

FINAL REPORT

Deliverable 3



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II. FINAL PUBLISHABLE SUMMARY REPORT

A. EXECUTIVE SUMMARY

The European Research community has provided many instances of excellence but the aquaculture industry wished to promote its research needs, particularly on subjects that will increase its long term competitiveness, at both national and European levels. Aquainnova looked to establish an operational framework for dialogue – based on best governance practises - between the aquaculture industry, the research community and policy makers, focusing on exploiting the potential for innovation and technological development in the European aquaculture value chain.



Aquainnova examined the exploitation, dissemination and communication of Community aquaculture RTD research actions and results, to improve how knowledge outputs can be efficiently and effectively managed, disseminated and transferred. Summary technical leaflets on EC aquaculture research were prepared, providing an in-depth background to progress on RTD topics that have received EC support. This effort was combined with legislative and policy reviews so as to facilitate the creation and development of vision documents and strategic research agendas for the main thematic areas within the aquaculture value chain.

8 Expert Working Groups, representing different thematic components of European aquaculture, each prepared detailed draft documentation and proposals for a Vision of European aquaculture in 2030, the knowledge gaps and Strategic Research Agendas. These were summarised and presented for review within 4 sectoral workshops, attended by more than 200 multi-stakeholder interests, characterised by participative debates and actions that were facilitated professionally. The workshops provided wide-ranging opinions on the current situation and future of the different components of European aquaculture, which were compiled, made available for public consultation for opinion and feedback. Additional consultation with consumer interest groups was also made.

This innovative approach, backed up by detailed documentation and information, was extremely successful in obtaining opinion and feedback on the products of the Working Groups. Aquainnova then proceeded to elaborate forecasts, scenarios, action plans and effects based on this data.

A comprehensive review of Knowledge Transfer actions, on EC funded aquaculture research was made, highlighting the difficulties of post-project follow-up for impact measurement.

Following further consultation with Aquainnova participants, this work was compiled as 'The Future of European Aquaculture – A Strategic Agenda for Research & Innovation'. This document contains a Vision for European Aquaculture in 2030 and analyses the challenges and needs to be able to attain this vision. Accompanied by agreed overall targets, goals and sub-goals to achieve these have been identified. Moving towards a Plan of Action that requires pan-European investment remains the core challenge following completion of Aquainnova.

Promotion of Aquainnova and dissemination of its progress and results was made in different fora, ranging from dedicated aquaculture and professional conferences to European parliamentary and advisory committees. Following completion of the Vision and Strategic Research Agenda, this was published in electronic and printed formats for circulation to interested professional and public parties.

The Aquainnova actions have fulfilled the original objectives, providing a wide range of European stakeholders with a new approach, based on science-economics- policy, so as to be able to address the challenges and opportunities for European aquaculture and identify new avenues for research and innovation to support the sustainable development of the sector.

B. PROJECT CONTEXT AND OBJECTIVES

European aquaculture has stagnated during the last decade, while growing elsewhere and seeing seafood demand increase. High levels of market competition with other food products and imports, combined with the effects of the global financial crisis have had strong influences on the European marketplace for aquaculture's products. European legislation on feed components, environmental issues, animal health and food safety are additional contributory factors to hesitant recent aquaculture developments in Europe. On the other hand, many positive signals for European aquaculture exist, which are highlighted in the EC Strategies for European aquaculture made in 2002 (COM 511 final) and in 2009 (COM 162 final). The European Research community has provided many instances of excellence in its research work but the industry still needs to discuss and promote its research needs, particularly on subjects that will contribute to long term competitiveness, at both national and European levels. These situations highlighted the need for improved communication and debate between the different societal actors that influence the development of European aquaculture.

Aquainnova thus sought to establish a solid framework for European aquaculture to support the sector's sustainable development, focusing on exploiting the potential for innovation and technological development in the aquaculture value chain.

This issue has been addressed partially by the establishment of the European Aquaculture Technology and Innovation Platform (EATIP), which was created in 2008 for the purpose of identifying and implementing actions so as to improve the competitiveness of professional European aquaculture and related industries, specifically through the application of knowledge-based activities. The EATIP is composed of representative companies and organisations that are active within the aquaculture value chain and research institutes and universities.

A statutory goal of the EATIP is to develop measures and structures that will improve the research, development and innovation framework conditions so as to support the sustainable development of European aquaculture.

