-services-danube-basin

Scalability assessment

The following table presents the scalability assessment of PES in the Danube region against 6 criteria.

Table 10 Innovation scalability assessment of PES.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	The **problems addressed by PES** (for example: ecosystem service decline, land-use change, floodplain degradation, water quality issues) **are significant** in the Danube region. The region has high value ecosystem services and restoring them is important for resilience, biodiversity and human well-being.	**5**
N°2	Credibility and visibility of the innovation	In the Danube region, PES have demonstrated **credible and observable results through pilot initiatives** led by the WWF Danube-Carpathian Programme, in cooperation with ICPDR, UNDP/GEF, as well as national ministries. However, **broader replication and long-term monitoring remain limited**, with most initiatives dependent on donor funding and lacking standardised evaluation frameworks to demonstrate impact at scale. Additionally, the **awareness among local stakeholders and policymakers is still uneven**, many of whom still perceive ecosystem restoration as a public responsibility rather than an economic opportunity.	**4**
N°3	Ease of adoption and implementation	Initiatives such as WWF Danube-Carpathian Programme have shown that the PES approach **can be implemented effectively** at a local and pilot scale. However, scaling up remains challenging due to several factors. One of the main challenges of establishing PES lies in the **complexity of assessing and quantifying the ecosystem services**[126]. Another barrier to PES adoption is **the insecure land and resource tenure** faced by many smallholders and marginalised groups, which limits their ability to participate in and benefit from schemes. Additionally, **complex bureaucratic procedures and high transaction and administrative costs** often make PES projects difficult to implement efficiently[127].	**3**
N°4	Benefits for adopters	Through PES, adopters receive **direct financial compensation** for managing land in ways that maintain or restore ecosystem services. These benefits can complement existing agricultural or forestry incomes, making adoption economically attractive and incentivizing sustainable land-use practices. However, although these economic incentives exist, the majority of PES funding currently comes from public or donor sources, which limits the long-term sustainability and predictability of payments. For PES to drive broader adoption and become a stable income stream for adopters, **more diversified financing mechanisms will be needed**.	**4**
N°5	Business case for investors	PES presents a **promising opportunity** for investors as it links measurable environmental outcomes with potential economic returns. However, **quantifying the monetary value of**	**3**

[126] https://www.unep.org/resources/report/payments-ecosystem-services-getting-started
[127] https://www.iied.org/markets-payments-for-environmental-services

		ecosystem services can be challenging[128]**,** which complicates investment decisions. In addition, most current PES initiatives rely heavily on public funding, and market-based or private investment mechanisms remain limited, making the business case **less predictable and somewhat risky for purely private actors**.	
N°6	Enabling public sector environment	At policy level, the PES concept is **aligned with EU-level frameworks** in the Danube region (e.g., the Water Framework Directive, EU Biodiversity Strategy, CAP rural development instruments, Natura 2000). For example, **WWF has set up PES schemes** to introduce economic incentives to support land managers in the lower Danube basin[129]. National and regional governments, in coordination with bodies, like the ICPDR and the WWF, have begun **integrating PES into river basin management and conservation planning**. However, the enabling environment is **not yet fully mature**: institutional capacity varies across countries, legal frameworks for PES contracts are still developing, and long-term funding mechanisms remain limited.	**4**

Challenges faced

The scalability assessment highlights several factors that may limit the wider uptake and replication of PES in the Danube region:

- Complexity of assessing ecosystem services. Quantifying, monitoring, and verifying environmental services can be technically challenging and costly.
- Insecure land and resource tenure. Many smallholders and marginalised groups face unclear land rights, limiting their ability to participate in PES schemes.
- Dependence on public funding and limited private investment. Current PES initiatives rely heavily on external funding, which affects long-term sustainability and predictability of payments. Market-based or private investment mechanisms remain underdeveloped, making the business case for investors less attractive.
- Uneven stakeholder awareness and engagement. Local stakeholders and policymakers often lack understanding of PES, reducing adoption and visibility.

Results

The scalability assessment indicates that PES is a highly promising innovation for ecosystem restoration in the Danube region. It addresses critical environmental issues (score 5/5), demonstrates credible results and stakeholder engagement (4/5), and provides meaningful benefits to adopters (4/5). However, challenges remain in scaling up due to technical, institutional, and financial constraints (Ease of adoption 3/5, Business case 3/5). With stronger institutional support, diversified financing, and improved monitoring and awareness, PES has significant potential to expand its impact across the Danube Basin (Enabling environment 4/5).

[128] Boithias, L., Terrado, M., Corominas, L., Ziv, G., Kumar, V., Marqués, M., Schuhmacher, M., & Acuña, V. (2016). Analysis of the uncertainty in the monetary valuation of ecosystem services: A case study at the river basin scale. Science of the Total Environment, *543*(Pt A), 683–690. https://www.sciencedirect.com/science/article/abs/pii/S0048969715310470

[129] https://wwf.panda.org/discover/knowledge_hub/where_we_work/black_sea_basin/danube_carpathian/our_solutions/green_economy/pes/the_danube_pes_project/

5.3. Social innovations

Beyond technology and finance, social innovation emphasises empowering local actors and strengthening community engagement in restoration.

5.3.1. Case study: Public participation mechanisms

Context and overview

Public participation mechanisms refer to processes and tools that enable citizens, local communities and stakeholders to engage in decision-making, planning, monitoring and restoration of ecosystems. Forms, methods and purposes of participation vary widely. Within the Danube River basin, as restoration activities progress, public participation stimulates creativity, generates knowledge and mobilises action[130].

