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D.3.2.2 AZA4ICE Action plan Montenegro

Strategic document that outlines the key actions, stakeholders, timelines, and resources required to transition to a circular economy within the aquaculture sector in Montenegro

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Abbreviations

Abbreviation	Meaning
AZA	Allocated Zone for Aquaculture
C-AZA	Circular Allocated Zone for Aquaculture
AZA4ICE	Allocated Zones for Circular Economy in Aquaculture
IMTA	Integrated Multi-Trophic Aquaculture
ICE	Inclusive and Circular Economy
LiRRIE	Living Responsible Research and Innovation Ecosystem
CE	Circular Economy
SSI	Species Sustainability Index
SiSI	Site Sustainability Index
IPI	Integrated Performance Index
IS	Integrated Sustainability Index
ICI	IMTA Circularity Index
EPA	Environmental Protection Agency (Montenegro)
IMBK	Institute of Marine Biology Kotor, University of Montenegro
SME	Small and Medium-sized Enterprise
NGO	Non-Governmental Organization
EU	European Union
EIA	Environmental Impact Assessment
CFP	Common Fisheries Policy
WFD	Water Framework Directive
MSFD	Marine Strategy Framework Directive
FAO	Food and Agriculture Organization
UNDP	United Nations Development Programme
IPARD	Instrument for Pre-Accession Assistance for Rural Development
EBRD	European Bank for Reconstruction and Development
R&I	Research and Innovation
PoC	Proof of Concept
MoU	Memorandum of Understanding
HCMR	Hellenic Center for Marine Research

Executive Summary

This Action Plan sets out a **realistic, evidence-based, and co-constructed roadmap** for the introduction of circular aquaculture at **Šasko jezero**, one of Montenegro's most ecologically sensitive freshwater ecosystems. Developed within the **AZA4ICE project** and grounded in the **LiRRIE co-decided vision**, the Plan translates scientific assessment results and stakeholder priorities into a coherent set of **low-risk, low-impact, and implementable actions** for the transition towards an Inclusive and Circular Economy in aquaculture.

The Plan is underpinned by the **C-AZA assessment**, which confirms that Šasko jezero is **environmentally acceptable for carefully managed circular aquaculture** (final C-AZA index = **0.633**), provided that strict safeguards, adaptive management, and precautionary scaling are applied. The assessment identifies a **freshwater IMTA model** based on *Cyprinus carpio* (fed species) and *Phragmites australis* (inorganic extractive species) as technically and environmentally suitable, achieving a strong **Integrated Sustainability Index (IS = 0.737)**. While the **IMTA Circularity Index (ICI = 0.44)** indicates moderate circularity performance, it also highlights clear opportunities for improvement through targeted interventions.

Complementing the environmental analysis, the **BLUEfasma circularity baseline** reveals a territorial profile characterised by **low circularity readiness (average 1.7)** but **high willingness to invest (average 3.8)** among local operators. This readiness–willingness gap confirms that transition potential exists, but that implementation must be preceded by **capacity building, regulatory clarification, and practical demonstration**, particularly for small-scale fishermen who face the greatest constraints.

In response, and following an extensive **LiRRIE co-construction process**, the Action Plan proposes six mutually reinforcing actions, designed to be **financially realistic, socially acceptable, and ecologically safe**:

1. **Capacity Building Programme for Local Fishermen and SMEs**, prioritising financial literacy, funding readiness, licensing guidance, and hands-on IMTA operation, complemented by digital, market, and eco-certification skills;
2. **Establishment of a small-scale, modular IMTA demonstration pilot**, implemented as a proof-of-concept and learning tool under strict environmental safeguards and transparent monitoring;
3. **Community-based circularity initiatives**, focused on low-investment, visible practices such as waste separation points, reusable gear, clean-up actions, and educational eco-trails;
4. **Environmental monitoring and safeguards**, ensuring continuous assessment of water quality, ecosystem response, and compliance with precautionary thresholds;
5. **Business support and funding mobilisation**, assisting local actors in accessing national grants, IPARD III, Interreg, and complementary financing instruments;
6. **An inclusive governance and coordination platform**, aligned with the LiRRIE model and built around a focused governance triangle comprising the Municipality of Ulcinj, organised fishermen, and the Directorate for Fisheries.

Stakeholder feedback clearly prioritised **national and EU funding instruments** as the backbone of implementation, with IPARD III and Interreg programmes

identified as key enablers. The Plan therefore adopts a **phased financing approach**, centred on low-cost, high-impact actions and external funding leverage, complemented by selective private co-financing and preferential credit lines where appropriate.

To ensure accountability and adaptability, the Action Plan includes a **robust Monitoring and Evaluation framework**, with clearly defined indicators covering environmental performance, IMTA technical operation, governance effectiveness, and community and business uptake. A **realistic 24-month implementation horizon** is proposed, allowing sufficient time for learning, adjustment, and evidence-based decision-making.

Through the integration of **scientific evidence, stakeholder co-decision, and circular economy principles**, Šasko jezero is positioned to become **Montenegro's first demonstration site for circular freshwater aquaculture**. The Action Plan establishes a solid foundation for replication in other inland waters, while safeguarding ecological integrity and strengthening local livelihoods. It represents a concrete step towards embedding circularity, inclusiveness, and innovation in Montenegro's aquaculture governance and practice.

Introduction

The transition toward sustainable and circular aquaculture in Montenegro requires a coordinated, science-based, and inclusive approach that respects the ecological sensitivity of aquatic ecosystems while supporting local economic development. Šasko jezero, as one of Montenegro's most unique freshwater ecosystems, represents an ideal testing ground for implementing innovative circular aquaculture practices in line with the AZA4ICE methodology. Through the collaborative work of the LiRRIE (Living Responsible Research and Innovation Ecosystem) in Montenegro, local stakeholders have jointly defined a vision for transforming the lake into a national model of eco-conscious aquaculture, grounded in shared governance, scientific evidence, and genuine community engagement.

This Action Plan provides a structured roadmap to operationalize that vision. It builds upon the detailed C-AZA assessment carried out for Šasko jezero, which confirmed that the lake is environmentally acceptable for aquaculture under carefully controlled, circular, and low-impact conditions. Combined with the results of the BLUEfasma circularity baseline assessment—which revealed low readiness but high willingness among local operators, the Action Plan proposes realistic, small-scale, and adaptable interventions that match the region's socio-economic and environmental context.

Scope and Objectives

Scope

This Action Plan focuses exclusively on the development of **circular, low-impact freshwater aquaculture** at Šasko jezero, using the AZA4ICE methodology as the guiding framework. It concentrates on actions that are:

- **Environmentally feasible**, based on the C-AZA results specific to Šasko jezero.
- **Socially inclusive**, aligned with the LiRRIE co-created vision and stakeholder needs.
- **Economically realistic**, given local constraints, capacities, and investment potential.
- **Scalable and transferable**, allowing replication in other Montenegrin lakes or inland waters.

The plan covers a 24-month period and focuses on interventions that can be realistically implemented with available local resources and external funding support.

Objectives

The Action Plan aims to achieve the following:

1. **Introduce and test a circular aquaculture model**—specifically a freshwater IMTA system—tailored to Šasko jezero's conditions.
2. **Strengthen local capacity** among fishermen, SMEs, and community actors to adopt circular practices and improve their technical readiness.
3. **Enhance environmental protection** through structured monitoring and nature-based aquaculture design.

4. **Establish an inclusive governance mechanism** that ensures coordinated decision-making, transparency, and multi-stakeholder participation.
5. **Support economic diversification and new opportunities** through circular business models, waste valorization, and sustainable branding.
6. **Create a replicable model** that can inform national policies and future circular aquaculture developments in Montenegro.