The objectives of Aquainnova were the following:

1. **To establish a basis for applying good governance principles between the different stakeholders, using a participative process**, so as to facilitate the creation and development of vision documents and strategic research agendas for the main thematic areas within the aquaculture value chain.
 - a. To optimise communication between stakeholders in European aquaculture
 - b. To identify knowledge and innovation gaps within the aquaculture value chain
 - c. To improve knowledge management within the operating sector
 - d. To develop policy support guidelines and identify potential inputs for future legislative processes
 - e. To respond to societal concerns on the processes and products of livestock rearing.
2. **To provide dedicated fora to facilitate the dialogue** between National and European policy makers, researchers and stakeholders, through the organisation of trans-national workshops covering the thematic components of the aquaculture value chain.

3. To assure the **promotion of the communication, dissemination and exploitation** of Community funded RTD projects.
 - a. To source and summarise, in easy-to-understand terms, research results in aquaculture from the different Community Framework Programmes, focusing on relevance to development and exploitation - using web-based information supply, compendia and demonstrations.
4. To **create the conditions for managing knowledge** by identifying needs, challenges and methodologies for knowledge application and utilisation.

To achieve these objectives, the following concepts were applied for their realisation.

- 1) The use of a core management team to provide support to the different stakeholders involved in the project, coordination of the preparation of documents and for organisation of the meetings, workshops and events foreseen.
- 2) Creation of expert working groups, populated by experts from industry, RTOs and CSOs, dedicated to the Thematic Areas of the European aquaculture value chain, namely:
 - a) Product quality & human safety and health
 - b) Technology and systems
 - c) Managing the biological lifecycle
 - d) Sustainable feed production
 - e) Integration with the environment
 - f) Aquatic animal health and welfare
 - g) Knowledge management
 - h) Socio-Economics & management
- 3) Provision of state of the art information on research, policies and aquaculture to the working groups for benchmarking, analysis and forecasting.
 - a) This aspect to include the preparation of new Technical Leaflets on EC aquaculture-related research projects, including an evaluation of the individual project results and its impact.
- 4) Development of standard methodologies for expert working groups (SWOT analyses), challenges and strategic responses, so as to generate answers, based on science, to specific societal concerns, through the preparation of thematic Strategic research agendas.
- 5) Organisation of regional/sectoral consultation workshops, assuring multi-stakeholder participation, for presentation, discussion and to provide informed feedback to the working groups.
 - a) Use of a participatory approach so as to generate results and provide informative feedback to the Working Groups
- 6) Consideration of the international dimension of European aquaculture
- 7) Promotion and dissemination of the project, its plans, achievements and results to the broadest audience.
- 8) Assurance of project transparency and public availability of project actions, proposals, results and reports.
- 9) Preparation of a condensed, overarching vision for European aquaculture in 2030, accompanied by relevant proposals for research and innovation, including policy options and risk management issues.

C. AQUAINNOVA – FOREGROUND & RESULTS

Aquainnova has generated a large amount of informative data during its timeline, providing valuable referenced opinions from the project participants and the stakeholders who were consulted during the project's execution. This information and data has served to give focus to the potential for innovation, technological development and policy support for the development of the European aquaculture value-chain, including RTDi contributions.

With a range of different goals and objectives to be achieved within the project, efficient and transparent communication efforts were assured to achieve these, covering the following conceptual objectives which demonstrate how Aquainnova achieved its results. New methodologies and approaches were developed and adopted so as to enable the project to meet its intentions.

1. MULTI-STAKEHOLDER INVOLVEMENT

Multiple inputs and involvement ranging from the aquaculture production sector, related upstream (including specialised feed and equipment suppliers) and downstream (including processing and marketing) activities, the European RTD community and Civil Society organisations (CSOs) and policy-involvement (government, European Commission) were all engaged in Aquainnova.

Aquainnova also accessed the work and initiatives of the European Aquaculture Technology and Innovation Platform (EATIP), notably through its thematic division of the value chain. EATIP had grouped many leading industrial players, RTD institutions and CSOs within its structure.

The project also built on the achievements and experience of 'AquaFlow'¹, 'Consensus'², 'Profet'³ and 'Profet Policy'⁴ which successfully addressed stakeholder involvement in issues affecting the development of European aquaculture and the effective dissemination of the results of European RTD projects.