Scalability assessment

The following table presents the scalability assessment of public participation mechanisms in the Danube region against 6 criteria.

Table 11 Innovation scalability assessment of public participation mechanisms.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	In the Danube region, where restoration often intersects with diverse land uses, cultural values, and transboundary management, engaging citizens and stakeholders is **essential to balance ecological and socio-economic interests**. Participation enhances collective responsibility, aligning local knowledge and community priorities with EU environmental and climate objectives.	**5**
N°2	Credibility and visibility of the innovation	The concept is credible and recognised: EU policy and literature emphasise citizen engagement in environmental governance. For example, the EEA briefing underscores **participation as driving force of the transition**[131]. While stakeholder consultation mechanisms exist under the EU Water Framework Directive, the **depth and quality of participation vary widely among Danube countries**[132]. The **evaluation of the effectiveness and outcomes of public involvement is often missing**[133].	**3**

[130] https://www.eea.europa.eu/en/analysis/publications/the-case-for-public-participation
[131] https://www.eea.europa.eu/en/analysis/publications/the-case-for-public-participation
[132] https://www.icpdr.org/sites/default/files/nodes/documents/danube_river_basin_managament_plan_-_update_2021_full_text.pdf
[133] https://www.euwipluseast.eu/images/2021/07/PDF/EUWI__Guidance_RBMP_PublicParticipation_ENG.pdf

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N°3	Ease of adoption and implementation	Public participation mechanisms are **conceptually easy to initiate**, as many local and regional authorities in the Danube region have experience with participatory planning through river basin committees, municipal councils, or EU-funded restoration projects. However, meaningful engagement requires **stakeholders being well-informed about the objectives and structure**[134]. Moreover, effective implementation often demands **specialised facilitation and communication capacities** to ensure inclusive participation across diverse groups (Perosa et al., 2021)[135].	**4**
N°4	Benefits for adopters	Public participation mechanisms generate multiple benefits for adopters. They **improve legitimacy and public commitment to environmental strategies**, making it more likely that outcomes will be accepted and implemented successfully[136]. Yet **quantifying these benefits (especially in economic terms) is challenging** and indirect.	**4**
N°5	Business case for investors	While these mechanisms can reduce project risk, improve legitimacy, and enhance long-term success, **the benefits are largely social and environmental** rather than monetary. Investors may indirectly benefit from reduced conflicts or improved stakeholder relationships, but these **outcomes are difficult to quantify and monetise**. Therefore, the business case for investors is relatively weak.	**3**
N°6	Enabling public sector environment	Policies, legal frameworks and guidelines in Europe (e.g., the Aarhus Convention[137], OECD guidelines[138]) provide a **supportive environment for participation**. While legal frameworks exist, imple**mentation varies considerably across countries**. Some countries still lack sufficient institutional capacity, well-defined participatory procedures, or effective cross-sector coordination, which can limit the meaningful engagement of stakeholders in restoration projects[139].	**4**

Challenges faced

Public participation mechanisms in the Danube region face several barriers that may limit their wider uptake and replication:

- Institutional and capacity constraints: Some local authorities lack the expertise, facilitation skills, or resources to conduct meaningful engagement.
- Limited evaluation and visibility: Many pilot projects do not include rigorous monitoring or assessment of outcomes, making it difficult to demonstrate effectiveness.

[134] https://www.icpdr.org/tasks-topics/tasks/public-participation
[135] Perosa, F., Gelhaus, M., Zwirglmaier, V., Arias-Rodriguez, L. F., Zingraff-Hamed, A., Cyffka, B., & Disse, M. (2021). Integrated Valuation of Nature-Based Solutions Using TESSA: Three Floodplain Restoration Studies in the Danube Catchment. *Sustainability*, *13*(3), 1482. https://doi.org/10.3390/su13031482
[136] https://www.eea.europa.eu/en/analysis/publications/public-participation-contributing-to-better
[137] https://unece.org/environment-policy/public-participation/aarhus-convention/text
[138] https://www.oecd.org/en/publications/2022/09/oecd-guidelines-for-citizen-participation-processes_63b34541.html
[139] https://www.icpdr.org/tasks-topics/tasks/river-basin-management/danube-river-basin-management-plan-2021

- Indirect benefits: Social and environmental benefits are often hard to quantify, particularly in economic terms, which may reduce incentives for both adopters and investors.
- Variable implementation: While legal frameworks exist, the quality and depth of participatory processes differ widely among countries.
- Coordination gaps: Cross-sector collaboration and integration into national policy cycles are inconsistent, affecting the efficiency and sustainability of participatory processes.

Results

The scalability assessment shows that public participation mechanisms are highly relevant and socially beneficial in the Danube region, scoring especially well in terms of importance, ease of adoption, and enabling environment. However, challenges remain in ensuring credibility, measurable benefits, and an attractive business case for investors. Overall, public participation received a score of 23 out of 30, indicating a promising innovation that can strengthen ecosystem restoration if institutional capacity, evaluation, and coordination are improved.

5.3.2. Case study: Knowledge sharing programmes

Context and overview

Knowledge sharing programmes are initiatives aimed at exchanging information, experiences, and best practices among stakeholders. They often include workshops, online platforms, training modules, and collaborative networks to facilitate learning across sectors and countries. In the Danube region, projects like the Horizon initiative Connecting Nature[140] organise webinars, campaigns, and workshops to build capacity for nature-based economies and sustainable solutions. These activities help local communities and stakeholders acquire the knowledge and skills necessary to actively participate in restoration.

