



Intelligent Fish feeding through Integration of ENabling technologies and Circular principle

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iFishIENCi Deliverable 6.1: Responsible Research & Innovation (RRI) Inreach Framework

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1.1 Introduction

This document outlines the rationale and concrete protocol for the innovative “RRI-Inreach” strategy and activities that will support the EU H2020 iFishIENCi project in 2019–2022.

1.2 What is RRI?

Responsible Research and Innovation (RRI) is a cross-cutting approach that includes a plurality of disciplinary and non-disciplinary perspectives of how science, technology and innovations can work together with society to produce sustainable and fair outcomes. Anticipation, public engagement, reflexivity and responsiveness are central concepts for successful RRI interventions. In RRI activities, both academic experts and innovation users and stakeholders and local experts engage in discussions regarding the creation and deployment of future innovations. The overall goal for RRI actions is to heighten the quality of research and innovations through open science and participatory processes. The antithesis to RRI ideals is therefore innovations that exclude relevant perspectives and people and erode or destroy societal values instead of supporting them.

In 2018, the Horizon 2020 Innovation Action project iFishIENCi was awarded over €6 million in funding to develop smart aquaculture products that will aid in ambitious Blue Growth for the aquaculture sector in the European Union and beyond. The iFishIENCi consortium consists of 16 academic and business partners from Norway, Malta, Hungary, France, Germany, Denmark and Greece. In order to aid the Blue Growth goals with innovative “smart aquaculture” products, iFishIENCi recognizes the need to capitalize on diverse and inclusive and interdisciplinary communication practices *within* the consortium. Since RRI approaches are usually focused at the science-society-policy interface, there is a deficit in the RRI literature of explicit approaches of RRI-inspired engagement in the laboratory, or “*inreach*” as we call it.

The motivation for this deliverable, therefore, is to present a new, innovative RRI framework that is designed explicitly for the iFishIENCi consortium in order to apply RRI approaches within and among the eight work packages of the project. This *inreach innovation* has been designed by the “RRI Champion” of the iFishIENCi project and refined by the work package leader and other partners in the project. As such, the RRI-inreach is a diverse co-production by the designers of the innovations.

1.3 The significance of the philosophy of science in RRI

How does a scientist or technologist *know*? How do scientists and technologist draw *meaning* from numbers or models? How do our values and conceptions of sustainable aquaculture affect our products? *What is the iFishIENCi project actually about?*

These iFishIENCi-relevant questions derived from the philosophy of science, a sub-category of philosophy, are examples of how the humanities can help induce a reflexive thinking so central to good RRI practice. We hypothesize that other major RRI aspects, *anticipation, engagement* and *responsiveness* will also become more concrete when challenges of the project are discussed with philosophical reflection. The RRI-Inreach framework will create spaces to discuss and critically analyze these types of questions within the iFishIENCi consortium on an iterative basis.

1.4 How can RRI-Inreach help communication and dissemination in iFishIENCi?

The goals of the iFishIENCi project are bold and ambitious. Success of iFishIENCi is two-fold: first the promised technological products must function; and second, the users of these products must find them useful. For the first goal, the interdependencies of the work packages are contingent on internal communication. And for the second goal, “*outreach*” communication (external to the iFishIENCi consortium) is paramount. Therefore, the first objective of RRI-Inreach is to explicitly identify aspects

of responsible research and innovation, including issues of the philosophy of science, in each work package. The second objective is to lift these issues onto a larger communication platform in the public engagement and outreach tasks of iFishIENCi (i.e. T6.2–6.6).

2 The iFishIENCi Work Package 6 Road Map

We have developed a Road Map In order to guide and coordinate the activities in Task 6.1 “RRI Framework and Inreach.” The Road Map will be used by the RRI Champion to identify Inreach activities that will likely produce RRI synergies for the consortium’s related tasks. The RRI Road Map has 2 parts: 1) Specific tactical activities of Inreach, and 2) connections to other tasks and activities in iFishIENCi.

WP6, T6.1 Road Map																													
Week 2020	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Inreach Dialogues	WP5	WP8	WP1																			WP5	WP8	WP1					
planned	WP3	WP4	WP7																			WP3	WP4	WP7					
completed	WP2																					WP2							
WP6 Bi-weekly mtg																													

Engagement Action towards RRI Inreach	Key Performance Indicators
Engaging Consortium members	<ul style="list-style-type: none"> • Number of partners in the consortium engaged in each Bi-weekly meeting • Percentage of partners who engaged in at least 1 bi-weekly meeting in every month • Number of partners who compose a blog post or tweet

3 The iFishIENCi Work Package (WP) objectives and associated RRI questions

This section presents each work package, its objectives and RRI questions specific to these. The following section then outlines a protocol that will be used in 2019–2022 and the penultimate section anticipates the future impact of this RRI-Inreach innovation.