Nonetheless, from the beginning of the project, it was decided to design proactive, participative meetings so as to generate the feedback required from the project and workshop participants. Stimulating debate and opinion from the different players was a base concept of the project,

2. FOCUS ON RTD NEEDS FOR LONG TERM SUSTAINABILITY

Within EATIP, eight thematic areas of interest were identified, each of which contributes to and affects the long term sustainability of European aquaculture – being

1. Product quality & human safety and health
2. Technology and systems
3. Managing the biological lifecycle
4. Sustainable feed production
5. Integration with the environment
6. Aquatic animal health and welfare
7. Knowledge management
8. Socio-Economics & management

The seventh area is horizontal in nature, covers all of the other topics and was given particular attention within Aquainnova.

Each Thematic Working Group developed a 2030 Vision for the future, relative to its topic, and then worked on a Draft Strategic Research Agenda that would achieve the goals identified to meet that Vision. For clarity, each Goal was composed of related and more detailed sub-Goals that, in turn, could be resolved by identified action (project) proposals.

¹ AQUAFLOW – a European project for the dissemination of the results of EU RTD projects – see www.aquaflow.org (1998-2004)

² CONSENSUS – a multi-stakeholder platform for sustainable aquaculture in Europe – FOOD CT 2005/513998

³ 'PROFET' – identifying the RTD requirements of the European Aquaculture Sector [contract Q5AM-2002-00256]

⁴ 'PROFET POLICY' – a fish Policy Flow initiative covering 'Policy support and anticipating scientific and technological needs' FP6-022771

3. FACILITATING THE DEVELOPMENT OF VISION DOCUMENTS AND STRATEGIC RESEARCH AGENDAS

This project thus looked to facilitate the **development of vision documents** which would provide a consensual view on the **future of European aquaculture**, and **strategic research agendas (SRA)** for each of the Thematic Areas identified, by applying the support and methodologies required for this approach. *These methodologies were developed within Aquainnova using innovative and participative techniques.*

A comprehensive benchmarking exercise on the state of the art of each Thematic Area was achieved, so as to identify strengths and weaknesses of the different components. These gave the basis for achieving the Gap Analyses needed to develop the SRAs.

4. SUPPORT TOOLS AND METHODOLOGIES

New support products/tools and methodologies were developed for analysis and decision-making within the project, on a standardised basis, so as to allow:

- Coordination of the data generated in the project to ensure consistency and compatibility
 - This was due to the number of thematic areas, the differences between sectors and interests specific to individual contributors
- To develop the tools and methodologies to assist project implementation, including:
 - Assessment of research outcomes of previous RTD projects
 - Incorporation of new information (outputs) into Technical leaflets and leaflets into the database of TAs
 - A template for Thematic Area Position papers
 - A template (matrix) for knowledge transfer efficiency of each project
 - Gap analysis (within thematic areas and topic identification)
 - Criteria classification for research prioritisation
- To develop the methodology for stakeholder consultation (stakeholder events, dissemination channels, feedback mechanisms)
- To set up indicators for measuring project achievements and project impact

5. BENCHMARKING OF RESEARCH OUTCOMES & KNOWLEDGE

Benchmarking was made as ex-post studies of the research outcomes and knowledge generated through the EU research projects (summarised previously as Technical Leaflets in 'Profet' and 'Profet Policy'), enabling an assessment of the research outcomes of past EC projects; this was to allow the thematic working groups to assess the potential of knowledge outputs to the sector. This benchmarking exercise was made so as to ensure that gap analysis was informed and comprehensive.

6. EXPERT PREPARATORY MEETINGS

Specific [benchmarking] documentation was prepared for each of the Thematic working groups, most of which had a Chairperson (from industry) and a Facilitator(s) (from RTD). While most of the experts selected for these groups possessed technical, academic or industrial knowledge, it was noted that few were well versed in European policies and legislation.

A start-up workshop for the Chairs and Facilitators was made for instruction (on background and proposed methodologies), discussion on the work to be achieved and to initiate organisation of the subsequent preparatory meetings.

To achieve this, each Working Group needed to be populated, assuring (where possible) a balance of industrial and research interests, geographical and gender balance.

With the proposals for the reform of the Common Fisheries Policy (which includes aquaculture) being prepared and reviewed during the timeline of the project, each working group was provided with the EC Aquaculture Strategy and updated materials that were available in respect of this. This documentation also included the available Technical Leaflet Summaries and previously prepared documentation of the EATiP (goals of the Technology Platform).