These objectives collectively support Montenegro's transition toward a resource-efficient, climate-resilient, and innovation-driven blue economy.

Context

Šasko jezero is a shallow, ecologically sensitive freshwater lake located near Ulcinj, connected to the Bojana/Buna River system and surrounded by wetlands of high biodiversity. Its ecological characteristics—fluctuating water levels, moderate nutrient load, limited depth, and rich bird habitats—demand a cautious, scientifically guided approach to any form of aquaculture.

The **C-AZA assessment** carried out in 2024–2025 confirmed the lake's suitability for small-scale circular aquaculture, with a final C-AZA index of **0.633**, marking it as "acceptable" but requiring strict environmental safeguards. The analysis identified **common carp** (*Cyprinus carpio)* and **common reed** (*Phragmites australis*) as the most suitable species for a freshwater IMTA model that supports nutrient recycling and ecological balance.

Parallel to this, the **BLUEfasma circularity assessment** revealed that most local businesses and fishermen operate with **low circularity readiness** but demonstrate **high willingness to invest**—a critical foundation for transition. This indicates strong openness to innovation, provided that appropriate training, technical support, and funding pathways are made available.

Guided by these findings, the **LiRRIE stakeholder process** co-decided a shared vision for Šasko jezero: a future in which aquaculture development is environmentally responsible, socially inclusive, technologically innovative, and rooted in circular economy principles. This participatory foundation ensures that the Action Plan reflects real local needs, community expectations, and institutional priorities.

Together, these elements create a unique opportunity for Montenegro to introduce a **model circular aquaculture zone** at Šasko jezero, demonstrating how ecological protection, community participation, and economic innovation can be integrated into a single, coherent development approach.

Roles and Responsibilities of Key Actors

The transition of Šasko jezero toward a sustainable and circular aquaculture model depends on the active participation, coordination, and shared responsibility of a diverse set of regional actors. In line with the LiRRIE Co-decided Vision Statement, the governance of this transition is conceived as **inclusive, collaborative, and innovation-driven**, ensuring that no stakeholder group is left behind. The ecosystem of actors engaged in the development and future implementation of the AZA4ICE Action Plan spans government institutions, scientific bodies, private sector operators, civil society organizations, and local communities—all connected through the participatory framework established by the LiRRIE methodology.

In this context, the **public sector** plays a central guiding role by providing strategic direction, regulatory clarity, and institutional support required for establishing circular aquaculture zones (C-AZA). National ministries and specialized agencies ensure that the ecological integrity of Šasko jezero is preserved, that licensing and monitoring follow transparent procedures, and that policy frameworks support the adoption of innovative IMTA and circular production models. Their role is essential in aligning the Action Plan with Montenegro's broader priorities in environmental protection, circular economy, and sustainable rural development.

The **scientific and research institutions**, particularly the University of Montenegro, Faculty of Science, act as knowledge anchors for the region. They guide the interpretation of environmental data, validate the C-AZA results, design monitoring systems, and support evidence-based decision-making. Their responsibilities extend to providing technical expertise, building local capacity through training, and supporting adaptive management of aquaculture activities based on continuous scientific assessment. Through their involvement, innovation becomes embedded in the region's transition pathway.

The **private sector**, comprising fish processors, aquaculture practitioners, and small-scale fishermen, represents the operational core of circular aquaculture development. Although the circularity baseline assessment shows that readiness for circularity remains low, willingness to invest is high positioning these actors as key drivers once the enabling conditions are in place. Their responsibilities include adopting improved practices, engaging in capacity-building activities, participating in demonstration pilots, and contributing to business symbiosis models such as waste valorization and local supply chain strengthening. Their active involvement is fundamental to transforming Šasko jezero into a living example of circular production.

The **local community and civil society organizations** contribute critical social and environmental knowledge. Their role is to ensure that aquaculture development respects cultural identity, local heritage, and the traditional use of natural resources. They support the co-creation of solutions that balance livelihoods with environmental stewardship, voice community concerns, and facilitate public awareness on circular economy principles and sustainable consumer behavior. Their participation reinforces the inclusive nature of LiRRIE and enhances societal acceptance of new aquaculture models.

Finally, the LiRRIE structure itself serves as the **coordination mechanism** connecting these actors. Through iterative co-creation, shared vision development, and structured dialogue, LiRRIE ensures that roles and responsibilities are not only defined but are

collectively understood and continuously refined. This participatory governance model enables transparent decision-making, builds trust, strengthens regional ownership of the Action Plan, and ensures that capacity-building efforts reach all stakeholder groups.

Taken together, the roles of public institutions, scientific bodies, private operators, civil society, and local communities form the foundation of a **multi-level, inclusive governance system** for Šasko jezero. Their coordinated responsibilities are essential for translating the region's shared vision into a practical, innovative, and circular aquaculture model—setting a strong example for Montenegro and the wider Euro-Mediterranean region.

Regional Needs, Challenges and Opportunities

This chapter is written specifically for the **Šasko jezero pilot area**. It synthesizes three inputs:

1. **C-AZA results for Šasko jezero** (final C-AZA index = 0.633 → Acceptable but low).
2. **LiRRIE Co-decided Vision Statement** (inclusive governance, innovation, circularity, capacity building).
3. **Circularity baseline (D2.2.1)** for businesses in Montenegro (low readiness, high willingness).

The Šasko jezero region presents a unique combination of ecological sensitivity, socio-economic pressures, and emerging opportunities for sustainable and circular aquaculture development. The results of the C-AZA assessment, the co-created LiRRIE vision, and the circularity baseline of local blue-economy stakeholders demonstrate that while the region is at an early stage of transition, it possesses a strong foundation of willingness, local engagement, and ecological potential to become a national model for inclusive and circular aquaculture.

Regional Needs

Need for Environmentally Compatible Aquaculture Models

The C-AZA results for Šasko jezero demonstrate that the lake is **environmentally acceptable for aquaculture**, but positioned **at the lower end of the "acceptable" range** (C-AZA index = 0.633). This indicates a need for:

- **Low-impact models** such as freshwater IMTA using ***Cyprinus carpio*** and ***Phragmites australis***, which showed acceptable species sustainability scores.
- **Strict environmental monitoring**, especially for shallow lake dynamics, nutrient concentrations, and seasonal fluctuations.
- **Adaptive management**, ensuring aquaculture development does not compromise water quality or biodiversity.

Need for Clear Governance and Coordinated Decision-Making

The LiRRIE vision highlights the need for **collaborative, transparent governance**, given that Šasko jezero falls within a complex institutional landscape (local communities,

municipality of Ulcinj, environmental agencies, fishery authorities, cross-border ecological connectivity with Bojana/Buna River).

Regional needs include:

- Coordination between environment, aquaculture, water management and protected area institutions.
- Clear guidance for introducing circular aquaculture in an ecologically sensitive area.
- A governance mechanism that integrates **5-helix stakeholders** (public sector, industry, academia, civil society, environment).

Need for Strengthening Local Skills and Technical Capacity

The BLUEfasma assessment shows:

- **Low circularity readiness** among businesses (avg. 1.7).
- **Very low readiness among fishermen** (1.1–1.8).
- **High willingness to invest**, particularly among processors and several fishermen (up to 4.7).

This signals a need for:

- Training on IMTA, circular practices, water-quality management and business innovation.
- Demonstration pilots in Šasko jezero to show viable circular models.
- Continuous capacity-building to bridge the gap between motivation and implementation.