3.1 WP1: “Smart” feeding and novel feed formulas

3.1.1 Objectives

WP1 aims to comprehensively and objectively test and qualify smart feeding approaches and feed formulas in controlled environments before further demonstrations in operational environments (WP3).

Sub-objectives: (1) Enable the iFishIENCi Biology Online Steering System (iBOSS) by integrating biology online (fish behaviour, growth, welfare, health & environmental microbiome) with state-of-the-art IoT-based water quality monitoring to improve decision-making and smart feeding control, (2) qualify methods to obtain new and functional feed ingredients from algae, (3) characterize the biological responses of the new feeds to the fish and the environment, and (4) design condition-based optimal valorisation processes for recirculation of carbon waste.

3.1.2 RRI Aspects Questions

There are strong interdependencies between WP1 and WP2 which underscores the importance of effective communication. Specific RRI-Inreach aspects in this regard are open discussions on how communication happens (who initiates communication, in what medium does communication occurs, how is data shared/integrated/

- How does WP1 “know” what the fish need?
 - *in vivo*
 - *in silico*
 - *in publicae*
- Ontological questions: definitions of data inputs and outputs (descriptions of what things *are*)
- Epistemological questions: (How does WP1 *know*?)
- How to qualify “real-time” information for the aquaculture farmers?
- What could go *wrong* with the sensors? What do the sensors *not* tell us?
- What are the uncertainties of *inputs/outputs* regarding iBOSS and Fish-Talk-To-Me?

3.2 WP2: Internet of Things and artificial technology integration

3.2.1 Objectives

The objectives are two-fold:

a) **On Internet of Things (IoT):** Bring sensors and actuators (feeders) into state of the art IoT environment. Integrate all sensors including new ones if needed and interface with feeders in controlled manner. Bring the data and actions into an open IoT architecture including advance network features (e.g. using Fiware) to order to be able to process a broad range of data. This the task T2.3

b) **On Artificial Intelligence (AI):** Provide additional data (T2.1) and do data analytics and use AI features in order to develop smart feeding algorithms (T2.2)

3.2.2 RRI Aspects and Questions

As mentioned, communication with WP1 is essential for the success of WP2. In this regard, many of the RRI aspects mentioned in WP1 are relevant also for WP2. Specific WP2 RRI aspects of the digital products and user interfaces of these products go beyond inreach (internal communication) and are directly related to outreach, or direct engagement with the public (users and consumers of the digital products).

- What are the uncertainties of *inputs/outputs* regarding iBOSS and Fish-Talk-To-Me?
- Who are the digital product users? Who are the WP2 stakeholders?

3.3 WP3: Demonstrations in operational contexts

3.3.1 Objectives

The new feeds and technologies developed and small-scale pilot tested in controlled environment will be scaled-up in large-scale demonstration experiments in WP3 for:

- Further testing the selected feed and iBOSS in operational environments.
- Provide additional experimental sites and data for tuning iBOSS and providing feedback to WP2.
- Validate data for WP4 assessments and modelling and for market assessment and business models in WP5
- Support the market replication of iFishIENCi products in WP6
- Provide farm visit opportunities for training and outreach activities.

3.3.2 RRI Aspects and Questions

The iFishIENCi project aims to develop generic technologies that can be used across different types of aquaculture systems and species, but the scope of the testing is limited to only a few of these varieties. How can we ensure that the products will be useful to as many users as possible? The definition of sustainability should necessary integrate social, economy and environmental aspects. We should be aligned with the international agreed concept of sustainability.

If we cannot affirm at this stage of the project the sustainability of the feed, we could say that the integration of the circular principle as well as the evaluation (and mitigation?) of the impacts along the value chain will ensure that the feed will have a better environmental profile than the status quo. We should prepare for eventuality that circular principle may not improve sustainability of the feed (Efforts to incorporate circularity can increase environmental impacts). We should adopt an accepted definition of sustainability. However, the definitions of sustainability are vague at best. Perhaps the best approach is to discuss the results / outcomes from a variety of perspectives or possibly even discuss and outline fluid definitions of sustainability.

- How does iFishIENCi define “sustainability”? What makes these feeds and technologies more sustainable than the status quo?
- What aspects of the Blue economy and of Blue Growth do these demonstrations address?
- Are these products equitable? Fair? For everyone?

3.4 WP4: Sustainability and circularity assessments

3.4.1 Objectives

In WP4, the sustainability of the iFishIENCi freshwater and marine aquaculture value chains integrated and demonstrated in WP2 and WP3 will be performed.