Scalability assessment

The following table presents the scalability assessment of knowledge sharing programmes in the Danube region against 6 criteria.

Table 12 Innovation scalability assessment of knowledge sharing programmes.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	Knowledge sharing programmes **address the need for knowledge transfer to improve restoration outcomes**, particularly in the Danube context. They enhance the ability of stakeholders to adopt innovative practices, respond to environmental challenges, and align with EU directives such as the Water Framework Directive.	**5**

[140] https://connectingnature.eu/

N°2	Credibility and visibility of the innovation	**Well-established programmes** such as the ICPDR training modules, Danube Learning Partnership[141], and Interreg knowledge-sharing initiatives have a credible **reputation among regional stakeholders**. Their outcomes (such as workshops, guidelines, and online resources) are generally visible to participants. However, visibility to broader public or cross-sector audiences is still limited, and systematic evaluation of effectiveness of programmes is often lacking.	**4**
N°3	Ease of adoption and implementation	Conceptually, knowledge sharing programmes are **easy to initiate**, can build on existing communication channels and learning platforms. However, their **effective implementation depends on several factors**: sufficient institutional capacity, stable funding, dedicated stakeholder engagement, and alignment in cross border regulatory frameworks.	**3**
N°4	Benefits for adopters	Adopters **benefit from enhanced knowledge, access to proven methodologies, and networking opportunities**. Learning from others could improve restoration effectiveness and reduce errors. Yet, **benefits are mostly qualitative and indirect**, and the impact of the programmes on measurable ecosystem outcomes may take time to materialise.	**4**
N°5	Business case for investors	While such programmes exert many benefits, they **rarely generate direct financial returns**, limiting their attractiveness to private investors. **Funding is mostly public**. Nonetheless, effective knowledge transfer can indirectly reduce costs and project risks, which may appeal to **socially responsible investors** supporting ecosystem restoration.	**3**
N°6	Enabling public sector environment	EU policy frameworks, Interreg programmes, and transnational initiatives all **support and encourage knowledge exchange**. National agencies in the Danube region often participate in such programmes. However, uneven institutional capacity and inconsistent coordination across sectors can sometimes limit its long-term sustainability.	**4**

Challenges faced

Knowledge-sharing programmes in the Danube region face several structural and operational barriers that limit their overall efficiency and scalability.

- Institutional capacity constraints: including limited staff, high turnover, and insufficient expertise in some authorities can hinder consistent participation and follow-up.
- Funding instability. as many programmes rely heavily on short project cycles (e.g., Interreg), reducing continuity and long-term knowledge retention.
- Cross-border differences in regulatory frameworks, data standards, and administrative cultures often make it difficult to transfer practices uniformly across countries.

Results

The scalability assessment shows that knowledge-sharing programmes play a highly relevant role in the Danube basin, particularly in strengthening institutional capacity, improving coordination, and supporting the uptake of innovative restoration practices. Their credibility and policy alignment are strong, and they provide clear, though often qualitative, benefits for

[141] https://www.iawd.at/eng/danube-toolbox/d-leap/

adopters. However, challenges remain in ensuring sustained funding, balanced participation across countries, and consistent follow-up that translates shared knowledge into operational improvements; also, some stakeholders might not feel the need to learn more about a specific issue. Overall, knowledge-sharing programmes received a score of 23 out of 30, indicating that they are a valuable and scalable innovation, provided that long-term institutional support and stronger evaluation mechanisms are developed.

5.4. Policy and governance innovations

Finally, there are innovative approaches to governance, policy-making, and cross-sectoral coordination.

5.4.1. Case study: Cross-sectoral and cross-border partnerships

Context and overview

Cross-sectoral and cross-border partnerships involve collaboration between multiple stakeholders, including governments, NGOs, research institutions, local communities, and the private sector, across national boundaries and administrative sectors. In the Danube region, these partnerships are particularly important because the river basin spans 19 countries with diverse political, institutional, and ecological contexts. Existing examples include the International Commission for the Protection of the Danube River (ICPDR), which coordinates water management and restoration actions across member states, initiatives like DANUBEPARKS[142], a network of protected areas promoting joint biodiversity and ecosystem management, and Living Danube Partnership[143], a cross-sector collaboration that unites various stakeholders to improve watershed health in the Danube basin. These partnerships facilitate knowledge sharing, align policies, and coordinate restoration efforts at a scale that single actors cannot achieve alone, supporting the implementation of EU directives (e.g., Water Framework Directive, Habitats Directive) and transboundary environmental goals.

Scalability assessment

The following table presents the scalability assessment of cross sectoral and cross border partnerships in the Danube region against 6 criteria.

Table 13 Innovation scalability assessment of cross sectoral and cross border partnerships.