Each Thematic Working Group then achieved the identification of challenges, opportunities, gaps and needs for their Thematic Area, working independently of the others.

These preparatory meetings usually included 6-10 persons, sometimes a larger number, using experts from the industry, RTD players and CSOs. Each received the relevant documentation in advance and instructions on the goals of the meetings and the methodologies to be applied. In 19 meetings of the Thematic Working Groups, more than 170 experts contributed to this component of Aquainnova.

These events allowed the preparation of individual draft vision documents and strategic research agendas, using a common template. These were reviewed for consistency in approach and presentation.

Many of these documents were detailed and long, requiring a degree of editing for presentation to aquaculture stakeholders. All were published on the project website.

7. MULTI-STAKEHOLDER CONSULTATION AND THEMATIC WORKSHOPS

Following the compilation of the Thematic proposals prepared by the Working Groups, multi-stakeholder consultation was achieved through the organisation of sectoral workshops that addressed operational, development and policy issues and the identified actions and/or RTD requirements to support these. These were organised for fish farming in freshwater, cold and warm water marine conditions as well as for shellfish culture.

This approach allowed consultation not only on thematic aspects but also for specific Regional conditions (e.g. freshwater vs. marine, inland vs. coastal....).

A common format was adopted – developed with professional meeting facilitators - combining presentation and discussion sessions – focusing on active participation and ‘voting’ procedures on the topics presented so as to rank needs for RTD/policy and items for knowledge transfer.

Coordinated by the meeting facilitator, each workshop was asked to provide opinions, hopefully consensus, on the vision content and produce recommendations for research initiatives for each of the topics presented.

The conclusions of these events provided valuable input for adjustments, by the Working Groups, of the synoptic documents of each Thematic Area and agreement on RTD priorities, contributing effectively to the purpose of the Support Action.

Importantly, these workshops also contributed to proposals for Action Plans (for each sector) that have been integrated into the project’s deliverables: these should provide a strong stimulus for actions at regional, National and European levels.

a) WORKSHOP FORMAT AND PARTICIPANT SATISFACTION

In recent years, ‘workshops’ have tended to become mini-conferences, based mainly on presentations followed by panel debates and opinions. It was Aquainnova’s intention to break this mould and to stimulate real debate and discussion amongst participants, so as to achieve the results foreseen.

All workshops were based on short (video where possible) presentations of the Thematic Working Group recommendations, followed by round-table debate and feedback. Templates for opinions/information were provided, to be filled in by each table. Completed templates were then available for review/comment.

This active participatory process was extremely productive and animated; nonetheless, it also demonstrated that

- most participants do not read the information provided beforehand
- for participants who are not working in their mother language, it is a very tiring exercise
- video presentations (by experts) are much shorter and more concise than live ones – which allows for best planning and management of the timing & agendas of the workshop
- most were astonished by the quality of both the debates and the results of the workshops

Feedback surveys, achieved following each workshop, showed very high satisfaction levels⁵ from participants in both the operation and achievements of the events and where many participants felt they would apply the results of the workshops to their own activities.

8. PLAN OF ACTION

The results of the each Regional workshop were analysed separately, using a common format, so as to give an individual publishable report on opinions and priorities. These reports were consolidated so as to give an overview of the results of the consultation exercise. Ranking of the identified priorities was achieved by workshop participants and these were seen as being important contributions for making a coherent Plan of Action. This plan was foreseen to cover the development of strategies to answer the challenges identified and highlighted within the workshops (including Governance, Business issues and Knowledge Transfer).

A complete and participative procedure was adopted for appreciation of the Visions, goals and objectives, and the related research proposals for each Thematic Area. This included asking the participants to:

- Validate the goals and objectives presented
- Identify or suggest means of strengthening the goals & objectives
- Identify or suggest missing components

Broader participant surveys were made to cover their views on sectoral and sub-sectoral contributions, society's understanding of the aquaculture activities, the role of RTD in contributing to development and innovation.

Predictions were made for how participants foresaw their sector to function in 2030 in terms of professional activity, husbandry and acceptance by society.

Participants were also asked to make forecasts for

1. A growth forecast for European aquaculture in 2030
2. A growth forecast for global aquaculture in 2030
3. The position of seafood imports (including freshwater aquaculture products) in 2030

These forecasts allowed expert views from each sector to be compared to other forecasts - notably of the FAO - referring to each component of European aquaculture, which were accompanied by detailed explanation.