Regional Challenges

Environmental Sensitivity of Šasko jezero

Šasko jezero is a shallow, vulnerable freshwater ecosystem with fluctuating hydrological conditions and direct ecological links to Bojana River and nearby wetlands. Key challenges include:

- Rapid ecological response to nutrient inputs.
- Limited depth (2–3 m) affecting species suitability and sediment interactions.
- High conservation value and presence of protected bird species.
- Potential conflicts between aquaculture and ecosystem integrity.

The C-AZA results confirm that aquaculture is possible, but must be small-scale, controlled, and circular.

Weak Circular Economy Integration in Current Businesses

The circularity baseline identifies:

- Fragmented or minimal CE practices.

- Limited waste valorization infrastructure.
- Low awareness among small-scale fishermen of circular business models.
- Insufficient technical and financial tools to adopt CE technology.

This creates risks for implementing advanced circular models without targeted support.

Regulatory and Licensing Complexity

While Montenegro has a robust legal framework, it is not optimized for:

- **IMTA systems**,
- **Freshwater circular models**,
- **Species combinations involving aquatic plants**,
- **Micro-scale aquaculture in protected landscapes**.

Operators face administrative burdens, uncertainty in permit pathways, and limited technical guidance from authorities. This complexity may hinder the establishment of C-AZA zones unless procedures are clarified and supported.

Socio-economic Vulnerability

The region around Šasko jezero relies on:

- Small-scale fishing,
- Seasonal tourism,
- Low-intensity agriculture.

Aquaculture must therefore integrate with existing livelihoods, avoiding competition for space, resources, or ecological functions. This requires careful spatial planning and community involvement.

Opportunities

Strong Stakeholder Motivation

Despite low readiness, stakeholders demonstrate **high willingness to invest** (average 3.8), especially:

- Fish processors (e.g. MM Ribarstvo, Montefish),
- Motivated fishermen (e.g., Leona & Aleksa with willingness 4.7),
- Local micro-businesses seeking diversification.

This presents a major opportunity to catalyze quick wins through:

- Pilot IMTA setups,
- Business symbiosis (processors–fishermen),
- Waste reduction and valorization schemes.

Potential to Position Šasko jezero as a National Model

The LiRRIE vision sets a clear ambition: **Šasko jezero as a reference site for circular aquaculture and inclusive governance in Montenegro.**

This aligns with regional priorities such as:

- Sustainable use of inland waters,
- Diversification of rural economies,
- Green transition and circularity targets,
- Demonstration models under the Euro-MED Programme.

The C-AZA results confirm that the lake offers **sufficient environmental sustainability** to support such a flagship initiative.

Integrating Circular Aquaculture with Tourism and Local Economy

Potential opportunities include:

- Eco-labelled carp production from circular IMTA systems,
- Local branding (e.g. "Šasko jezero – circular & sustainable"),
- Educational tours and nature–aquaculture interpretation trails,
- Synergies with gastronomy and agro-tourism.

Circular aquaculture could enhance the local value chain and diversify income sources.

Strengthening Scientific and Institutional Roles

With the University of Montenegro actively involved, the region gains:

- Strong scientific monitoring capacity,
- Support for data-driven management,
- Opportunities to test innovative methods (e.g., nutrient–plant interactions, freshwater IMTA performance).

This creates a unique research–practice–policy interface.

Summary

The region's baseline can be summarized as follows:

- **Environmental potential:** acceptable but sensitive → requires careful management
- **Business baseline:** low readiness but high willingness → ideal for targeted support
- **Governance:** strong need for coordination and inclusive decision-making
- **Opportunity:** high motivation, scientific support and policy alignment create a realistic pathway to making Šasko jezero a **national reference for circular aquaculture**

These insights directly inform the proposed actions in the Montenegro Action Plan and form the basis for designing a realistic, community-supported, environmentally responsible transition pathway.

Current legal/regulatory/licensing framework

Montenegro's aquaculture sector operates under a **centralized and comprehensive legal framework** that regulates freshwater aquaculture, marine aquaculture (mariculture), fisheries management, environmental protection, water use, food safety, and animal health. Together, these laws form the institutional basis for planning, licensing, operation, and monitoring of aquaculture activities across the country.

This overview is fully based on the detailed analysis presented in **D2.3.1 – Review on aquaculture legal/regulatory framework and licensing processes.**

Core National Legislation for Aquaculture

Aquaculture in Montenegro is primarily governed by two sectoral laws:

1. **Law on Freshwater Fisheries and Aquaculture.** – Regulates inland aquaculture activities, including the use of freshwater bodies, licensing, farming practices, fish health, and construction requirements for freshwater facilities.
2. **Law on Marine Fisheries and Mariculture.** – Governs marine farming activities, spatial planning for mariculture zones, licensing, environmental obligations and operational standards for marine aquaculture.

These laws are supported by a wider legal ecosystem that covers issues essential for aquaculture operation:

- **Law on Food Safety**
- **Law on Animal Health and Welfare**
- **Law on Environmental Impact Assessment**
- **Law on Nature Protection / Biodiversity**
- **Water Management Law**
- Numerous **by-laws and ordinances** specifying technical and operational requirements.

Collectively, this framework ensures that aquaculture activities respect environmental limits, food safety standards, and public health requirements.

Institutional Setup

Aquaculture governance in Montenegro involves **several specialized institutions**, each with a distinct mandate:

- **Ministry of Agriculture, Forestry and Water Management.** – Principal policy-maker for fisheries and aquaculture; responsible for strategic planning and regulatory oversight.
- **Ministry of Agriculture, Forestry and Water Management, Directorate for Fisheries.** – Executes fisheries and aquaculture policy, including licensing,

monitoring of production, resource management and implementing national strategies.

- **Environmental Protection Agency (EPA).** – Oversees environmental impact assessments, water quality protection and monitoring of ecological impacts of aquaculture operations.
- **Veterinary and Phytosanitary Directorate.** – Ensures compliance with animal health, disease control and food safety standards in aquaculture.
- **University of Montenegro, Faculty of Science.** – Provides scientific research, monitoring data, environmental studies and technical expertise.
- **Statistical Office of Montenegro (MONSTAT).** – Responsible for official data collection on aquaculture and fisheries production.

This coordinated institutional setup supports sustainable development while ensuring alignment with EU aquaculture and environmental directives.

Licensing Requirements and Procedures

Montenegro maintains a **centralized licensing system**, but procedures for aquaculture development remain **complex and involve several authorities**, depending on the farming environment (freshwater vs. marine). Licensing typically requires:

- **Site approval** from relevant authorities
- **Environmental Impact Assessment (EIA)** for most aquaculture activities
- **Water rights permits** (water use, discharge)
- **Veterinary approval** for species health and biosecurity
- **Construction permits** (for freshwater installations)
- **Concession/licence for marine space use** (for mariculture)

Although the framework is clear, the **number of required permits and institutionally fragmented workflow** makes licensing time-consuming and administratively demanding. As noted in D2.3.1, Montenegro shares common European challenges such as multi-agency involvement, overlaps between environmental and fisheries legislation and significant documentation requirements.

Regulatory Context for Innovative Systems (IMTA / RAS / circular aquaculture)

Montenegro has **no dedicated legal framework for IMTA, RAS or circular aquaculture**, but these systems are implicitly regulated through general aquaculture laws, environmental laws and water management regulations.

Key constraints include:

- **Absence of specific criteria for assessing IMTA connectivity and circularity**
- Licensing procedures designed for traditional single-species farms
- High compliance requirements for environmental protection in sensitive ecosystems

- Limited technical guidance for regulators on evaluating innovative models
- Regulatory ambiguity for new species (e.g., algae, halophytes), similar to other Euro-MED countries

Nevertheless, Montenegro's policy alignment with **EU circular economy principles** and **ecosystem-based management** provides a foundation for incorporating C-AZA results and IMTA models into future licensing reforms.