Innovation scalability assessment			
Criteria		**Assessment**	**Score**
N°1	Importance of the issue addressed	Cross-sectoral and cross-border partnerships are **essential** in the Danube region because ecosystem restoration often spans multiple countries and sectors, requiring coordinated action to **address transboundary challenges** such as water quality, flood management, and biodiversity loss. These partnerships **align policies, and coordinate restoration** efforts at a scale that	**5**

[142] https://danubeparks.org/
[143] https://wwfcee.org/partnerships/the-living-danube-partnership

		single actors cannot achieve alone, supporting the implementation of EU directives and transboundary environmental goals.	
N°2	Credibility and visibility of the innovation	Partnerships like the ICPDR and EUSDR have a **credible track record and are visible** to policymakers, stakeholders, and the public. Joint reports, monitoring platforms, and coordinated restoration projects demonstrate tangible outcomes. However, the **impact of some partnerships is unevenly documented**, and smaller or newer initiatives may lack visibility or systematic evaluation[144].	**4**
N°3	Ease of adoption and implementation	Conceptually, partnerships possess the **flexibility to adapt to diverse contexts and operate within existing institutional frameworks**. However, their effective implementation requires **robust coordination capacities, clear governance structures, and commitment from multiple stakeholders**. Therefore, without sufficient facilitation and support, scaling these partnerships across the Danube region remains challenging.	**3**
N°4	Benefits for adopters	Cross-sectoral and cross-border partnerships enable adopters to **share knowledge, technical expertise, pool resources and access wider funding networks**, which enhances implementation efficiency and legitimacy of restoration initiatives[145]. For example, the RISE project fosters cooperation among 22 organisations across borders of 11 countries from Danube region[146]. However, these **benefits are often qualitative** rather than immediately quantifiable, and the **effort required to maintain collaboration can be resource-intensive**, which may offset or delay tangible gains.	**4**
N°5	Business case for investors	While transboundary cooperation improves coordination, it often depends on public funding and **rarely generates direct financial returns** for investors as the benefits are mostly social, environmental, and governance-related rather than profit-driven [147]. The **complexity of cross-border arrangements** may also deter private investors. One example is the Living Danube Partnership, which demonstrates how partnerships attract funding from foundations and EU programs[148].	**3**
N°6	Enabling public sector environment	The EU provides a **supportive policy environment** for cross-sectoral and cross-border partnerships through directives such as the Water Framework Directive, Habitats Directive, and regional initiatives like the EUSDR. However, **implementation is uneven across the Danube countries**: institutional capacity, political commitment, and coordination mechanisms vary, affecting partnership effectiveness[149].	**4**

[144] https://danube-region.eu/wp-content/uploads/2019/12/EUSDR_OperationalEvaluation_2019.pdf
[145] https://link.springer.com/chapter/10.1007/978-3-030-72124-4_14
[146] https://interreg-danube.eu/projects/rise/results/136
[147] https://www.icpdr.org/tasks-topics/tasks/river-basin-management/danube-river-basin-management-plan-2021
[148] https://wwfcee.org/partnerships/the-living-danube-partnership
[149] https://westernbalkans-infohub.eu/wp-content/uploads/2025/01/EUSDR-Implementation-Report_2022-23.pdf

Challenges faced

Cross-sectoral and cross-border partnerships in the Danube region encounter several barriers that can limit their wider adoption and replication:

- Coordination and governance requirements: Effective implementation demands strong coordination, clear governance structures, and sustained commitment from multiple stakeholders, which can be difficult to maintain across countries.
- Resource intensity: Maintaining partnerships requires significant administrative effort, facilitation, and technical expertise, which can offset or delay tangible benefits.
- Limited direct financial incentives: Benefits for investors are largely social, environmental, or governance-related rather than profit-driven, reducing private investment appeal.
- Uneven documentation and visibility: Smaller or newer initiatives often lack systematic evaluation, making it difficult to demonstrate outcomes and best practices.
- Variable enabling environment: Institutional capacity, political commitment, and coordination mechanisms differ across countries, affecting the ability to scale and sustain partnerships.

Results

The scalability assessment shows that cross-sectoral and cross-border partnerships are highly relevant and provide substantial benefits in coordinating restoration efforts across multiple countries. They score strongly in terms of importance, credibility, and enabling policy environment. However, challenges remain in achieving uniform visibility, ease of replication, and financial attractiveness for investors. Overall, these partnerships received a score of 23 out of 30, highlighting their strong potential as a governance innovation to support ecosystem restoration in the Danube region, provided coordination and capacity constraints are addressed.

6. Blueprint for upscaling

6.1. Shortlisting of promising innovations to be scaled up

The following table presents the summary of the scalability assessment of the nine innovations assessed across the Danube region.

Table 14 Summary of the innovation scalability assessment.

Innovation scalability assessment								
Innovation type	Case studies	Score for each criteria number (/5)						Total score (/30)
		N°1	N°2	N°3	N°4	N°5	N°6	
Technological innovation	NBS	5	4	4	4	4	4	25
	Biomimicry-based design	4	3	2	3	3	3	18
	Remote sensing technologies	5	4	3	3	3	4	22
	AI-driven analysis	5	4	3	3	3	4	22
Economic and financial innovation	Green bonds	5	4	3	3	3	4	22
	PES	5	4	3	4	3	4	23
Social innovation	Public participation mechanisms	5	3	4	4	3	4	23
	Knowledge sharing programs	5	4	3	4	3	4	23
Policy and governance innovation	Cross-sectoral and cross-border partnerships	5	4	3	4	3	4	23

When it comes to the innovations assessed, the followings can be observed:

- **NBS** emerge as **the most promising innovation**, achieving the highest score (25/30) due to their strong relevance, maturity, and broad policy alignment.
- They are followed closely by **PES, public participation mechanisms, knowledge-sharing programmes, and cross-sectoral partnerships**, each scoring 23/30.
- Technological and financial innovations such as **remote sensing, AI-driven analysis, and green bonds score** slightly lower (22/30), reflecting their high potential but also constraints related to technical capacity, data needs, and financial viability.
- **Biomimicry-based design** scores the lowest (18/30), mainly due to limited applicability across restoration contexts.

