



**Programme: FP7 Cooperation**  
**Theme 2 Food, Agriculture, Fisheries and Biotechnologies**

**Deliverables 11, 12, 13**

- D11. Gap Analysis methodology for working groups**
- D12. Problem solving methodology for working groups**
- D13. Cost-Benefit analysis for working groups**

<b>Project Acronym :</b>	AQUAINNOVA
<b>Project title :</b>	Supporting governance and multi-stakeholder participation in aquaculture research and innovation
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<b>Project coordinator :</b>	European Aquaculture Technology & Innovation Platform



**Deliverables 11, 12 and 13** are presented together.

## **Introduction**

- D11. Gap Analysis methodology for working groups
- D12. Problem solving methodology for working groups
- D13. Cost-Benefit analysis for working groups

The 3 deliverables D11,12,13 have been grouped for reporting due to the fact that they were integrated as activities in the Thematic Working Group (TWG) methodology of work.

This grouping of methodologies was necessary in order to ensure that any processes presented to the TWGs was practical and functional, taking into consideration that, at the most, they would only have 1 or 2 face to face meetings of 1-2 days and therefore that such meeting time had to be optimised.

This operative approach was based on an original discussion document developed in the first months of Aquainnova but was refined as meetings progressed, based on expert inputs and experience generated by the work in the TWGs.

## Deliverable 11

### A Discussion Note on the Methodology for Gap Analysis in Aquainnova

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Supported by Courtney Hough

In one of the reports from the “Expert Group on Key Technologies for Europe” it is stated that the manufacturing industry:

“has faced significant challenges over the past 25 years and rapid changes are certain to continue. The new information and communications technologies, and the processes of globalisation which have been associated with them, have already changed the face of manufacturing. Much of manufacturing is now *globalised*, in the sense that a wide range of functions from R&D and marketing to production and distribution are now undertaken on an integrated global basis; *networked*, in that the coordination of these functions makes intensive use of electronic networks and of virtual and geographical clusters of expertise; *customised*, in that methods of production must allow for detailed customization of products to meet the needs of individual markets and individual consumers; and *digitised*, in the sense that many of these processes, and particularly final production, are controlled by advanced computers systems which limit the need for human intervention.”<sup>1</sup>

– and the same could generally be said about the aquaculture industry: it is ever more globalised, networked, customised [and perhaps digitalised]. The synthesis of all of these changes is that the state of the art of aquaculture has always been, and remains, ever changing with new requirements and demands for technological advances, innovation and research. It is most likely that this position will continue in the future.

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One of the tools capable of supporting successful preparations for the future (industrial and technological advancement) is the ‘Technology Roadmap’ which is a time-based plan that define technology goals and promote a focused effort to achieve those goals. Many industries, most notably the Semiconductor Industry, have used such technology roadmaps for a long time.

EATiP was created from a recognition of the common need to identify and evaluate the key technology innovation and knowledge development paths needed for the future, and this is one of the key changes and achievements within the sector – the recognition of the need for greater collaboration, as was demonstrated with the overwhelming support for EATiP in its initial Stakeholder Forums.

To create such future roadmaps, EATiP initially established seven Thematic Areas (TAs), representing key inter-related areas that are critical for the identification of future aquaculture technology requirements.

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<sup>1</sup> José Sá da Costa (2005). *Manufacturing - Background paper for the European Commission’s High Level Group on Key Technologies for Europe*. [http://cordis.europa.eu/technology-platforms/kte\\_reports\\_en.html](http://cordis.europa.eu/technology-platforms/kte_reports_en.html)

These Thematic Areas will achieve the following:

- 1) Review the state of the art for all subject areas including existing roadmaps and research agendas
- 2) Identify Essential Long Term Knowledge and Innovation Challenges to the European Aquaculture sector
- 3) Flowing down from these high level Essential Challenges<sup>2</sup>, the roadmaps of each TA should present a high-level plan for the technologies that are required in the next 5,10 and 20 years (short, medium and long term) enabling a future state of the aquaculture arts and practice in Europe. These roadmaps will include:
  - a. Visions on European aquaculture regarding its present state and defined goals, requirements and other enabling actions that are necessary to realise the Vision
  - b. A Strategic Research Agenda<sup>3</sup> (SRA) which should define the details on planned content, with issue/topic identification and justification.
  - c. Following the SRA a detailed Implementation Plan will give details regarding timing of programs and projects, funding issues, etc.