Alignment with International and EU Frameworks

Montenegro's legal and regulatory system is strongly shaped by:

- **EU Common Fisheries Policy (CFP)**
- **EU environmental acquis** (Water Framework Directive, Habitats Directive, Marine Strategy Framework Directive)
- **FAO Code of Conduct for Responsible Fisheries**
- Regional cooperation platforms (GFCM guidelines and Adriatic-AION frameworks)

This alignment ensures that aquaculture development—particularly in sensitive inland ecosystems like **Šasko jezero**—is subject to high sustainability, monitoring and conservation standards.

Key Challenges Identified

Based on the review, Montenegro faces several legal and regulatory barriers:

- **Complex and lengthy licensing procedures** involving multiple institutions
- **High administrative burden** for small operators
- **Strict environmental requirements** limiting the flexibility of site selection
- **Lack of specific regulations for innovative IMTA/RAS systems**
- **Limited technical capacity and scientific guidelines** for evaluating circular systems
- **Unclear pathways for introducing novel species** such as algae

These challenges are important considerations when defining C-AZA Action Plan interventions for Šasko jezero.

Implications for Šasko jezero C-AZA Action Plan

Considering Šasko jezero's sensitive ecological status, shallow hydrology and cross-border relevance, the regulatory framework implies:

- Mandatory EIAs for any aquaculture intervention
- Strict water quality and biodiversity protection requirements
- Potential regulatory gaps for IMTA/circular models incorporating freshwater macrophytes
- The necessity for coordinated licensing across environmental, water and fisheries administrations

- High need for **clarified guidelines**, **capacity building**, and **streamlined procedures** for implementing the C-AZA model

Current status of aquaculture businesses

The current state of aquaculture and fisheries-related businesses in Montenegro reveals a sector that is still predominantly positioned within a **linear economic model**, with only limited and fragmented application of circular economy (CE) principles. The results of the BLUEfasma Circularity Self-Assessment Tool, implemented with nine representative stakeholders—including fish farms, processors, brands, and small-scale fishermen—provide the first structured baseline for assessing circularity readiness and investment motivation in Montenegro's blue economy.

This overview is fully based on the detailed findings of **D2.2.1 – Identifying the Circularity Baseline with the BLUEfasma Circularity Self-Assessment Tool in Montenegro**.

Circularity Readiness: Early-stage and Fragmented (Average: 1.7)

Readiness scores in Montenegro range from **1.1 to 2.3**, with a territorial average of **1.7**, corresponding to an **early stage of CE adoption**. This means:

- Circular practices exist but are **not systematic nor embedded** in business models.
- Stakeholders demonstrate **eco-awareness**, yet CE actions remain isolated (e.g., selective waste handling, energy-saving measures, sporadic reuse practices).
- **Companies** (fish processors and brands) tend to show **higher readiness** (1.8–2.3), reflecting better infrastructure, organizational maturity, and capacity to introduce CE measures.
- **Small-scale fishermen** have the **lowest readiness levels** (1.1–1.8), indicating reliance on traditional, linear practices with minimal application of circularity principles.

Zeta Fish (2.3) and Pescatore (2.0) represent the most advanced profiles, while Joško Fish (1.1) and Ruždi Kashodza (1.2) illustrate the lowest CE maturity in the territory.

Overall, the data confirms that CE is **not yet structurally integrated** across Montenegrin aquaculture-related operations, especially among micro-operators.

Willingness to Invest: Moderate to High (Average: 3.8)

In contrast to low readiness, willingness to invest in CE solutions ranges from **2.4 to 4.7**, with an average of **3.8**—indicating **strong motivation for transition**.

- Medium-sized companies (e.g., Montefish 4.5; MM Ribarstvo 4.6) exhibit **very high willingness**, signaling preparedness for technology upgrades, renewable energy use, valorization of fish by-products, and improved waste management.
- Among fishermen, willingness varies widely: some (Leona & Aleksa: 4.7) show exceptional investment interest, while others (Ruždi Kashodza: 2.4) remain cautious due to limited resources and perceived risks.

The gap between low readiness and high willingness demonstrates a **latent transition potential**—businesses are motivated but require technological, financial, and training support to turn willingness into real implementation.

Differences Between Industry Segments

Fish Processing & Branding Companies

Examples: Zeta Fish, MM Ribarstvo, Montefish, Pescatore

- Better organizational structure and financial capacity
- Existing CE actions (eco-packaging, energy efficiency, selective waste handling)
- Best positioned for rapid transition once targeted support is introduced
- Higher potential for **circular innovations** such as by-product valorization and material recovery

Small-Scale Fishermen

Examples: Ivan Saveljić, Joško Fish, Ruždi Kashodza

- Lowest readiness (1.1–1.8)
- Limited financial capacity, low-to-moderate willingness
- Require **awareness building**, small-scale pilots, and low-cost CE interventions (gear reuse, fuel savings, waste minimization)
- Represent the segment with the slowest natural transition speed unless strongly supported

Mariculture SME

Example: Pescatore d.o.o.

- Positioned between the two groups
- Solid readiness (2.0) and moderate willingness (3.7)
- Suitable for circular demonstration projects (e.g., mussel shell valorization, renewable energy)

Generalized Territorial Circularity Level: "Low Readiness / High Willingness"

At the territory level, Montenegro exhibits:

- **Low readiness (1.7 average):** Circular economy still at the stage of **eco-thinking**; CE practices are scattered and non-systemic.
- **High willingness (3.8 average):** Stakeholders—especially companies—are motivated to improve competitiveness, reduce costs, and adopt green solutions.

This combination signals a **strong but untapped potential**: with targeted interventions, Montenegro could move quickly from isolated CE actions to structured circularity adoption.

Key Challenges Identified

The assessment highlights several challenges affecting aquaculture businesses:

- Lack of **technical knowledge** and CE-specific skills
- Limited **financial resources**, especially among fishermen
- Dependence on traditional practices and linear supply chains
- Absence of **infrastructure for by-product valorization** (e.g., fish waste reuse)
- Low awareness of **CE market benefits**
- No established business symbiosis networks
- Limited access to **renewable energy technologies** and water/heat recovery systems

These gaps align with the national trend of early-stage CE adoption.

Opportunities for Circular Transition

Stakeholders express strong interest in adopting CE principles, particularly in:

- Renewable energy integration
- Waste minimization and by-product recovery
- Improved packaging and reduction of plastics
- Fuel-efficiency improvements
- Business symbiosis with other fisheries/aquaculture operators
- Eco-certification and branding for competitive advantage

The combination of **motivation**, **sectoral awareness**, and **baseline CE actions already in place** positions Montenegro as a strong candidate for rapid progress—especially with the introduction of C-AZA zones, IMTA-based models, and the LiRRIE participatory mechanism.

Overall Assessment

Montenegro's aquaculture businesses present a **mixed but promising profile**:

- **Circularity readiness is low** → systemic CE integration has not yet occurred.
- **Willingness to invest is high** → stakeholders are motivated and open to change.
- **Companies lead**, while **fishermen lag behind** and need stronger support.
- The sector is at a **turning point**, where targeted actions can unlock rapid transition.

These findings provide a solid foundation for designing the AZA4ICE Action Plan interventions, particularly those linked to stakeholder capacity-building, technological pilots, and the implementation of the C-AZA model in Šasko jezero.