Overall, biomimicry-based design shows the lowest potential for upscaling (at least, at the current conditions) and can be taken out of further analysis in the context of WP5. In contrast, **all other case studies show quite a good potential for upscaling in the region**, as their total scores are pretty close: **all of them will thus be further investigated** as part of deliverable D5.3.

6.2. Strength and challenges for upscaling promising innovations in ecosystem restoration in the Danube region

At the same time, the table above also provides precious indications on the main opportunities and challenges to upscaling inn ovation in ecosystem restoration in the Danube region. More in detail:

- **Criterion 1: All case studies address important issues**, including for examples a range of environmental and societal challenges (e.g. climate change, ecosystem degradation, hydrological dynamics, land use changes,), financing gaps, balance between ecological and socio-economic interests, knowledge transfer needs, transboundary challenges.

- **Criterion 2: most case studies are fairly credible and observable by key stakeholders.** In this respect, to be credible and observable, public participation mechanisms need some greater attention in the way the outcomes, as well as the evaluation of their effectiveness, is measured and reported back to the public: in fact, these steps are often overlooked, undermining the credibility of the processes.

- **Criterion 3: the ease with which the innovation can be effectively adopted and implemented can be a weak point** of several innovations assessed as part of this Task. For this reason, this is analysed in more detail below.

- **Criterion 4:** in the case of ecosystem restoration, **the benefits are not always immediately visible, and are normally fully realised over the long term**. This can be a weak point for upscaling remote sensing technologies, AI-drive analysis, green bonds and PES schemes, and it is further analysed below.

- **Criterion 5:** several of the assessed innovations can **struggle in providing an attractive business case for investors**. This is analysed in more detail below.

- **Criterion 6: the public sector enabling environment is fairly favourable** to upscaling restoration in ecosystem restoration in all retained case studies, especially regarding the provision of public funding and grants to the implementation of these solutions.

The tables below provide a more detailed analysis of the three main weaknesses identified by the analysis; in some cases, it can be seen that some challenges are common to more than one instrument.

Table 15 Main challenges to upscaling of the assessed innovations with respect to their ease of adoption.

	Case studies	Main challenges to adoption
Criterion 3: Ease of adoption	NBS	Institutional capacity limitations / institutional readiness Uneven (or lack of) skills and technical capacity, in particular at the level of local authorities Technical complexity Infrastructural and governance challenges
	Remote sensing technologies	
	AI-driven analysis	
	Green bonds	Limited domestic investor networks Institutional capacity
		High transaction and/or administrative costs
	PES	
		Assessing and quantifying ecosystem services Insecure land and resource tenure
	Knowledge-sharing mechanisms	Sufficient institutional capacity Stable funding
		Dedicated stakeholder engagement and/or commitment from multiple stakeholders Alignment in cross border regulatory frameworks.
	Cross-sectoral and cross-border partnerships	
		Coordination capacities Clear governance structures

Table 16 Main challenges to upscaling of the assessed innovations with respect to the benefits they can offer to adopters.

	Case studies	Main challenges to upscaling
Criterion 4: Benefits for adopters	**All innovations listed below**	**The benefits of ecosystem restoration actions are not always immediately visible or quantifiable**
	Remote sensing technologies	As above
	AI-driven analysis	Model outputs may require interpretation before informing actions High implementation costs
	Green bonds	Aligning bond-financed projects with measurable biodiversity or ecosystem outcomes remains complex due to limited impact-tracking frameworks
	PES	Quantification of the value of ecosystem services
		The business case less predictable and somewhat risky for purely private actors

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Table 17 Main challenges to upscaling of the assessed innovations with respect to the attractiveness of the business case for investors.

	Case studies	Main challenges to adoption
Criteria 5: Business case for investors	**All innovations listed below**	**Current experiences are largely publicly or grant-funded**
	Remote sensing technologies	Uncertain timeframe for economic returns Initial setup costs of these technologies
	AI-driven analysis	High initial development costs Ongoing model maintenance Long timeframes to translate environmental insights into measurable returns all limit immediate profitability
	Green bonds	Differences in investment needs, lack of universally accepted green bond standards and definitions uneven development of green bond markets across EU MS Issuer characteristics and corporate governance factors might significantly affect the issuer's decision to opt for green bonds over conventional bonds
	PES	Quantification of the value of ecosystem services The business case is less predictable and somewhat risky for purely private actors
	Public participation mechanisms	These mechanisms rarely generate direct financial returns
	Knowledge-sharing mechanisms	
	Cross-sectoral and cross-border partnerships	Complexity of cross-border arrangements

Key messages emerging from the scalability assessment

The importance of the issues addressed, the credibility and observability of innovations and the public sector enabling environment can be seen as **key strengths** in upscaling innovation in ecosystem restoration in the Danube region.

In contrast, the **main weaknesses** are the ease with which the innovation can be effectively adopted and implemented, the visibility of the benefits of ecosystem restoration and the provision of attractive business case for investors.

6.3. Upscaling innovation in the Danube region by strengthening the pillars of the innovation ecosystem

In order to understand how these insights can be helpful in supporting the upscaling of innovation in ecosystem restoration in the Danube region, it is useful to go back to the main pillars of an innovation ecosystem – as it presented in D5.1 of the EcoDaLLi project.

Three main pillars allow constructing an innovation ecosystem: Actors, Enabling Environment, and the existing Resources.