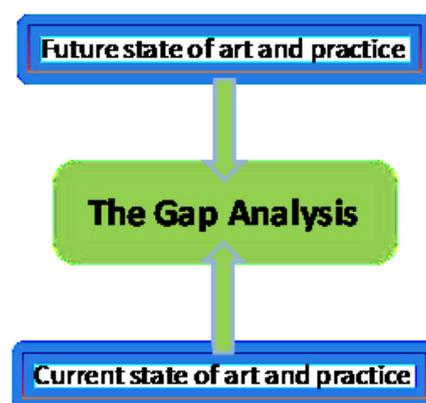
In relation to the Essential Challenges, there will most likely be some overriding capabilities which will have major impact and afford favourable returns on investments to organisations and industry when solved or implemented in industry. These must be identified clearly.

One of the key tasks for the TAs is to assess the present and future state of aquaculture and its sub-sectors, and make explicit the gaps between these positions. By examining the RTDI activities/goals that are described in the existing roadmap(s) – the vision of the future, state of art and practice – identification of future technology needs can be done.

However, merely knowing which technologies are required for the future is insufficient to coherently allocate resources to assure that the technology needs and goals are met.

Therefore, in order to effectively and efficiently allocate resources to research, development and innovation processes this must be coupled with an assessment of current state of art and practice.

Hence, ascertaining the current state of art and practice is vital.



This process of identifying and evaluating relevant current and past RTDI projects and mapping these to the roadmaps, is integral to successful **Gap Analysis**. This analytical process on the differences between the future and current state of aquaculture must address issues/positions such as:

- Where are the RTDI voids?
- Which are the current RTDI areas where little (insufficient) research is being conducted?
- Which are the current RTDI areas that are heavily supported?

Then comes a range of questions: Why? Why are these issues/positions such as they are? Should it or they be changed? How could that change happen? How important is it (ranked on some scale)?

The answers to these questions give inputs the roadmaps – strategic research agendas – for the TAs, Aquainnova and for the technology platform itself.

<sup>2</sup> Interpreted as Key Goals in the Aquainnova documents

<sup>3</sup> SRA became Strategic Research and Innovation Agenda within EATiP/Aquainnova

For European aquaculture there are already several available databases which should provide valuable input for this evaluation of current state of art and practice (e.g. Profet Policy fact sheets; sector/national RTDI needs, plans and strategies...).

Regarding the establishment of the future state of art and practice the TAs will have the original EATiP Vision as a major source of inputs.

In addition to the original EATIP Vision document, the Thematic Areas might also wish to consider including more extensive and/or more focused needs. For example along the lines for establishing priorities and the issues that Nigel Edwards (Chair TA1) addressed:

- **What can damage our industry reputation?**
  - Food safety issues and poor medicine controls
  - Environmental impact
  - Poor welfare
- **What can enhance our industry efficiency?**
  - Feed conversion
- **What can enhance our industry reputation?**
  - Traceability
  - Sustainable feed
- **What are the consumer perceptions of the industry**
- **Is there a quality problem?**
- **Comparison with other farming sectors, strength and weakness analysis**

He also made explicit some strategic priorities for his company (the Icelandic Group):