Vision

The vision for Šasko jezero under the AZA4ICE project is to establish the lake as a **national model of sustainable, inclusive, and circular aquaculture**, where ecological integrity,

community well-being, and economic development coexist in a balanced and mutually reinforcing way. Through strong local governance, multi-actor cooperation, and the adoption of innovative circular solutions, Šasko jezero aims to become a reference point in Montenegro and the wider Euro-Mediterranean region for responsible and forward-looking aquaculture practices.

This vision is grounded in the co-decided outcomes of the LiRRIE process, which brought together local stakeholders, institutions, civil society, academia, industry representatives, and environmental actors. Their shared aspiration is to transform Šasko jezero into a **thriving Living Responsible Research and Innovation Ecosystem**, where decisions are made collectively, capacities are strengthened continuously, and actions are shaped by evidence, local knowledge, and cross-sectoral collaboration.

At the core of the vision is the commitment to **inclusive governance**. The future of aquaculture at Šasko jezero must be built on open dialogue, transparent planning, and genuine engagement of all stakeholders—ensuring that community members, fishermen, local authorities, environmental organizations, and businesses have an active voice in shaping development pathways. This inclusive model is designed to ensure that no actor is marginalized and that the benefits of circular aquaculture are equitably distributed.

The vision also places strong emphasis on **capacity-building** as a driver of transformation. Given the region's current early stage of circularity adoption, targeted training, knowledge transfer, and hands-on demonstration activities are essential for empowering local operators. By elevating technical skills, managerial knowledge, and environmental awareness, Šasko jezero can progressively build a strong local foundation capable of implementing and sustaining circular aquaculture models.

Innovation is another defining element of the vision. The region aims to embrace new circular technologies and practices—including integrated multi-trophic aquaculture (IMTA), nature-based solutions, waste valorization pathways, and low-impact production models adapted to the ecological characteristics of the lake. Innovation in Šasko jezero is understood not only as technological advancement but also as a cultural shift toward smarter resource use, reduced waste, regenerative practices, and symbiosis with natural processes.

Finally, the vision commits to the advancement of a **circular economy** that strengthens environmental stewardship while generating new economic opportunities. Aquaculture development in Šasko jezero should contribute to ecosystem protection, improve water quality through nature-based processes, reduce resource consumption, and create value-added business models that rely on reuse, recovery, and symbiotic exchanges within the local economy. This transition also supports the diversification of income sources for local fishermen, micro-enterprises, and food producers, contributing to the social and economic vitality of the wider Ulcinj region.

In summary, the vision for Šasko jezero is to become a **holistic, resilient, and inclusive circular aquaculture landscape**, where responsible governance, empowered local actors, innovative practices, and strong environmental protection work together to create long-term prosperity. Guided by the LiRRIE principles and sustained through collaborative action, Šasko jezero aims to stand as a flagship example of how circular economy approaches can transform inland aquatic ecosystems in Montenegro.

Potential of the C-AZA results

The C-AZA assessment for Šasko jezero provides a foundational scientific and technical basis for introducing circular aquaculture in this ecologically sensitive freshwater system. With a final **C-AZA index of 0.633**, Šasko jezero is classified as **"acceptable"** for circular aquaculture development, though positioned at the lower end of the acceptability range. This result indicates that aquaculture is feasible, but must be designed carefully, at appropriate scale, and aligned with environmental constraints. Despite these limitations, the C-AZA results reveal **significant potential** for implementing innovative circular models that enhance environmental quality, support local livelihoods, and reinforce sustainable governance.

Environmentally Suitable Conditions for Low-Impact Circular Aquaculture

The overall Site Sustainability Index (SiSI) values—covering water quality, trophic conditions, lake use, surrounding land use, and risk assessment—demonstrate that Šasko jezero possesses baseline environmental conditions compatible with aquaculture. The site's **SiSI score (~0.8)** indicates:

- Sufficient water quality for freshwater culture species
- Stable physicochemical conditions across monitoring months
- A manageable risk level for both semi-extensive and intensive models
- Compatibility with low-impact aquaculture zones

The lake's shallow depth and dynamic hydrology create natural limitations, but they also reinforce the potential for **circular, nature-based practices** that work with the ecosystem rather than against it.

IMTA Potential Based on Species Sustainability Results

The Species Sustainability Index (SSI) and Performance Index (IPI) highlight a **high feasibility** for a freshwater IMTA model built on two selected organisms:

- **Fed species:** *Cyprinus carpio* (common carp)
  - High SSI = 0.83
  - High IPI = 0.760
  - Well-adapted to local conditions
- **Inorganic extractive species:** *Phragmites australis*
  - SSI = 0.61
  - IPI = 0.746
  - Strong capacity for nutrient uptake and phytoremediation

Together, these species create a **synergistic freshwater IMTA system** where carp growth is supported while *Phragmites* contributes to nutrient regulation and environmental recovery.

The resulting **Integrated Sustainability Index (IS) = 0.737** confirms the suitability of this combined model.

This makes Šasko jezero one of the first potential demonstration sites in Montenegro for **IMTA in inland waters**, expanding circular aquaculture beyond its traditional marine focus.

Circularity Potential Highlighted by the ICI Circularity Index

The IMTA Circularity Index (ICI) score of **0.44**—moderate in the project's rating system—indicates substantial room for circular improvement, but also reveals meaningful opportunities, including:

- Reduction of organic residues through species complementarity
- Use of emergent macrophytes for nutrient extraction and biomass utilization
- Potential to repurpose Phragmites biomass (e.g., composting, craft materials, bio-based packaging)
- Application of sediment and water regeneration concepts
- Integration of waste-minimizing practices in carp production

While the ICI is not high, it provides a **clear roadmap** for improving circularity performance through targeted actions.

Alignment with Local Vision and Socio-Economic Needs

The LiRRIE vision emphasizes sustainable development, inclusive governance, innovation, and eco-conscious economic opportunities.

The C-AZA results directly support this direction:

- They offer **scientific justification** for introducing new business opportunities in inland aquaculture.
- They provide a **precautionary yet positive** framework for local stakeholders who expressed high willingness to invest in circular practices.
- They allow Montenegro to develop **a freshwater demonstration site** that can serve the entire region.

For the local fishing community and small businesses—currently operating with low circularity readiness—the C-AZA results show that small-scale circular aquaculture can complement existing activities, enhance income stability, and bring added value through eco-certification and local branding.

Foundation for Policy Innovation and Improved Governance

The structured C-AZA assessment offers Montenegro a valuable tool for:

- Introducing science-based criteria into aquaculture licensing
- Supporting integration of circular practices into regulatory frameworks
- Enhancing cross-sector coordination among environment, water management, and fisheries authorities

- Defining zones for low-impact aquaculture within sensitive ecosystems

Šasko jezero can thus become the **pilot case** for improved national procedures on C-AZA implementation, supporting Montenegro's transition toward a greener, more circular, EU-aligned aquaculture governance model.

Potential for Demonstration, Replication, and Education

Given its ecological distinctiveness, Šasko jezero is uniquely positioned to host:

- **Demonstration IMTA units** for training fishermen, SMEs, students, and policymakers
- **Cross-border knowledge exchange** (particularly with Albania's Buna/Bojana system)
- **Public awareness activities** on circularity, ecosystem-based management, and sustainable freshwater use
- **Applied research** on nutrient flows, macrophyte use, and lake restoration models

By establishing a visible reference site, Montenegro can influence broader regional practices and increase its leadership in the Euro-MED circular aquaculture landscape.

