

CONCEPT PAPER

European Modular Engineering Platform for Sustainable Aquaculture Development

Executive Summary

European aquaculture is entering a new stage of development driven by increasing demands for food security, environmental sustainability, resource efficiency and climate resilience. Although numerous technological solutions have been developed over recent decades, engineering systems remain fragmented and are typically designed as independent components rather than as integrated adaptive systems.

Mottra Technology Group proposes the development of a **European Modular Engineering Platform for Sustainable Aquaculture Development** based on the principles of Adaptive Modular Engineering. The proposed platform is intended to integrate engineering, digital technologies, water management, automation and environmental solutions into a unified engineering architecture capable of adaptation to different regional conditions across Europe.

The initiative is proposed as a foundation for international cooperation within Horizon Europe and other European innovation programmes.

1. European Challenge

European aquaculture is expected to contribute significantly to food security, sustainable blue economy, climate adaptation, circular resource management and regional development.

However, the engineering infrastructure supporting aquaculture remains highly fragmented. Individual technologies - including recirculating aquaculture systems (RAS), water treatment, monitoring, automation, energy systems and environmental protection - are often developed independently, limiting interoperability, scalability and long-term sustainability.

Future development requires a transition from isolated engineering solutions to integrated adaptive engineering systems.

2. Engineering Vision

The proposed concept introduces a new engineering paradigm based on **Adaptive Modular Engineering Platforms**.

Instead of designing aquaculture facilities around individual technologies, engineering begins with an integrated assessment of regional water resources, environmental conditions, energy availability, production objectives, economic efficiency and digital infrastructure.

Based on this assessment, engineering modules are combined into a unified adaptive platform capable of continuous modernization throughout the entire life cycle of the facility.

3. Engineering Innovation

The proposed platform combines interoperable engineering modules including Adaptive Water Management, water treatment technologies, RAS engineering, automation and robotics, digital monitoring, Artificial Intelligence, Digital Twins, environmental monitoring, circular resource management and renewable energy integration.

Each engineering module may evolve independently while maintaining compatibility with the common engineering architecture.

This approach significantly reduces engineering risks, simplifies modernization and enables rapid technology transfer between regions.

4. European Added Value

The concept is designed as an open collaborative engineering framework.

It creates opportunities for cooperation between engineering companies, universities, research organisations, technology developers, equipment manufacturers, aquaculture producers and regional innovation ecosystems.

Rather than developing competing technologies, consortium partners jointly contribute interoperable engineering modules forming a common European engineering platform.

5. Expected Impact

The proposed engineering platform is expected to contribute to improved resource efficiency, reduced environmental impact, increased energy efficiency, digital transformation of aquaculture, climate resilience, accelerated innovation transfer, modular industrial development and European technological cooperation.

6. Potential Horizon Europe Implementation

The proposed initiative directly supports European priorities related to Sustainable Food Systems, Blue Economy, Green Deal, Climate Adaptation, Circular Economy, Digital Europe and Regional Innovation.

The platform may serve as a common engineering framework for future Horizon Europe collaborative projects, demonstration activities, pilot facilities and international engineering cooperation.

7. Partnership Invitation

Mottra Technology Group invites partners interested in developing next-generation engineering solutions for sustainable aquaculture.

The consortium may include universities, research institutes, engineering companies, technology developers, equipment manufacturers, regional authorities, innovation clusters and aquaculture enterprises.

The objective is to jointly establish a European engineering platform supporting long-term innovation and sustainable development.

Conclusion

The future of European aquaculture depends not only on technological innovation but also on the development of integrated engineering systems capable of adapting to changing environmental, economic and climatic conditions.

The proposed **European Modular Engineering Platform for Sustainable Aquaculture Development** represents a new engineering paradigm that integrates modular design, adaptive engineering and international cooperation into a unified framework for sustainable development.

The concept provides a solid foundation for establishing a multidisciplinary Horizon Europe consortium capable of delivering next-generation engineering solutions for European aquaculture.