Such explanations included:

- Identification of why growth (European-Global) would increase
- Which species would be farmed
- What characteristics of such species would be
- What technologies are needed and/or would be developed
- How and why aquaculture would develop in Europe

The results of each workshop were compiled as individual reports, which were not communicated prior to the subsequent workshops so as to avoid influencing results.

⁵ See Deliverable 36 – Realisation of Workshops

The ranking results were provided to the Aquainnova Thematic Working Groups for comment and observation; no changes to the rankings obtained from the workshops were put forward, respecting the participant contributions and the transparency of the process.

The data and opinions provided served to develop scenarios for growth and development for each sub-sector of European aquaculture; these were taken from the forecasts of the sectoral workshops but included additional data provided by Working Group experts, including:

- Productivity forecasts
- Employment
- Market influences

Based on current production levels and values (first sale), draft scenarios were prepared for expert evaluation in a workshop devoted to scenario and action plan development. This exercise sought to translate the workshop views and [verbal] projections into numbers, based on expert appreciation.

For each sector, a 2030 Vision was provided, converting projected growth into an appreciation of development (how, why, which species); this was accompanied by identification of the challenges that need to be faced to achieve the Vision and the action plan required to face these challenges. Finally, an interpretation of the effects of the growth foreseen on each sector was provided.

This analysis allowed the transposition of the workshops' results through expert appreciation and consultation so as to provide a comprehensive interpretation of the participants' contributions, the expert opinions and the proposals for the Strategic Research and Innovation Agendas.

The issues highlighted many practical, planning needs – such as the need for space for growth and licensing – as well as research and innovation requirements.

a) ACTION PLANS FOR THEMATIC AREAS

In line with the detailed forecasts and scenarios developed for the different sectors of European aquaculture, the proposals of the individual workshops were combined with the draft positions of the Thematic Working Groups so as to develop more detailed proposals for activities that respond to the Goals and sub-Goals defined for each Thematic Area.

For the Goals and sub-Goals within the Strategic Research Agenda of each Thematic Area, 'Activities' were defined under the headings RTD, TT (Technology Transfer), Policy (Policy & Legislation) or Other.

These Activities were given a short description and, based on the experience of the contributors, an estimate timeline and budget indication. Expected results, outputs and the impact of successful 'activities' were also identified.

The most difficult part of this exercise, and seldom resolved fully, was the identification of funding options and projects in progress that would contribute to resolving the sub-goals. It was also rare for estimates for actions beyond a medium-term timeline.

These Action Plans are reported in detail in a separate Deliverable (Plans of Action from Consultation Workshops) and demonstrate the detailed thinking and proposals obtained during Aquainnova.

D. AQUAINNOVA RESULTS

The overall Vision for European Aquaculture in 2030 – on the basis of the work described - is the following:

“In 2030, European aquaculture will be sustainable and globally competitive a dynamic activity in coastal and inland economies, not only supplying significant amounts of high quality and nutritious food to the consumer but also diversifying to provide a range of new products and integrated services.

Aquaculture production will grow and diversify in Europe, following consumer and market demands, adapting to climatic and geographic circumstances, in harmony with nature and society.

This will be achieved by enhancing husbandry, welfare, technology and knowledge management while improving the understanding of the factors influencing development, be these technical, commercial or social, so as to assure the sustainability of European aquaculture and its global role in technological leadership.

The vision of the European aquaculture industry is, by the year 2030, to provide annually 4.5 million tons of sustainable food products, worth 14 billion euros, and supporting more than 150,000 direct jobs”

To achieve this Vision, core **challenges to progress** were identified, being:

- Competition in the marketplace (with other seafood products, mainly cheaper imports)
- Access to and competition for space (to do aquaculture in Europe)
- Maintaining health and welfare (of livestock materials)
- Improving resource use (throughout the production process)
- Improving aquaculture governance within the Common Fisheries Policy

Factors for successful development were identified as being:

- **Dynamic Research and Innovation**
 - Resolving applied and fundamental research challenges, relating to sectorial and societal needs and combined with improved access by scientists to ‘state of the art’ facilities
 - Applying multi-disciplinary approaches
 - Ensuring the effective management and transfer of both knowledge and technology.
 - Developing curricula and competence-building relative to the needs of the aquaculture value chain
 - Building specialised and efficient networks to ensure successful technology transfer and innovation implementation
- (Having a) **Responsible Aquaculture Value-Chain**
 - Supplying the consumer not only with the products required, but also with the associated information assuring them that the product has been produced sustainably.
 - Producing high quality, safe and nutritious food, ethically and efficiently
 - Incorporating innovative technology and management systems, producing more from less and with minimal waste
 - Providing a wide range of career opportunities within a safe, stable working environment

- (Being) **Accountable to Society**

- Participating in multi-disciplinary and multi-stakeholder governance, assuring the requirements of transparency and responsibility
- Communicating with society on all aspects of the aquaculture value chain
- Assuring the recognised stewardship of natural resources for a sustainable activity

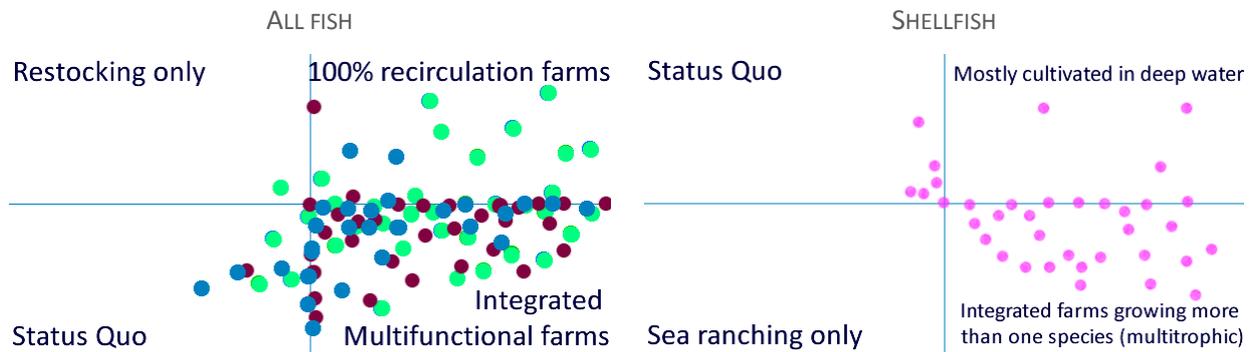
In recognition of these challenges and factors for success, it was recommended that:

- 1) Research and innovation efforts on aquaculture must be increased, focused and supported
- 2) The capacity for progress must be strengthened within the aquaculture value chain – including the legislative framework, RTDi and education, financing and market conditions
- 3) Networks must be built and consolidated, within and between the research and industrial sectors, and including civil society and governmental representation

The creation of an innovation-friendly environment was highlighted and that extensive public-private cooperation is needed to fulfil these needs.

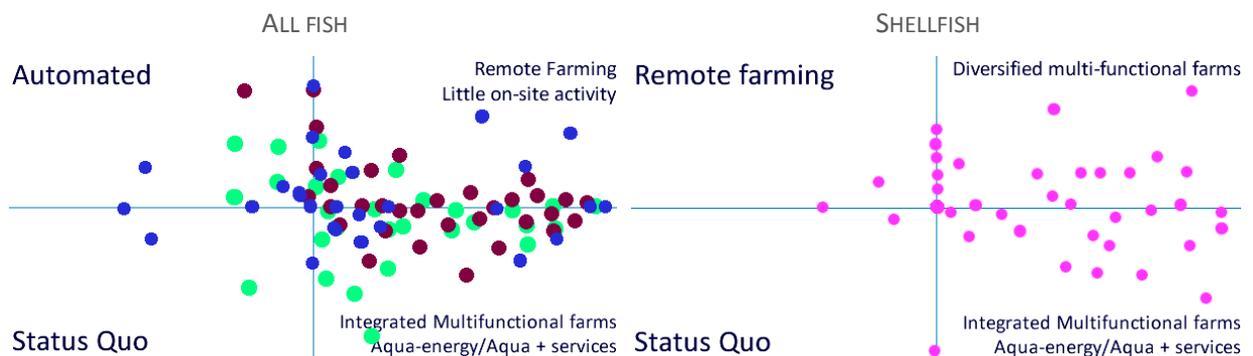
1. OPTIONS FOR SECTORAL DEVELOPMENT

(1) RESPONSES TO HOW AQUACULTURE FARMS WILL OPERATE IN 2030



1. The majority of the fish farming sector foresees a move towards multifunctional activities
2. Some believe that recirculation systems will become more important, particularly the freshwater sector.
3. The shellfish sector forecasts more integrated, multitrophic production, growing more than one species