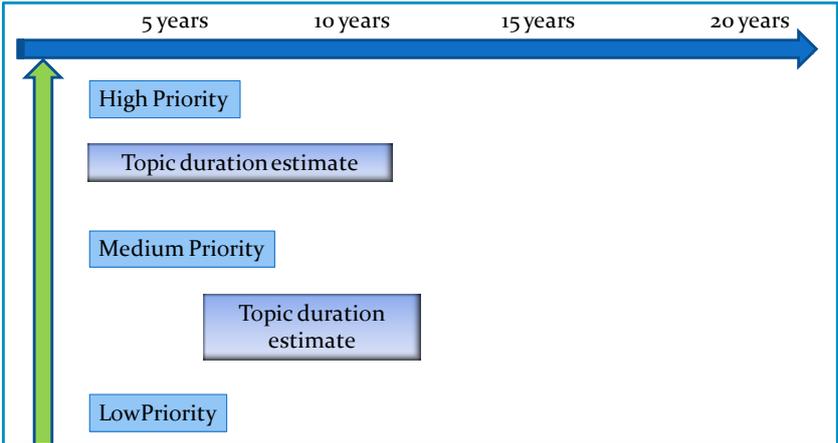
- **Food safety first –**
  - Listeria control through the supply chain
  - Removing contaminants from feed
- **Efficient feed conversion,**
- **Disease control strategy**
- **Maintenance of human nutrition benefits**
- **Fish welfare**
- **Carbon footprint**
- **Shelf life extension**
- **Feed sustainability**

On such a basis, a major task is then to add substance and detail into the EATIP Vision through the preparation of comprehensive Thematic roadmaps which can be used for individual Strategic Research Agendas and for inclusion in the overarching EATIP SRIA.

The keywords to apply are **Identification, Analysis, Prioritisation & Ranking:**

- Present scope of the Thematic Area
- Analysis of the issues/problems
- Assess competitive advantage
- Identify goals and outcomes
  - Prioritise issues
  - Estimate time-scale to resolution
  - Which sector will take up results & when

On this basis the probabilities for success should be assessed. This assessment will in turn give input to a priority ranking of the topics as well as a time-mapping of the duration of the tasks.



Furthermore it appears necessary to assess the abilities to adopt the results/outcomes of the RTDI activities as well as its effects and the development capacities in Europe following the dimensions of:

- Scientific capacity
- Company/industrial capacity
- Strategic/Market
- Sustainability

– as illustrated in the following figure.

Effects, Development & Adoption of Results		Dimensions			
		Scientific capacity	Company capacity	Strategic Market	Sustainability
Scale	<b>Large Scale</b> e.g. improve live food production	High	Medium	EU	Yes
	<b>Medium Scale</b> e.g. new diets for broodstock	High	High	EU Int	Yes
	<b>Small Scale</b> e.g. species diversification	High	Medium	EU	No
<b>Background Information</b>					

It would also be useful to present a list of priorities and an action plan coupled with a timeframe for the execution.

The following figure gives an example:

Thematic Area	Timespan	High Priority	Medium Priority	Low Priority
Quality	2009-2012	Contaminants		
	2012-2017		Effects of new feeds on quality	
	2017-2022			Use of krill
Biological Lifecycle	2009-2012	Broodstock selection		
Health & Welfare	2009-2012	Vaccine development		

For the later EATiP Implementation Plan, these findings should be evaluated for their applicability, potential (i.e. return on investment) and maturity. These issues will be dealt with later.

**Suggested approach**

The process is initiated by identifying the current state of art and practice. The elements of this should be mapped with the goals in the EATiP Vision, producing a list (see example Table 1 below). It also seems useful to group these elements around the distinct industrial and corporate processes – i.e. from breeding/feeding of fish to the outbound logistics for finished products.

As sketched above, there are three steps in this process:

- **Assessment of current state of art and practice**, starting with an overview of relevant ongoing RTDI activities that also identify technology-needs, major voids and deficiencies, barriers to technology advancement – an assessment of current state of art and practice should be made for use in the gap analysis.
- **Future state, vision goals and requirements** gives a conceptual view of the desired future state of aquaculture relative to each thematic area and goals and requirements to achieve the vision relative to the TA (framework for recommended RTDI activities)
- **Roadmap** a high level milestone plan that maps the future-state goals and requirements over time in a framework intended to support the EATiP Strategic Research Agenda (SRA) and Implementation Plan (IP).