Inputs: Inputs and outputs from the target systems, regarding the energy, materials, emissions, wastes and residues as well as regarding the costs associated with iFishIENCi value chains will be needed to produce Sustainability analyses inventories. Mainly inputs from technology developers participating in WP2 and WP3. There is no alternative to LCA in this work package. To deal with the smoke-screen issue we must make logical modelling choices and describe fully what these choices are and the consequences they have upon results. Actually, the list of question could go on forever, but it is such questions that make LCA interesting, it gets people thinking about issues of sustainability. Task leaders believe LCA is currently limited in its ability to deliver robust results. There is also significant, almost unavoidable potential for subjective bias influencing results. But it is these limitations that are the strength of LCA. Instead of trying to cover it up or avoid the discussion, which unfortunately is the trend, you talk about it and get people thinking. What Dorothy calls “Quantitative story telling.”

Outputs: (i) Evaluation of the sustainability and *circularity* of the proposed aquaculture value chains, and recommendations to increase the performance of the system, considering environmental, economic and social aspects, based on identification of hotspots along the value chains, (ii) Identification and evaluation of Legal, responsible farming standards, certification schemes, Ethical, Environmental, and H&S Requirements.

3.4.2 RRI Aspects and Questions

The data that is collected and used in LCA and the LCA approach itself must be treated with utmost care. This is not simply due to issues of business confidentiality or personal privacy concerns or to complex calculus. In fact, traditional LCA approaches, although robust in the academic and business literature have been criticized not for a lack of “doing the sums right” but for not “doing the right sums.” This means that LCA can be used as a techno-scientific smoke screen, or crutch, to produce results that are not relevant or beyond the scope of the actual issue at hand.

- Is LCA the correct approach for the insights we need?
- What are alternatives to LCA in this WP?
 - [WP4 Leader comment:] Although there are several alternatives for the evaluation of the environmental aspects (i.e ISO 14001), LCA is the most appropriate methodology to assess the environmental profile of products and processes. The combination of LCA with social acceptance, Life Cycle Costing and circularity analysis will allow us to achieve an holistic picture of the value chain.
- What can the LCA tell us about our innovations?
- What can't LCA tell us about our innovations?

3.5 WP5: Exploitation and market strategy

3.5.1 Objectives

The objective of this WP is to guarantee that iFishIENCi results are prepared for exploitation supported by:

- High level business decisions concerning the establishment of integrated business model for intelligent fish feeding through integration of enabling technologies and circular principle

- Assistance to business customers in determining viable economic of the solutions developed and tested.
- To generate a business plan to commercialize the project results and to penetrate iFishIENCi at European and International level in the aquaculture sector.
- Engagement of all the stakeholders through the value chain to ensure the most cost-effective options for intelligent fish feeding through integration of enabling technologies and circular principle.
- To analyse market potentials, applications perspectives, risk and opportunities for the implementation of iFishIENCi solutions.
- To assess all the issues related to the creation of the necessary infrastructure for the promotion of a mass market.
- To define the most appropriate strategy for the exploitation of the results and exploitation plan, with special focus on the IPR management among partners.

3.5.2 RRI Aspects and Questions

This WP is business-, and thus stakeholder-, oriented. The stakeholder mapping and associated authority and power mapping will aid the RRI *anticipation* and *responsiveness* aspects of the objectives of WP5.

- Do the iFishIENCi products favor some businesses more than others? Why or why not?
- Should iFishIENCi products favor some businesses over others? Why or why not?
- How can iFishIENCi ensure sustainable business practices?

3.6 WP6: RRI framework, communication and dissemination

3.6.1 Objectives

The overall goal of the iFishIENCi project is to provide new intelligent feeding technologies to support ambitious, but sustainable growth for the European aquaculture industry. In order to do this, cutting-edge research will combine with a holistic understanding of how these new technologies will interact with society and stakeholders in terms of economy, politics, social welfare, animal welfare and ethics. WP6 aims to develop and apply an innovative Responsible Research and Innovation (RRI) platform that focuses on practices of “inreach” within the entire consortium and outreach to stakeholders and society. RRI is a cross-cutting interdisciplinary framework now commonly applied in Horizon 2020 projects. The iFishIENCi WP6 contributors will practice RRI by applying methods from social science (institutional theory, socio-economics, political science), anthropology (ethnography) and the philosophy of science to examine these issues.

3.6.2 RRI Aspects and Questions

This document is the first deliverable of this WP.

3.7 WP7: Project management

3.7.1 Objectives

1) To coordinate and manage the project and the efficient, smooth and timely execution of all planned project activities. 2) To revise and maintain the project work plan. 3) To ensure an accurate and on time communication flow among the project partners and with EC in order to track the project

progress and meet its objectives. 4) To complete the project within the agreed time schedule and budget.