If we look at the challenges to the upscaling of assessed innovations listed in section 6.2 above, it can be seen that these are undermining all three pillars of the innovation ecosystem: **if these weaknesses are not addressed, the risk is that the innovation ecosystem supporting NBS in the Danube region remains just an idol with feet of clay**.

Instead, **if we want an innovation ecosystem able to support the upscaling of the assessed innovation, we need to strengthen current weaknesses** and, thus, address the challenges highlighted in the scalability assessment – as illustrated in the figure below, where the challenges highlighted in section 6.2 are represented as "cracks" in the three pillars.

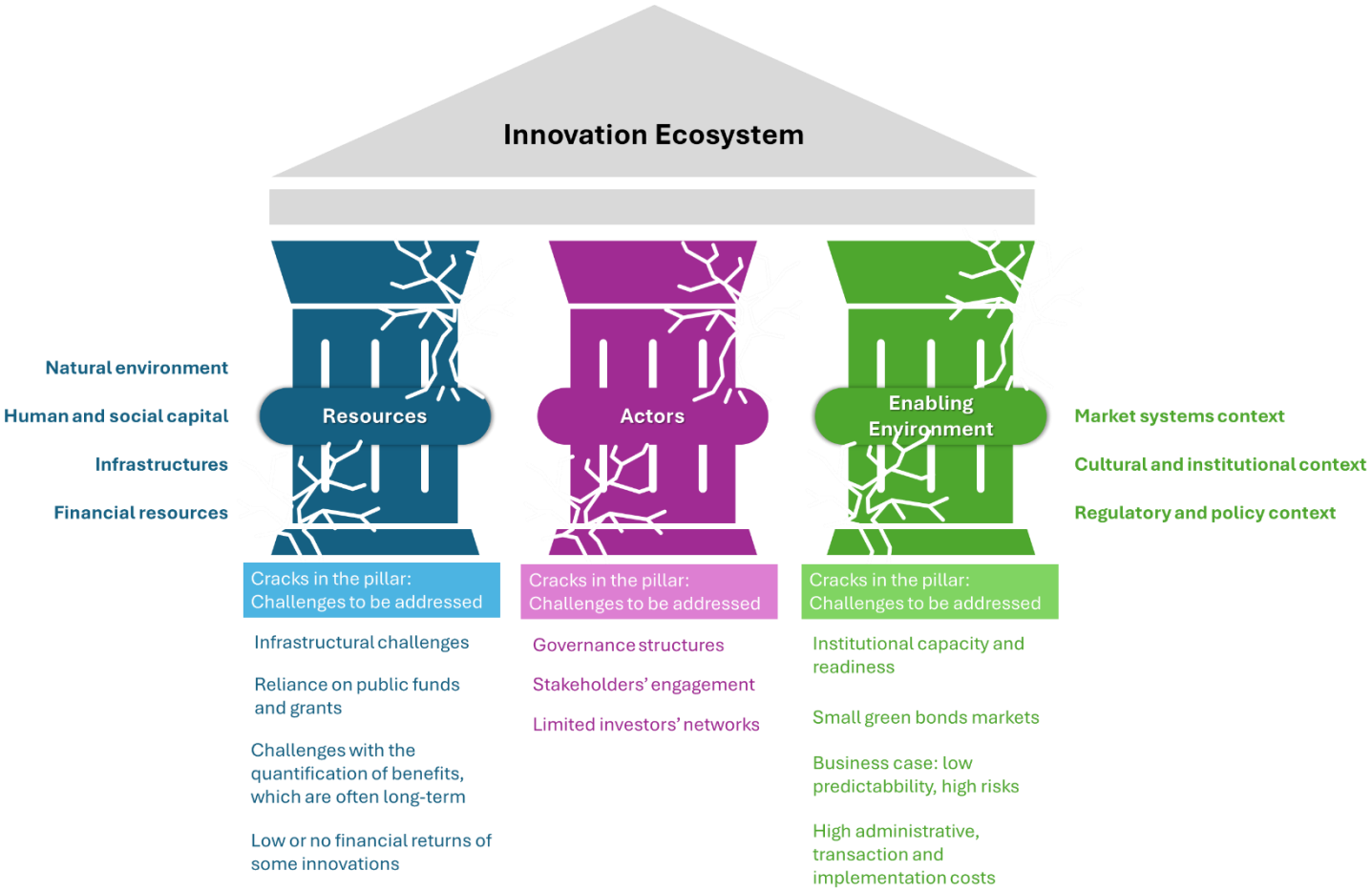

Figure 14 The pillars of innovation ecosystem and the challenges undermining them in the Danube region with respect to innovation in ecosystem restoration (Source: own elaboration based on D5.1 of the EcoDaLLi project and findings presented in chapter 5 and 5 of this deliverable).

7. Conclusion and next steps

7.1. Summary of insights

The guidebook supporting innovation in ecosystem restoration in the Danube region

The guidebook was developed based on previous work as part of Task 5.1, and it aims to:

- Provide **actionable insights** and practical guidance tailored to the specific needs of innovation actors in the region; and
- Assist in identifying and understanding the **types of support** available and how to access them.