**Table 1: Where are we now, and where are we going - example<sup>4</sup>**

Function	Current state of Art/Practice	EATIP TA (1-7) Vision
<b>Supporting infrastructure</b>		
<b>Life-cycle Product support</b>	<ul style="list-style-type: none"> <li>• Product user responsible for disposal</li> <li>• Producer limited responsibility for disposal</li> </ul>	<ul style="list-style-type: none"> <li>• Products designed for life-cycle support</li> <li>• Tools for disposal of packaging &amp; shipping materials</li> <li>• Producer responsible for cradle-to-grave for product</li> </ul>

<sup>4</sup> This table is made on inspiration from the IMTR-project: Manufacturing Processes

<b>Waste Management</b>	<ul style="list-style-type: none"> <li>• Waste Management driven by regulatory requirements</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Product design minimize environmental impact</li> <li>• Producer responsible for all waste streams</li> <li>• zero-residuals production processes; zero emissions; closed loop recycling</li> </ul>
<b>RM handling &amp; Management</b>	<ul style="list-style-type: none"> <li>• Manual material handling &amp; Control ....</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Self diagnostic systems</li> <li>• Flexible reconfigurable, autonomous material handling systems</li> </ul>
<b>Materials / Products / Processing</b>		
<b>Overall</b>	<ul style="list-style-type: none"> <li>• Most operations not automated</li> <li>• Limited use of sensors</li> </ul>	<ul style="list-style-type: none"> <li>• Lubricant &amp; coolant free processes</li> <li>• 3D measurement and control</li> </ul>
:		
:		
:		
<b>Outbound Logistics</b>	<ul style="list-style-type: none"> <li>• Wide variety in shipping technologies</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Shipping technology an integral part of product design</li> <li>•</li> </ul>

This table shows the disparity or gaps between current state and future goals (Vision) and, basically, provides the gap analysis.

Based on the identification of top level goals, supporting needs/requirements to achieve these goals can be identified. It would be useful to rank these supporting needs/requirements and formulate the most important ones as critical capabilities or attributes that underpin the EATIP Vision, and which offer the greatest returns (given broad application in the sector).

These goals, supporting requirements and critical capabilities are sometimes in the literature termed “Nuggets”, but here we call them Essential Challenges<sup>5</sup> (EC).

Starting with an Essential Challenge (incorporating vision and goals), a number of Requirements or Tasks could be formulated. Taking EATiP TA 1 “Product quality and human safety and health”, as an example, the following breakdown can be made:

**Goal:** Sustaining and building a competitive advantage through the production of high quality, healthy and safe seafood. Having documentation and communicating these, as well as being cost-effective are prerequisites.

**Vision:** ----?----

**EC 1: Maximizing the health benefits**

- a. Seafood as an efficient provider of n-3 PUFA`s
- b. Health effects beyond the n-3 PUFAs
- c. Understanding species diversity
- d. Optimizing the nutritional content of aquaculture products
- e. Alternative sources for LC n-3 PUFAs and marine proteins

<sup>5</sup> EC became sub-goals to Key Goals in the SRIAs of the Thematic Areas

**EC 2:** Reassuring the consumer

- f. Perceived existing hazards
- g. Potential new hazards
- h. Traceable and transparent complete production chain
- i. Risk assessment on drug residues

**EC 3:** To keep an internationally recognized high reputation

- j. Clear recommendations and guidelines
- k. Overturning the prejudices
- l. Raising confidence in European farmed seafood.
- m. Perception of food safety and risks

**EC 4:** Product quality

- n. Texture and quality as affected by farming conditions
- o. Consumer Sensory studies
- p. Bespoke seafood products

This is summarised in the following table.