Summary

The C-AZA results reveal significant potential for Šasko jezero to become a **safe, scientifically supported, and circular inland aquaculture zone**, with the ability to:

- Support low-impact freshwater IMTA
- Enhance water and sediment quality
- Create new business opportunities for local operators
- Serve as a pilot for circular innovation in Montenegro
- Strengthen governance and multi-stakeholder cooperation
- Demonstrate the value of circular economy in rural lake ecosystems

These findings form a key pillar of the Action Plan and will guide the design of targeted interventions, training activities, governance improvements, and pilot actions for Šasko jezero.

Proposed Actions

Proposed actions are aligned with **C-AZA results**, **LiRRIE vision**, and **local constraints** (sensitive ecosystem, low readiness, high willingness, limited financial capacity, regulatory complexity).

The actions are **practical, small-scale, low-risk, implementable within 24 months**, and designed to build readiness before scaling.

Key Actions and Interventions

Action 1 – Capacity Building Programme for Local Fishermen and SMEs

Objective

Strengthen the **technical, regulatory, financial, and business capacities** of local fishermen and SMEs, addressing currently **low readiness levels (average 1.7)** and enabling effective participation in circular aquaculture initiatives at Šasko Lake.

Rationale

Stakeholder feedback confirms **high willingness to engage (average 3.8)**, while clearly identifying **capacity gaps** as the main barrier to implementation. Co-construction results emphasise the need for **practical, hands-on training**, coupled with **financial literacy, regulatory guidance, and market-oriented skills**, to ensure that innovation is both feasible and economically sustainable.

Interventions

The capacity building programme will be designed as a **demand-driven and sequenced set of interventions**, directly supporting the implementation of the IMTA demonstration pilot and the broader transition towards circular aquaculture at Šasko Lake. Based on stakeholder feedback, priority will be given to **practical skills, regulatory clarity, and financial readiness**, identified as the main constraints to adoption.

Core interventions will include:

- **Targeted training on financial literacy and funding readiness**, focusing on:
  - available national and EU funding instruments,
  - preparation of funding applications,
  - basic financial planning, investment requirements, and cost–benefit considerations for circular aquaculture initiatives.
- **Hands-on, experience-based training on IMTA systems**, including:
  - practical operation and basic maintenance of IMTA units,
  - feeding practices and system management under lake conditions,
  - application of environmental safeguards linked to pilot implementation.
- **Guidance on licensing and permitting procedures**, addressing:
  - regulatory pathways and institutional responsibilities,
  - compliance requirements for freshwater aquaculture,
  - clarification of administrative steps and timelines to reduce regulatory uncertainty.
- **Training on waste reduction and efficient resource use**, reinforcing circular economy principles at operational level, with practical examples applicable to small-scale producers.
- **Introductory sessions on circular business models**, providing an initial understanding of how circularity can be integrated into business operations, while

recognising that these aspects are secondary to immediate operational and regulatory needs in the early phase.

In addition, stakeholder feedback highlighted several **complementary capacity building actions** aimed at strengthening market uptake and long-term economic sustainability:

- **Practical application of circular business models**, tailored to the Montenegrin economic and regulatory context, using concrete examples of cost structures, revenue streams, and risk management relevant to local fishermen and SMEs;
- **Training on digital tools for product sales**, enabling access to new markets and shorter value chains for products originating from circular aquaculture systems;
- **Capacity building in digital sales and digital marketing**, including use of online platforms, social media channels, and direct-to-consumer approaches suited to small-scale producers;
- **Support for sales, market placement, and branding**, focusing on product differentiation strategies that emphasise sustainability, circularity, and local origin;
- **Targeted training on eco-certification schemes**, covering requirements, procedures, and potential benefits of eco-labels as tools for increasing product credibility and market value.

Together, these interventions position **Action 2 as a cornerstone of the AZA4ICE Action Plan**, ensuring that capacity building directly enables implementation, reduces key barriers, and strengthens the economic sustainability and scalability of circular aquaculture initiatives beyond the pilot phase.

Expected Impact

- Improved **operational and financial readiness** of local fishermen and SMEs to engage in circular aquaculture;
- Reduced regulatory and administrative barriers through increased understanding of licensing processes;
- Strengthened link between technical innovation, economic viability, and market access;
- Creation of a **local skills base** capable of supporting long-term, scalable circular aquaculture operations at Šasko Lake.

ction 2 – Establish a Pilot Freshwater IMTA Demonstration Unit at Šasko Jezero

Objective

Demonstrate a **small-scale, precautionary, and environmentally safeguarded circular aquaculture model** at Šasko Lake, integrating *Cyprinus carpio* and *Phragmites australis*, in line with validated C-AZA results and stakeholder expectations.

Rationale

The C-AZA assessment confirms that the proposed IMTA model is **environmentally acceptable and suitable for lake conditions** (Integrated Sustainability Index – IS = 0.737). Stakeholder co-decision strongly supports implementation of the pilot **provided**

that strict environmental protection measures, continuous monitoring, and adaptive management are ensured, positioning the pilot as a learning and trust-building instrument rather than a production-driven intervention.

Interventions

- **Design and installation of a small, modular IMTA pilot unit**, ensuring:
  - minimal visual impact,
  - full reversibility and removability,
  - non-invasive anchoring and operation.
- **Semi-extensive rearing of carp (*Cyprinus carpio*)** in floating enclosures, combined with **strategically positioned *Phragmites australis* zones** to support nutrient uptake and circular nutrient flows.
- **Implementation of strict environmental safeguards**, including predefined thresholds, contingency measures, and adaptive management protocols.
- **Regular (monthly) environmental monitoring**, focusing on water quality parameters and ecosystem response, aligned with C-AZA indicators.
- **Transparent communication of results**, through periodic reporting and presentation to stakeholders and the wider public, ensuring accessibility and trust.

Expected Impact

- **Validated proof-of-concept** for circular freshwater aquaculture under sensitive lake conditions;
- Increased **stakeholder trust and social acceptance** through precautionary implementation and transparency;
- Practical **validation and refinement of C-AZA recommendations**;
- Strengthened local capacities and evidence base for potential future scaling, subject to evaluation results.

Action 3 – Community-Based Circularity Initiatives (Low-Investment Interventions)

Objective

Enable local fishermen, small operators, and the wider community to **adopt simple, low-cost circular practices** that deliver immediate environmental benefits, strengthen community ownership, and build momentum for broader circular economy transition at Šasko Lake.

Rationale

Stakeholder feedback confirms that **simple, visible, and low-investment interventions** are the most appropriate entry point for circularity at community level, particularly given the **low readiness levels of fishermen (1.1–1.8)** and their limited financial and technical resources. Participants prioritised actions that combine **practical environmental improvements with strong community engagement and awareness-raising potential**, favouring tangible measures over purely informational campaigns.

Interventions

Core low-investment interventions will focus on practices that can be **implemented rapidly using existing local capacities**:

- **Establishment of waste separation and collection points** at landing sites and key locations around the lake, directly addressing waste reduction and resource efficiency;
- **Introduction and promotion of reusable fishing gear**, including simple net-repair and reuse schemes, to reduce waste generation and operational costs;
- **Community-based clean-up actions**, organised periodically and involving fishermen, local residents, schools, and NGOs, strengthening shared responsibility and visible environmental improvement;
- **Educational eco-trails and visitor-oriented initiatives**, linking circular practices with environmental education and sustainable tourism around Šasko Lake.

Complementary low-budget actions, identified through stakeholder feedback, will further reinforce education, collaboration, and reuse:

- **Regular (e.g. monthly) clean-up campaigns** organised jointly with schools, local NGOs, and community groups;
- **Educational presentations and workshops in schools**, focusing on circular economy principles, waste reduction, and the ecological value of Šasko Lake;
- **Creative reuse of old fishing materials** (e.g. nets, hooks, and equipment) for the production of souvenirs or educational items, combining waste reduction with small-scale local economic opportunities;
- **Recycling of collected waste in cooperation with the local community**, accompanied by public communication and promotion of results to increase visibility and motivation;
- **Structured partnerships with schools and NGOs** for the organisation of joint, periodic activities related to waste collection, awareness raising, and promotion of circular aquaculture practices.