The contents of the guidebook reflect the needs of key stakeholders in the Danube region with respect to innovation in ecosystem restoration, which were investigated as part of this task. In particular, the guidebook provides information and insights on the following topics:

- **Financial support** (grants, venture capital, subsidies), as this access to funding remains the most critical barrier to scaling innovation.
- **Market intelligence** and networking opportunities, responding to stakeholders' need for better access to market data, visibility, and collaboration platforms to foster connections and synergies within the regional innovation ecosystem.
- **Regulatory procedures**, addressing strong concern over complex or unclear regulations that can hinder or delay innovation processes, particularly in areas related to ecosystem restoration and sustainability.
- Access to **expert mentoring and coaching**, highlighting the importance of strategic guidance, experience-sharing, and individual support throughout different innovation stages.
- **Training on business models and commercialisation** and tailored consulting on business model design and market analysis, as these were recognised as valuable enablers.

These support services are seen as essential for helping innovators refine their strategies, improve market readiness, and successfully scale their solutions.

The guidebook will also be available as a separate pdf document for free download on the EcoDaLLi portal[150].

Innovation in ecosystem restoration in the Danube region: the potential for upscaling of available case studies and innovation types

An innovation scalability assessment was performed for each of the nine innovation types identified in the Danube river basin with respect to ecosystem restoration.

The assessment identified **NBS** as **the most promising innovation**, achieving the highest score due to their strong relevance, maturity, and broad policy alignment. They are followed

[150] https://portal.ecodalli.eu/

closely by **PES, public participation mechanisms, knowledge-sharing programmes, and cross-sectoral partnerships.** Technological and financial innovations such as **remote sensing, AI-driven analysis, and green bonds** got a slightly lower score, reflecting their high potential but also constraints related to technical capacity, data needs, and financial viability. All these case studies show quite a good potential for upscaling in the region, as their total scores are pretty close: **all of them will thus be further investigated as part of this deliverable as well as D5.3**.

In contrast, biomimicry-based design shows the lowest potential for upscaling mainly due to limited applicability across restoration contexts, and it was decided to exclude this typology from further assessments under WP5.

At the same time, it is worth noting that, although some innovation types score higher than others, in practice many effective solutions are combinations of multiple types: in this sense, upscaling NBS and ecosystem restoration often relies on integrating different innovations rather than focusing on a single "highest-scoring" type. How to combine innovation solutions in an upscaling perspective will be further investigated in D5.3. The **importance of the issues addressed**, the **credibility and observability** of innovations and the **public sector enabling environment** can be seen as **key strengths** in upscaling innovation in ecosystem restoration in the Danube region.

In contrast, the **main weaknesses** are the ease with which the innovation can be effectively adopted and implemented, the visibility of the benefits of ecosystem restoration and the provision of attractive business case for investors.

If we look at the challenges to the upscaling of assessed innovations it can be seen that these are undermining all three pillars of the innovation ecosystem (resources, actors and enabling environment): if these weaknesses are not addressed, the risk is that the innovation ecosystem supporting NBS in the Danube region remains just an idol with feet of clay. Instead, **if we want an innovation ecosystem able to support the upscaling of the assessed innovation, we need to strengthen current weaknesses** and, thus, address the challenges highlighted in the scalability assessment.

7.2. Next steps: Upscaling innovation in ecosystem restoration in the Danube region

The final months of WP5 of the EcoDaLLi project will bring the work done so far on upscaling innovation one step forward along the innovation upscaling cycle – and, in particular, it will focus on **leveraging resources for upscaling**.

As part of this phase, the knowledge gained so far as part of WP5 will be used to **demonstrate the potential of the innovation**, **which can attract additional resources** from governments, the private sector, and other partners, potentially also leading to broader alliances and policy changes.

While conducting this work, it will be key to **concentrate on the challenges to upscaling highlighted in this deliverable**, which can undermine to different extent the three pillars of the innovation ecosystem for NBS in the Danube region (resources, actors and enabling environment).

The ultimate objective of this work, which will be presented in D5.3, will be to identify **actionable paths to strengthen the innovation ecosystem in the region to upscale the promising innovations** identified so far.

Annex I: Survey: Identifying Innovation Needs in the Danube Basin

Objective

The objective of this survey is to collect information on the needs and priorities of innovators in the Danube region. The insights gathered will contribute to the development of a guidebook aimed at supporting innovation in the region.

Thank you for participating in this survey! Your input will help us develop practical guidance to support innovation in the Danube Basin. The survey takes about **5 minutes** to complete.

Section 1: General Information

1. **What type of organization do you represent?** *(Multiple choice, select one)*
    - Startup
    - SME (< 50 FTE)
    - Large company (> 50 FTE)
    - Research institution
    - Government agency
    - NGO
    - Other (please specify)
2. **Which sector is your innovation activity related to?** *(Multiple choice, select all that apply)*
    - Coastal and marine ecosystem restoration
    - Freshwater ecosystem restoration
    - Sustainable fisheries and aquaculture
    - Climate adaptation and nature based solutions
    - Circular economy and waste management
    - Digital and technological solutions for ecosystem restoration
    - Other (please specify)

Section 2: Innovation Needs & Barriers

3. **What are the three main challenges you face in developing or scaling innovation?** *(Multiple choice, select up to 3)*
    - Lack of funding
    - Limited access to technical expertise
    - Regulatory barriers
    - Difficulty accessing markets
    - Lack of infrastructure or facilities
    - Weak collaboration networks
    - Other (please specify)
4. **What type of support would help address these challenges?** *(Multiple choice, select all that apply)*
    - Financial support (grants, venture capital, subsidies)
    - Access to expert mentoring & coaching
    - Training on business models & commercialization
    - Market intelligence & networking opportunities
    - Market analysis (guidance/training)
    - Market analysis (consulting)
    - Economic analysis (guidance/training)
    - Economic analysis (consulting)
    - Business model development (guidance/training)
    - Business model development (consulting)
    - Simplified regulatory procedures
    - Infrastructure support (labs, co-working spaces, testbeds)
    - Other (please specify)
5. **Please prioritize the top three types of support that would be most beneficial to your innovation efforts.** *(Rank your top 3 choices from question 4 from most important to least important)*
6. **Have you used any public or private innovation support programs?** *(Single choice - specify)*
    - Yes, and they were helpful
    - Yes, but they were not very useful
    - No, I was not aware of them