**Table 2: EATiP Essential Challenges for Thematic Area 1<sup>6</sup>**

Essential Challenge	Benefits of implementation	Supporting requirements/Tasks
<b>Maximizing the health benefits</b>	<ul style="list-style-type: none"> <li>• .....</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
<b>Reassuring the consumer</b>	<ul style="list-style-type: none"> <li>• Trusting consumers will have preference to buy European products and thereby increase revenues to European Aquaculture</li> </ul>	<ul style="list-style-type: none"> <li>• Perceived existing hazards</li> <li>• Potential new hazards</li> <li>• Traceable and transparent complete production chain</li> <li>• Risk assessment on drug residues</li> </ul>
<b>To keep an internationally recognized high reputation</b>	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
<b>Product quality</b>		<ul style="list-style-type: none"> <li>•</li> </ul>

These Essential Challenges (and Critical Capabilities) Requirements and Tasks should, for evaluation purposes be evaluated/mapped against their impact given successful knowledge development and its implementation. Therefore we must have an identification of areas of beneficial impact. These we may establish from the three EATiP Core Priorities:

- To establish a strong relationship between aquaculture and the consumer (including contributions to health, quality, traceability... )
- To assure a sustainable aquaculture industry (covering social, environmental and economic issues)
- Consolidate the role of aquaculture in society (hereunder addressing knowledge management, skill development, communications, networking...)

<sup>6</sup> This table is made on inspiration from the IMTR-project: Manufacturing Processes

Additionally it might be useful to include other attributes, eg.:

- Enhanced competitive advantage cfr. the Lisbon agenda (both relative to imports and European investment abroad)
- Reduced development, production and distribution costs
- Improved product quality
- Faster time to market
- Greater responsiveness to customer needs
- Higher return on capital

Below is an example of such mapping, inspired by the Thematic Area 1 (Product quality and human safety and health), using the following Areas of beneficial impact:

- A strong relationship between aquaculture and the consumer
- Assures a sustainable aquaculture industry
- Consolidates the role of aquaculture in society
- Enhanced competitive advantage
- Reduced development, production and distribution costs
- Greater responsiveness to customer needs
- Higher return on capital

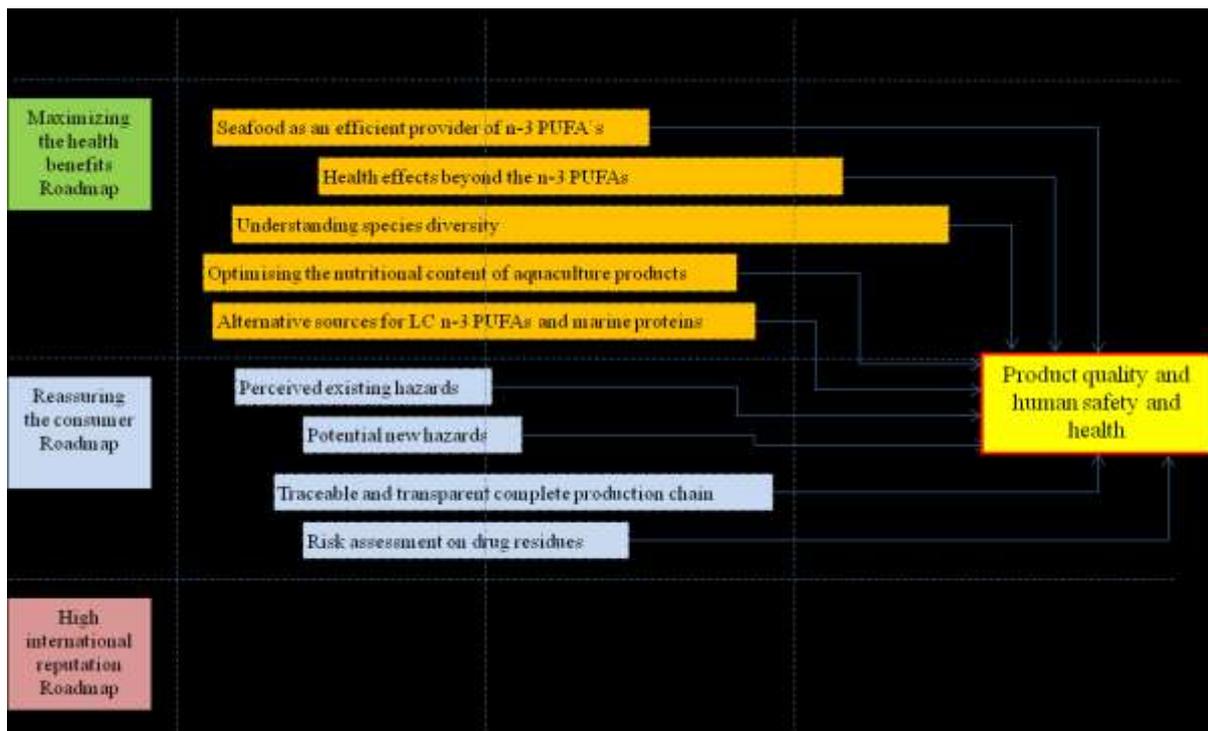
Within each cell in the table below, the impacts of the attributes are ranked on simple “yes/no” (don’t know), high and moderate impact-scale. This scale used is just an example; other scales might be more useful. Also, the Areas of beneficial impact used here are merely for exemplifying, others (e.g. “Improved product quality”, “Faster time to market”) might be useful.

