Bilateral Cooperation Agreement

Between:

1. **Egyptian Partner:**
   The Central Laboratory for Aquaculture Research (CLAR), Agricultural Research Center (ARC), Ministry of Agriculture, Cairo, Egypt.
2. **Chinese Partner:**
   Fisheries College, Ocean University of China, Qingdao 266003, China.
3. **Brazilian Partner:**
   Universidade Federal do Rio Grande, Brazil.
4. **Brazilian Partner:**
   Chiesa & Frighetto Cia Ltda, Brazil.

Project Title

"Advancing Sustainable Shrimp and Tilapia Aquaculture through Biofloc Technology: From Development to Commercialization in a Circular Bioeconomy Context (BioAquaCE)"

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1. Preamble

Recognizing the shared commitment to advancing sustainable aquaculture technologies, environmental protection, and scientific innovation, the **Central Laboratory for Aquaculture Research (CLAR)** Agricultural Research Center (ARC), Ministry of Agriculture, Cairo, Egypt; **Fisheries College of Ocean University of China**, the **Universidade Federal do Rio Grande, Brazil and the Chiesa & Frighetto Cia Ltda, Brazil** (hereinafter referred to collectively as "the Parties") agree to cooperate in the implementation of the project titled:

"Advancing Sustainable Shrimp and Tilapia Aquaculture through Biofloc Technology: From Development to Commercialization in a Circular Bioeconomy Context."

This collaborative initiative will focus on the development and application of **smart, sustainable aquaculture technologies** under the **BRICS STI Framework Programme – 1st Coordinated Call for BRICS Innovation Projects 2025**, thereby promoting joint research and technological development among the BRICS member countries.

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2. Relevance to BRICS Priorities

The proposed project directly supports BRICS priorities in **Food Security, Biotechnology, Environmental Sustainability, and the Circular Economy**.

It aims to:

- Promote sustainable resource utilization;
- Enhance aquaculture productivity and efficiency;
- Minimize ecological impacts and waste generation; and
- Contribute to achieving the **United Nations Sustainable Development Goals (SDGs)**:
    - **SDG 2:** Zero Hunger
    - **SDG 12:** Responsible Consumption and Production
    - **SDG 14:** Life Below Water

The multi-national partnership further advances **South–South cooperation**, **capacity building**, and **technology transfer** among BRICS nations.

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3. Project Objectives

1. **Optimize** nutrient recycling and reuse efficiency within biofloc systems to achieve a near-zero-waste production model.
2. **Convert** excess biofloc solids into high-value **vermicompost** enriched with humic substances and natural antimicrobials.
3. **Enhance** vermicompost with natural antioxidants to improve fish and shrimp health and nutritional performance.
4. **Clarify** inorganic nitrogen transformation processes and related microbial mechanisms to develop safe and efficient **probiotic formulations** for improved water quality and system stability.

Implementation Framework

The project adopts a **Circular Bioeconomy Framework** implemented through three regional axes:

- **Egyptian Axis:**
  Develop vermicompost-based BFT (Biofloc Technology) systems for **Nile tilapia**, evaluating effects on biofloc formation, fish growth, immunity (e.g., immunoglobulin, antimicrobial peptides), and nutrient recycling.
- **Chinese Axis:**
  Focus on ***Penaeus vannamei*** BFT systems, investigating **inorganic nitrogen dynamics**, **microbial regulation mechanisms**, and developing **eco-friendly water treatment probiotics** and strategies for commercial-scale implementation.

- **Brazilian Axis:**
  Optimize **nitrifying and denitrifying bacterial communities** in biofilm-based systems for *P. vannamei* under varying salinity and temperature conditions. Demonstrate **anaerobic denitrification** and **suspended solids management** strategies at full operational scale.

Cooperation Methods

The Parties agree to:

- Exchange skills, expertise, and technical knowledge;
- Conduct **joint research, demonstration projects**, and training;
- Deliver **workshops**;
- Organize and participate in **seminars, conferences, and symposia**;
- Produce **joint publications** and disseminate research outcomes collaboratively.

Funding Sources

- **Egypt:** Science and Technology Development Fund (STDF)
- **China:** Ministry of Science and Technology (MOST)
- **Brazil:** Financiadora de Estudos e Projetos (Finep)

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4. Roles and Commitments of the Parties

Egypt (CLAR – ARC)

- Provide **research facilities, staff, and field sites** for Nile tilapia BFT and vermicompost systems.
- Participate in **research planning, execution, and data analysis**.
- Facilitate **dissemination of scientific outcomes**, technology transfer, and joint publications.
- Support **training activities** for local and international researchers.
- Help in providing **logistical assistance**, including accommodation and residency facilitation for visiting scientists.

China (Ocean University of China)

- Provide **laboratories, staff, and experimental sites** for *P. vannamei* BFT system development.
- Participate in research planning and execution to advance smart sustainable aquaculture.
- Contribute **advanced laboratory technologies** for microbial enrichment and BFT optimization.
- Facilitate **knowledge sharing**, **joint patent applications**, and **co-publications**.

- Assist with **logistics and residency arrangements** for visiting researchers.

Brazil (Universidade Federal do Rio Grande and Chiesa & Frighetto Cia Ltda)

- Provide **experimental sites, laboratories, and personnel** for *P. vannamei* BFT research.
- Contribute to **research design and technological development** of sustainable aquaculture systems.
- Offer expertise in **nitrifying/denitrifying microbial communities** and biofilm-based system management.
- Facilitate **joint patent applications**, publications, and technology transfer.
- Provide **support for visiting researchers** in Brazil.

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5. Intellectual Property and Commercialization

- **Ownership Principles:** Each Party shall retain full ownership of its Background Intellectual Property (IP). Foreground IP arising from the work of personnel from a single Party shall be owned solely by the institution of that Party. Foreground IP arising from the joint work of personnel from two or more Parties shall be owned jointly by the institutions of those Parties.
- **Management of Joint Foreground IP:** Regarding jointly owned Foreground IP, no Party shall license or assign its interest to any third party without the prior written consent of the other co-owning Party(ies). Each co-owning Party is hereby granted a perpetual, royalty-free, non-exclusive license to use the Joint Foreground IP for its own non-commercial research and educational purposes. The co-owning Parties shall negotiate in good faith to enter into a separate agreement concerning the protection (e.g., patent filing), maintenance, commercialization, and allocation of any resulting revenues.
- **Publications and Authorship:** Scientific publications arising from the Project shall involve all relevant contributors. The order of authorship shall reflect the relative scientific contributions of the participants, following established international academic conventions.
- **Compliance with Laws and Regulations:** This agreement shall be subject to and construed in accordance with the relevant national laws and regulations of the countries of the participating Parties.

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6. Duration

This Agreement shall remain in force for an initial period of **three (3) years**, corresponding to the funded project duration, and may be **renewed by mutual written consent** of all Parties.

7- Signature

Agricultural Research Center (ARC), Egypt	Ocean University of China, Qingdao, China	Universidade Federal do Rio Grande, Brazil	Chiesa & Frighetto Cia Ltda, Brazil
Signature (Principal Investigator)	Signature (Principal Investigator)	Signature (Principal Investigator)	Signature (Director)
Date: 12 /03 /2025	Date: 12/03/2025	Date: 12/02/2025	Date: 12/02/2025
Signature of ARC president	Signature of Ocean University of China	Signature of Universidade Federal do Rio Grande	Signature of CEO
Stamp	Stamp	Stamp	Stamp