- No, they were not accessible to me

Section 3: Future Perspectives

7. **Would you be interested in participating in workshops or trainings to refine innovation support strategies?** *(Single choice)*
   - Yes
   - No
   - Maybe, depending on the topic

s

Section 4: Final Comments

8. **Do you have any additional insights or recommendations on how to better support innovators in the Danube Basin?** *(Open text response)*

📩 **Thank you for your participation!** Your responses will help shape practical guidance to support innovation in the Danube Basin.

Annex II: Semi Structured Interview Questions

1) Introduction & case presentation

i) Can you briefly introduce yourself and your organization?
ii) Could you describe the innovation you're currently working on?
   a. What is innovative about it (technological, social, governance, etc.)?
   b. What environmental challenges does it address, and what benefits does it bring?
   c. What motivated your organization to launch this initiative?
   d. At what stage is the project currently (idea, pilot, implementation, scale-up)?
iii) Are there any partners involved in this innovation? If yes, who and how do they contribute?

2) Financial support and access to funding

i) What sources of funding have been mobilized for this innovation? (EU funds, national grants, private investment, internal financing).
ii) How did you find and apply for this funding? Was support available for this process?
iii) Was it difficult to acquire funding? What were the main challenges? How did you overcome them?
iv) How long did it take to obtain the funding once the process started?
v) Did the private sector play a role in financing (investment, partnerships)?
vi) Are there funding needs or gaps that remain unaddressed?

3) Business model reflection

i) SWOT analysis
   a. What are the Strengths and weaknesses of your innovation (internal factors)?
   b. What are the opportunities and threats in your environment (external factors)?
ii) PESTEL analysis
   a. Can you briefly reflect the external environment that may have an impact on the innovation:
      i. Political (e.g. policy support)?
      ii. Economic (e.g. market dynamics)?
      iii. Social (e.g. use acceptance)?
      iv. Technological (e.g. maturity, R&D needs)?
      v. Environmental (e.g. climate resilience)?
      vi. Legal (e.g. permits, regulatory hurdles)?
iii) Business Model Canvas
   a. Who are your key partners?
   b. What are your key activities?

c. What resources are essential?
d. What is your value proposition?
e. Who are your customers or beneficiaries?
f. How do you reach and engage them (channels)?
g. What are your customer relationships like?
h. What are your revenue streams, if any?
i. What are your cost structures?

4) Innovation support needs & ecosystem gaps
   a. Regulatory environment & procedures: have you encountered regulatory or administrative barriers during development or scale up? Were regulations or permitting procedures clear and accessible? Did you receive support to navigate regulatory processes?
   b. Market intelligence & networking: how do you access market and sector specific information? Are you part of any networks or platforms that support innovation or collaboration? What types of networking or visibility opportunities would be helpful?
   c. Stakeholder engagement: who are your key stakeholders? Have you faced challenges in involving or gaining support from stakeholders? What methods or tools have helped facilitate engagement?
   d. Capacity building training: have you participated in training sessions related to innovation, Business Development, or ecosystem management? What skills would you like to further develop?
   e. Infrastructure & technical support: do you have access to infrastructure needed to test or demonstrate your innovation? What additional technical support would be useful to scale your work?

5) Upscaling the Innovation
   a. Have you attempted to upscale your innovation?
      i. What motivated this decision (e.g. policy demand, funding opportunity, success of pilot, stakeholder interest)?
      ii. At what stage in the project lifecycle did you begin considering upscaling?
   b. What did the upscaling process involve?
      i. Was it about geographic expansion, increased capacity, replication, or transfer to other sectors/contexts?
      ii. What specific strategies or approaches did you use?
   c. How did you assess whether the innovation was ready to be upscaled? Was a scalability assessment performed?
   d. What were the main challenges in the upscaling process?
      i. Technical? Regulatory? Financial? Governance related?
      ii. How were these barriers addressed (e.g. regulatory support, new partnerships, target funding)?
   e. What role did stakeholders or adopters play in scaling up the innovation?
      i. How were they engaged or incentivized to adopt the solution?
      ii. Did credibility or visibility with stakeholders play a role?

f. Was the innovation adapted during upscaling? If yes, in what way (technical design, governance model, financing approach, etc.)?
g. What type of enabling environment supported upscaling?
    i. Was there public sector support (e.g. local/regional/national policies or programs)?
    ii. Were there investors, platforms, or intermediaries that facilitated the process?
h. Have you tracked the results or impacts of the upscaling phase?
    i. Were the benefits as expected (environmental, social, economic)?
    ii. Were any unintended effects observed?
i. What lessons or recommendations would you give to other innovators aiming to scale up in the Danube Region?

6) Closing questions
    a. Is there anything else you'd like to share about your experience or the innovation process?
    b. Would you be interested in participating in a training session on innovation support?
    c. Would you be open to your case being included in our upcoming guidebook with your consent?