Areas of beneficial impact	A strong relationship aquaculture - consumers	Assures a sustainable aquaculture industry	Consolidates the role of aquaculture in society	Enhanced competitive advantage	Reduced development, prod. & distrib. costs	Greater responsiveness to customer needs	Higher return on capital
EATIP TA1 ECs							
Maximizing the health benefits							
Reassuring the consumer							
To keep an internationally recognized high reputation							
Product quality							

Yes & No     
 Yes! High Impact     
 Moderate Impact

The table above assessing the beneficial impacts is given on the Essential Challenge level as an example. The impacts should of course also be assessed on the task-level.

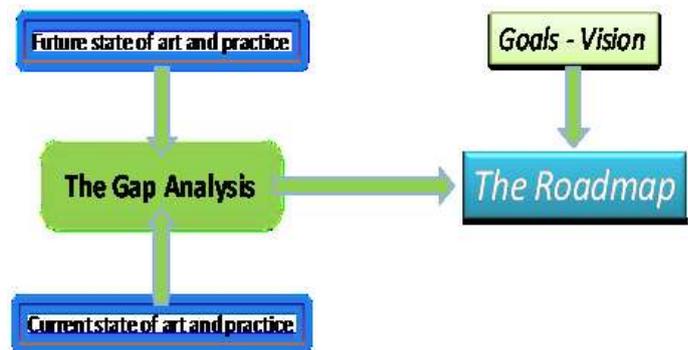
Finally it is useful to map the goals above into a time-based plan, a roadmap, eg like in the figure below.



**Summing up**

The gap analysis consists of:

- comparing the future desired state (vision) with the current state
- analysing the gaps (e.g. regarding development paths, desirability, ranking)
- establish the roadmaps with its goals, requirements and tasks



The road mapping process identifies top level goals to be achieved, requirements to support the goals and tasks to accomplish the requirements:

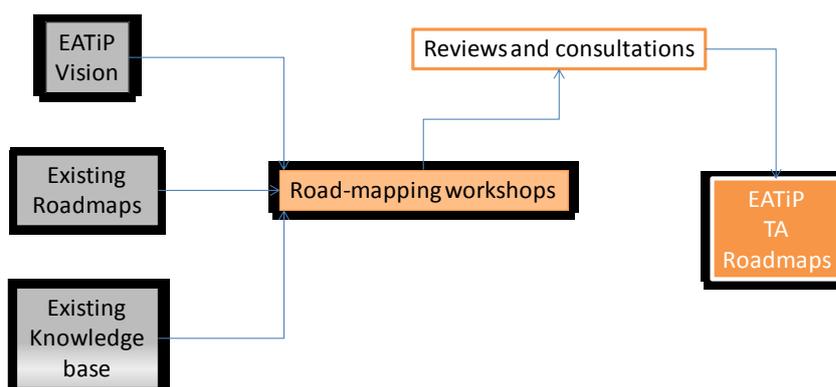
**The Goal** describes the basic capability(ies) that should be developed to realize the vision

**The Requirement** defines the specific RTDI effort required to achieve the goal

**The Task** A specific action that must be taken to meet the requirement

The process could be performed by these steps:

1. Surveying the existing knowledge bases and roadmaps (e.g. other ETPs, DG Mare, etc) and making the goals in the EATiP vision explicit (by a core group of experts).
2. Arranging consultation and road mapping workshops with a wider set of stakeholders
3. Subject the documents coming out of the roadmapping workshops to consultation, invited expert reviews, internet based consultation/feedback.
4. Formal roadmap established by vetting within EATiP/Aquainnova Stakeholder Forums.
5. Then the roadmap becomes the EATiP/Aquainnova Strategic Research & Innovation Agenda.



Prepared May 2010

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As such, after carefully review of the methodologies used in other more mature Technology Platforms who have already developed SRIA's and Plans of Action (e.g. waterborne, biofuels, wind energy), it was decided embed the methodology for **Gap Analysis**, **Problem Solving** and **Cost-Benefit** in the overall working group approach through a blended approach using a combination of actions;

- 1) **Provision of D9 (Database of TLs) and D8 (Position Paper) in order to identify what RTD has been carried out in past EC funded RTD**
- 2) **Embedding D11,12 and 13 within the template for the Strategic Research and Innovation Agenda and Plan of Action (POA) (D14)**
- 3) **Provision of a Facilitator to all Thematic Working Groups**

To elaborate on the actions for these deliverables;

### **1) Provision of D9 (Database of Tls) and D8 (Position Paper) in order to identify what RTD has been carried out in past EC funded RTD**

As part of the **Gap Analysis**, D8 and D9 were provided to each TWG group in order to show what RTD has been done in the past. It was important to do this so that the TWGs could make recommendations based on past work rather than make suggestions in the SRIA or POA that are outmoded.

It was also part of the **problem solving** in that the participants could ensure that they were aware of the latest RTD outputs which could inform them of what has/hasn't worked in the past and lead to discussions as potential new approaches to solve the challenges in the future.

### **2) Embedding D11,12 and 13 within the template for the Strategic Research and Innovation Agenda (SRIA) and Plan of Action (POA) (D14)**

One of the early challenges identified at project start up was that some of the working groups had already been pre-formed and had started voluntary work on developing the SRIA and POA for the Thematic Areas.

Whilst positive that efforts and buy-in to the process had already commenced, the negative was that the documents they were developing had little or no structure or there was no consistency in the approach or format. Thus an early task was to harmonise the contributions through the provision of templates (D14), which was compulsory for all TWG's to use.

As can be seen in D14, the template developed was designed not just to develop the ultimate final content of the SRIA and POA, rather it was much more detailed. The details actually became part of the methodology so as to ensure that the TWGs carried out **gap analysis** for the SRIA and **cost-benefit** for the POA.

The details were also necessary so that later in the process, if any internal or external stakeholders challenged the relevancy of any proposed activities, it would be possible to go back and review the initial justifications and arguments that took place in the TWG's.