3.7.2 RRI Aspects and Questions

- Is the iFishIENCi project management transparent in its decision-making?
- Is the iFishIENCi project management fair and inclusive in its decision-making?
- Is the iFishIENCi project management responsive to issues and concerns of the consortium?
- Does the iFishIENCi project management anticipate issues to support the consortium?

Mitigation: Project internal procedures to ensure transparent and inclusive decision-making are described in the Project Manual (D49) and in the Consortium Agreement. Both documents can be modified according to response the needs of the partners and to anticipate the solution of problems and issues in the consortium.

3.8 WP8: Ethics

3.8.1 Objectives

Based on the ethical review of the proposal evaluation the Grant Agreement (GA) defined the ethical issues of the project which have to be tackled by established procedures.

According to the Ethics Summary Report of the submitted project proposal the following ethics issues were identified:

1. Involvement of humans and corresponding data on organoleptic work and social acceptance studies.
2. The project will include fish trials and observations on Salmon, Sea bass, Rainbow trout and African catfish.
3. There will be an exchange of samples amongst EU member states and Norway as a non-EU country.
4. Composition of sludge and water can harm to the environment, to animals or plants.

To handle and mitigate these issues the project will implement five ethics related tasks based on deliverables required as an output of coordinating these issues.

3.8.2 RRI Aspects and Questions

Ethics are a central theme in RRI. In the iFishIENCi project, ethical concerns include animal welfare issues, as well as issues of data sharing, open access, and privacy concerns regarding the digital products and the types of data that they produce and share.

- Are the experimental sites licensed to do research using fish or for fish production?
- Is it investigated if specific experiment really need fish or animals can be replaced by using models etc.
- If the project research use animals, is it ensured that the possible minimum number of animals is used?
- Are the experimental staff properly qualified to minimize the suffer of animals during research?

Mitigation: As a part of the internal communication, project experiments and tests using fish will be continuously monitored to ensure the adherence to the “Three Rs “ (Replacement,

Reduction, Refinement) principles. The internal procedures of this work are defined in the Deliverable 55.

- Are the personal data handled according to the GDPR in the project and also on the partner level?
- How all of the data processed in the project is relevant and limited to the purposes of the research project (in accordance with the 'data minimisation 'principle)?

Mitigation: To protect the personal and research data, each partner will appoint a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For beneficiaries not required to appoint a DPO under the General Data Protection Regulation 2016/679 (GDPR) a detailed data protection policy for the project must be kept on file and submitted to the Agency upon request. To minimize personal data protection issues, these will not be collected where this information is not necessarily needed. The procedures of the personal research data protection and sharing will be described in the Deliverable 54.

4 The iFishIENCi “RRI-Inreach” Protocol Steps and Methods

In the previous section, we have outlined specific RRI aspects and questions for each work package. The purpose of these RRI questions is to start specific RRI reflections internally among WP participants. The RRI Champion will use this framework as a training guide to lead the initial RRI discussions with WP leaders in Steering Group meetings.

A sequence of steps is necessary to build the RRI-Inreach capacity needed. First, careful and critical analysis of this document (the RRI-Inreach Framework) is needed to create a consortium consensus as to the benefits of the RRI-Inreach strategy. Next, the framework needs to be practiced and formalized in regular meetings of the iFishIENCi consortium members. Then the RRI Champion needs to mediate, moderate and document the progress of RRI reflections from each WP. Finally, synergies among WPs will be identified through consortium-wide annual RRI workshops.

To summarize:

Step 1: Introduction to RRI-Inreach Framework for each WP (by the RRI Champion)

Step 2: Creation of RRI-Inreach formal, iterative “spaces” in the Steering Group meetings; WP leaders ask questions and gain competencies in discussing RRI-Inreach topics within their specific WP

Step 3: RRI Champion hosts annual RRI workshops for each WP to record progress

Step 4: RRI-Inreach synergies will be identified in annual RRI workshops at the annual meetings of the iFishIENCi consortium and used in the communication and dissemination Tasks 6.2–6.6.

But who is the audience? Who are we doing the iFishIENCi work for? To assist the RRI workshops in bridging the RRI-Inreach with good external communication, the RRI Champion and Task 6.1 leader will lead the work of a stakeholder mapping analysis with accompanying power analysis (which stakeholders are most powerful? What kind of power do the stakeholder groups have?). This stakeholder mapping is also related to Task 4.1 which the RRI Champion also leads.

5 Future impact

We anticipate that the co-production process of the RRI-Inreach framework will significantly aid in the uptake and impact of this framework as it's practiced in the coming years. We also foresee the potential of spin-offs and replications of this RRI-Inreach framework in future collaborations. Since the responsibility of applying the RRI-Inreach framework has been spread across the work packages, each individual work package and task leaders will gain competency and experience in RRI therefore increasing the future impact and possibilities of effective and responsible aquaculture innovations.