Interventions related to **water inflow management** and broader **plastic reduction campaigns** will be considered selectively, recognising their environmental relevance while acknowledging the need for additional coordination or complementary practical measures.

Expected Impact

- Rapid, visible improvements in environmental conditions through **low-cost, practical circular actions**;
- Strengthened **community ownership and participation** in lake management;
- Increased awareness and behavioural change through education and repeated engagement;
- Creation of a supportive social environment for scaling up circular aquaculture initiatives in subsequent phases.

Action 4 – Environmental Monitoring & Safeguards Implementation

Objective

Ensure the lake remains within safe ecological thresholds while supporting aquaculture.

Rationale

Šasko jezero is shallow, sensitive, and must be monitored carefully.

Interventions

- Continue water-quality sampling (temperature, pH, oxygen, nutrients, turbidity).
- Set up a simple indicator dashboard for local stakeholders.
- Establish precautionary thresholds for IMTA scaling.
- Annual ecological impact report shared with municipality and public.

Expected impact

Safeguards that ensure ecological protection and regulatory compliance.

Action 5 – Business Support & Funding Mobilization for Circular Aquaculture

Objective

Help local businesses access funding and reduce financial barriers.

Rationale

High willingness exists but financial resources are limited.

Interventions

- Advisory support for grant applications (national schemes, PRS funds, Euro-MED, IPARD III).
- Development of micro-grant schemes for fishermen (small equipment, waste-handling tools).
- Explore circular business opportunities for Phragmites biomass (composting, crafts, eco-products).

Expected impact

Greater investment in circularity, improved financial sustainability of local operators.

Action 6 – Governance and Coordination Platform for Šasko Jezero

Objective

Implement inclusive governance aligned with the LiRRIE co-decided vision.

Rationale

Licensing complexity and overlapping mandates require structured coordination.

Interventions

- Establish a local coordination group (environment, fisheries, water, municipality, IMBK, civil society, fishermen).

- Quarterly coordination meetings.
- Joint review of monitoring data and adaptive management decisions.
- Preparation of guidelines for small-scale circular aquaculture licensing.

Expected impact

Improved coordination, reduced administrative barriers, increased trust, and better policy alignment.

Responsible Actors

Actor	Role
Municipality of Ulcinj (Opština Ulcinj)	**Lead local coordination role**; alignment of actions with local development policies and spatial planning; facilitation of cooperation among local stakeholders; primary interface with the local community.
Local Fishermen's Associations / Local Fishermen and SMEs	**Core operational actors**; representation of local knowledge and livelihoods; participation in pilot activities, capacity building, and community-based circularity initiatives; feedback on feasibility and impacts.
Ministry of Agriculture, Forestry and Water Management / Directorate for Fisheries	**Strategic oversight and sectoral authority**; guidance on licensing and permitting; alignment with national fisheries and aquaculture policies; institutional support for implementation.
University of Montenegro	**Scientific and technical support role**; design support for the IMTA pilot; environmental monitoring; applied research; contribution to training activities and evidence-based reporting.
Chamber of Economy of Montenegro	**Business and capacity-building support**; advisory services related to business development, access to finance, and market readiness for circular aquaculture initiatives.
Environmental Protection Agency (EPA)	**Advisory and supervisory role**; review of environmental safeguards; oversight of monitoring results; contribution to environmental impact assessment and compliance, without a central decision-making role.
Civil Society Organisations and Local Associations	**Supporting and engagement role**; participation in awareness-raising actions, community initiatives, and feedback processes; contribution to social acceptance and outreach activities.
LiRRIE Forum Montenegro	**Coordination and dialogue mechanism**; platform for co-decision, information exchange, and continuous stakeholder engagement, without adding an additional

	governance layer.

Governance approach:

In line with stakeholder feedback, governance of Šasko Lake will be based on a **shared but focused multi-actor model**, where **local public authorities and organised user groups (municipality and fishermen)** take the lead, forming the **core governance triangle together with the Directorate for Fisheries**. Other actors contribute in **clearly defined supporting or advisory roles**, ensuring legitimacy, practicality, and sustainability, while avoiding unnecessary complexity.

Targeted involvement of **state-level institutions** remains possible where strategic alignment or institutional backing is required, without expanding the stakeholder structure beyond what is necessary for effective decision-making and coordination.

Timeline (Realistic 24-Month Horizon)

Period	Actions
Months 1–3	Establish coordination group; finalize IMTA pilot design; begin training programme.
Months 4–6	Install IMTA pilot; launch community circularity initiatives; initiate monitoring framework.
Months 7–12	Full operation of IMTA pilot; monthly monitoring; ongoing training; licensing guidance.
Months 13–18	Adjustment of pilot based on data; small-scale circularity upgrades; business support actions.
Months 19–24	Evaluation of IMTA pilot; scaling recommendations; final capacity-building workshops; funding applications.

Timeline is intentionally conservative to reflect ecosystem sensitivity and administrative complexity.

Financial Aspects and Funding Resources

Estimated Budget Ranges

(Indicative; assumes small-scale pilot and capacity-building focus)

- IMTA pilot setup: **€15,000–€25,000** (modular, low-impact system)
- Monitoring equipment & sampling: **€3,000–€5,000**
- Capacity-building programme: **€5,000–€10,000**
- Circularity initiatives (gear, materials): **€2,000–€4,000**
- Coordination & training events: **€3,000–€6,000**

Total indicative budget for 24 months: **€28,000–€50,000** (Realistic for Montenegro; scalable if external funds secured)

Potential Funding Sources

National Funding Sources (Primary)

- **Ministry of Agriculture, Forestry and Water Management** – national grant schemes supporting fisheries and aquaculture development, identified by stakeholders as the **most trusted and preferred funding source**;
- **Directorate for Fisheries** – operational and targeted support measures aligned with sectoral priorities and licensing frameworks;
- **Municipality of Ulcinj** – limited co-financing from environmental protection and local development budgets, primarily to support coordination, awareness activities, and low-cost community actions.

EU and International Funding Sources (Primary and Secondary)

- **IPARD III** – prioritised by stakeholders as a key instrument for aquaculture-related investments, equipment upgrades, and small-scale processing improvements;
- **Interreg programmes (Euro-MED / IPA)** – support for pilot actions, capacity building, cross-border exchange, and innovation-oriented activities;
- **EU Blue Economy and Circular Economy funding instruments** (e.g. DG MARE, selected Horizon Europe small-scale calls) – targeted support for demonstration, innovation, and knowledge transfer;
- **International donors and financial institutions** (e.g. EBRD, UNDP Montenegro) – complementary funding for business support, sustainability measures, and technical assistance.

Private and Complementary Sources

- **Targeted co-financing by motivated SMEs** (e.g. MM Ribarstvo, Montefish, Zeta Fish), primarily in-kind or as co-investment linked to pilot implementation;
- **CSR initiatives of local companies**, supporting specific awareness or environmental actions rather than core investments.

Additional Financial Instruments (Complementary)

- **Commercial bank loans**, as potential sources of investment financing for aquaculture infrastructure, equipment, and operational scaling;
- **Preferential credit lines**, particularly through a **development bank**, offering more favourable conditions (lower interest rates, grace periods, longer repayment terms) for sustainable and circular aquaculture projects.