To ensure that the TWG's carried out a "**Gap Analysis**" and "**Problem Solving**" the following fields were inserted in the SRIA template which each WG had to complete;

#### **Q3. Impact on TWG Vision/Overall Vision**

*Describe specifically how achieving the goal will impact the vision of the TWG and the overall one of the EATiP. One goal could impact several aspects and TWG objectives.*

#### **Q4. Sustainability Assessment**

*Describe how achieving the goal will affect the 3 elements of sustainability (ENV/€€€/Society) for European Aquaculture in 2030.*

#### **Q5. Risk/ Opportunity Assessment**

*5a. What assumptions have you made regarding global macro changes between now and 2030? Identify how global changes could affect the relevance of this goal. Will the goal become more or less important, for example, considering climate change, environmental degradation, food security, energy supply, or water usages?*

*5b. Are the issues related to this goal multifaceted or are they limited to one single issue? Who says they are issues? Does it affect certain sectors of industry? Does it affect only certain member states or all member states? Are there subsidiary issues?*

To ensure that the TWG’s carried out a **Cost Benefit Analysis** relevant fields were inserted into the SRIA template but also the POA template.

**SRIA Template**

**Q4. Sustainability Assessment**

4a. *What impact will achieving the goal have on Economical sustainability? (economic growth/cohesion/competitiveness)*

**Plan of Action Template**

In the POA, the focus is on suggesting tangible actions that could achieve the goals set in the SRIA. In order to do that the template (See D14) was provided as an excel worksheet where each TWG could suggest multiple and even competing ideas on actions to achieve the goal.

For each one, they had to fill out the fields below outlining estimated costs and timeline for achievement. This was necessary so that later on in the process (*Overall Cost-Benefit Analysis has not yet taken place*), it would be possible to assess and select actions that have high potential for “benefit” and are “cost effective” ways to achieve the goal. It also allowed in the stakeholder consultations for others to suggest alternative actions that could achieve the same goal, perhaps more cost effectively or in a shorter time frame, thereby meeting the needs of the sector.

<p><b>Timeline</b> The plan of Action has several time periods to achieving the Vision in 2030. Indicate when the ACTION should or could be achieved; <b>2015, 2020, 2030?</b></p>	<p><b>Time required to complete action?</b> &lt;1 yr 1-3 yr 3-7 &gt;7</p>	<p><b>Cost Scale (Euros)</b> estimate an approximate cost of the Action</p>	<p><b>Link to other TA's</b> highlight where this action might overlap with TA.</p>
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**Diagram 1: Extract from the POA template provided to all WG’s.**

### 3) Provision of a Project Facilitator to all Working Groups

Each WG was provided with an industrial chair and at least one academic facilitator. However, the project management team recognised that there was a significant problem in assuring the common approach required by the methodologies developed. Initial documents and meeting reports indicated that action had to be taken so as to assure that the documents/ideas developed within the TWGs were consistent and comparable.

David Murphy of AquaTT was tasked with providing the main support to the TWGs, given that AquaTT developed the WG methodology and templates. Since AquaTT only had 0.5 man months for this activity and this activity was also seen as being integral to effective knowledge management, the time input was shared between these workpackages. Due to the difficulties in time management and the number of TWG meetings that occurred, this task was shared with Francesca Margiotta (FEAP).

David Murphy thus helped the TWG's significantly during the WG meetings and, with Francesca Margiotta (FEAP), provided further support on conference call meetings and Basecamp (discussions on document development and content).

Remotely, help to the TWGs was provided via email, Basecamp and telephone where any required clarifications were given to the TWG's and feedback on drafts.

Related to events, assistance was given in the form of agenda setting for the workshops, during the events attended and David Murphy/Francesca Margiotta gave assistance as required

- to introduce the work of the groups and how they fit into the overall structure,
- provide clarity on expectations for the WGs and the output documents,
- help to chair the workshops,
- help to take minutes/notes as required
- importantly, help facilitate any of the exercises for **gap analysis** and **problem solving**.

The exact methodologies in the TWG meetings varied given the different profiles of some of the groups' participants and TWG focus. Examples of exact methodologies can be found in the minutes of the meetings of the TWG's.