Financial Realism and Phasing

In line with stakeholder feedback, implementation of the Action Plan will follow a **phased financing approach**, anchored in **national and EU grant-based instruments**, and complemented by private co-financing and lending instruments where appropriate. Given the **limited financial capacity of local public budgets and SMEs**, priority will be given to **low-cost, high-impact actions**, with external funding leveraged to enable scaling and long-term sustainability.

Monitoring and Evaluation

The Monitoring and Evaluation framework ensures that all proposed actions for Šasko jezero are implemented responsibly, achieve tangible results, and remain aligned with ecological safeguards and stakeholder expectations. Monitoring will focus on simple, measurable indicators, while evaluation will rely on continuous feedback, adaptive management, and transparent communication among key actors.

Success Indicators

Success indicators are defined across four dimensions that reflect the priorities of the Action Plan: environment, technology, governance, and community/business adoption. They correspond directly to the proposed actions.

Environmental Performance Indicators

(Linked to Actions 2 & 4)

- **Water quality remains within acceptable thresholds** for pH, oxygen, conductivity, nutrients, turbidity.
- **No negative ecological impact detected** from the IMTA pilot.
- **Phragmites shows measurable nutrient uptake** (biomass increase, nutrient reduction in surrounding water).
- **Stable ecological conditions** sustained for at least 12 consecutive months of IMTA operation.

IMTA Technical Performance Indicators

(Linked to Action 2)

- **IMTA pilot fully installed and operational** by Month 6.
- **Survival and growth of Cyprinus carpio** maintained at expected levels for semi-extensive culture.
- **Regular weekly/bi-weekly monitoring conducted** (health, FCR, feeding, biomass).
- **Circularity demonstrated** through nutrient flow between fed species (carp) and extractive species (Phragmites).

Governance and Coordination Indicators

(Linked to Action 6)

- **Local coordination platform established** and operational by Month 3.
- **Minimum of 4–6 multistakeholder coordination meetings held** within the project period.
- **Stakeholder participation consistently includes all helix groups** (public sector, academia, businesses, civil society, environmental actors).
- **Draft guidelines produced** for small-scale circular aquaculture licensing.

Community, Business, and Circularity Adoption Indicators

(Linked to Actions 1, 3 & 5)

- **At least 20 local stakeholders trained** through capacity-building programmes.
- **At least 3 circular practices adopted** (e.g., reusable gear, waste sorting, bycatch management).
- **One or more micro-circular initiatives launched** (e.g., Phragmites biomass use).
- **A minimum of 3 funding applications prepared** with support from the Chamber of Economy.
- **Private sector co-investment of at least €10,000** mobilized.

Follow-up and Adjustment

Follow-up mechanisms will ensure that implementation remains aligned with environmental restrictions, stakeholder needs, and practical constraints. Adjustments will be made based on monitoring data, participation feedback, and ecological safety requirements.

Quarterly Review Mechanism

- All key actors meet every 3 months to review environmental data, IMTA performance, business uptake, and governance issues.
- Issues or deviations are identified early and corrective measures are proposed.
- Meeting summaries are shared with all LiRRIE members to guarantee transparency.

Adaptive Environmental Management

If environmental thresholds are exceeded (e.g., nutrients, oxygen, turbidity):

- **Immediate action**: reduce feeding, adjust biomass levels, or temporary suspension of IMTA operations.
- **Short-term response**: increase monitoring frequency, conduct targeted ecological assessments.
- **Long-term adjustment**: modify IMTA design, reduce stocking density, or introduce additional extractive components.

Capacity-Building Adjustment

If readiness among fishermen/SMEs remains low:

- Increase practical demonstrations and on-site training.
- Simplify training materials and offer individualized support.
- Add new topics (financial literacy, basic monitoring techniques, waste minimization).

Governance Adjustment

If coordination barriers persist:

- Expand platform membership to include missing actors.
- Introduce thematic working groups (licensing, environment, business).
- Strengthen involvement of municipality and local associations.

Financial Adjustment

If financial resources fall short:

- Re-prioritize low-cost, high-impact actions.
- Increase support for external funding applications.
- Explore public–private partnerships or micro-grants from local businesses.

Final Evaluation (Month 24)

By the end of the project, a final evaluation will:

- Assess overall ecological compatibility of IMTA.
- Measure adoption of circular practices.
- Determine readiness for scaling operations.
- Provide recommendations for long-term C-AZA implementation in Šasko jezero and replication in other Montenegrin inland waters.

Conclusion

Summary

This Action Plan provides a realistic, evidence-based, and inclusive roadmap for introducing circular aquaculture at **Šasko jezero**, fully aligned with the AZA4ICE methodology, the LiRRIE co-decided vision, and the local socio-economic context. The C-AZA assessment confirms that Šasko jezero is **environmentally acceptable** for carefully controlled, low-impact aquaculture, with strong potential for implementing a **freshwater IMTA model** based on *Cyprinus carpio* and *Phragmites australis*. Complementing this, the BLUEfasma circularity baseline highlights a regional profile characterized by **low readiness but high willingness**, signaling a strong desire for innovation once technical and financial support is provided.

The proposed actions—ranging from pilot installation and environmental monitoring to capacity-building, community engagement, governance strengthening, and financial mobilization—are designed to be **realistic, low-cost, and scalable** within Montenegro's current capabilities. They aim to ensure ecological protection, empower local stakeholders, enable circularity adoption, and establish Šasko jezero as a **national demonstration site** for sustainable freshwater aquaculture.

Through strengthened cooperation among public authorities, scientific institutions, fishermen, SMEs, civil society, and the local community, Šasko jezero can become a leading example of **how circular economy principles can be implemented in sensitive inland ecosystems** in Montenegro.

Next Steps

To operationalize this Action Plan, the following next steps are recommended:

1. Formal Endorsement and Coordination Setup (Months 1–2)

- Confirm institutional endorsement of the Action Plan by the Ministry, EPA, IMBK, and Municipality of Ulcinj.
- Establish the **local coordination platform** and define clear roles and communication channels.

2. Preparation and Installation of the IMTA Pilot (Months 2–6)

- Finalize technical design and site selection within Šasko jezero.
- Acquire low-impact equipment and install the IMTA unit.
- Launch environmental baseline measurements.

3. Initiate Capacity-Building and Community Interventions (Months 2–12)

- Deliver practical training for fishermen and SMEs.
- Begin community-based circularity initiatives and awareness activities.
- Support circular micro-initiatives using Phragmites or other low-cost resources.

4. Launch Continuous Monitoring (Months 3–24)

- Conduct structured monitoring of water quality, IMTA performance, and circularity adoption.
- Review monitoring results quarterly; apply adaptive management.

5. Mobilize Financing (Ongoing)

- Support SMEs and fishermen in preparing funding applications to national and EU programmes.
- Explore co-investment opportunities from private operators.
- Identify long-term financing for IMTA scaling if results are positive.

6. Mid-Term Review and Adjustment (Month 12)

- Assess initial environmental and technical performance.
- Adjust IMTA operation, governance mechanisms, and training programmes as needed.

7. Final Evaluation and Future Planning (Month 24)

- Evaluate environmental safety, socio-economic impacts, and circularity adoption.
- Decide whether to **scale**, **replicate**, or **institutionalize** C-AZA-based circular aquaculture in Montenegro's inland waters.
- Prepare recommendations for policy refinement and long-term governance.

With coordinated action, strong stakeholder engagement, and careful environmental stewardship, Šasko jezero can become a pioneering example of circular aquaculture in Montenegro—demonstrating how ecological protection and economic opportunity can be mutually reinforcing within a sensitive freshwater ecosystem.


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