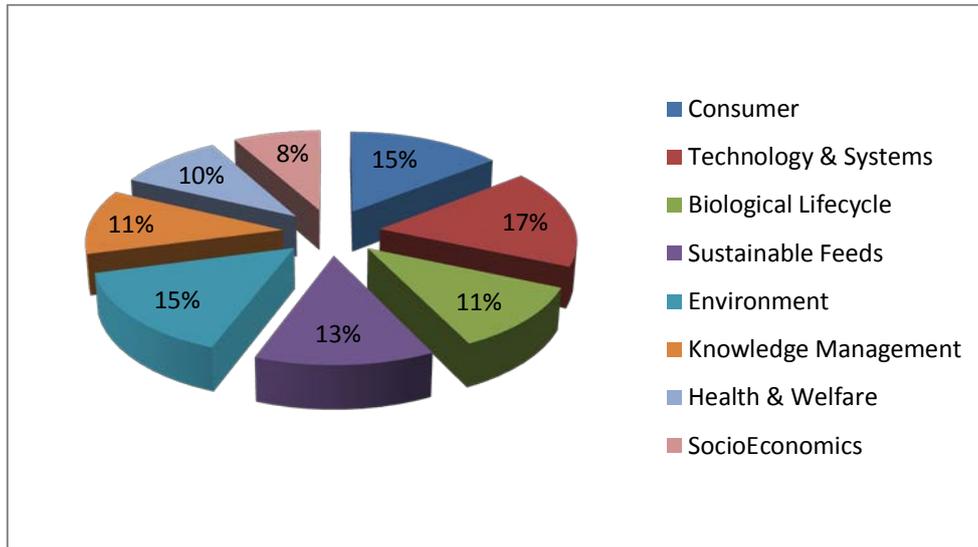
(2) RESPONSES ON FARM OPERATION IN 2030



1. Sectoral differences are clearer; while most see integrated multifunctional activities as a development, the fish farming sector also foresees more remote management (automated in cold water)
2. The shellfish sector's opinions match the first diagram – more multifunctional activities will reflect husbandry and management demands

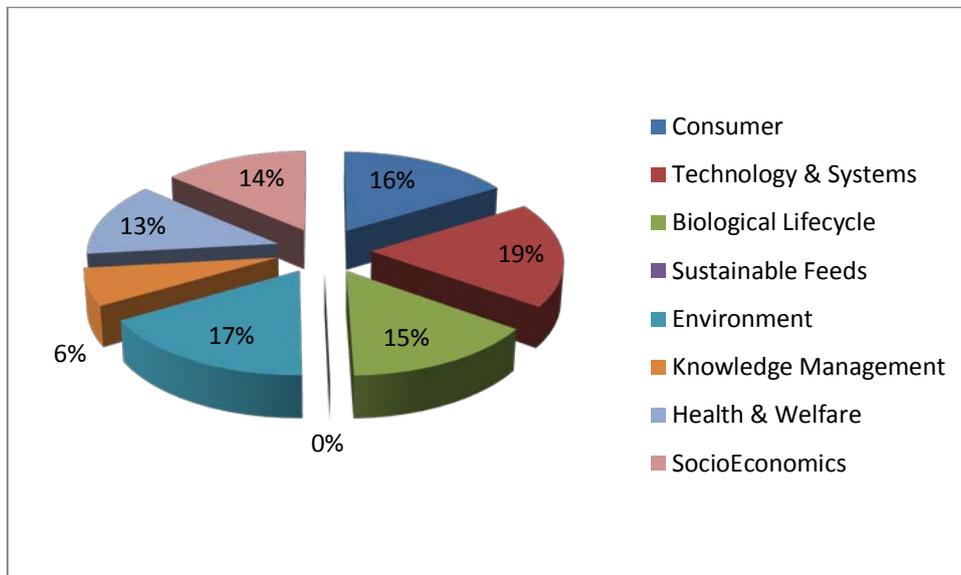
(3) RELEVANCE OF THEMATIC AREAS TO SECTORS

Fish Farming (consolidated)



1. The participants views on the importance of the different goals/sub-goals were consolidated by Thematic Area, indicating that there was a reasonable balance of the different targets and issues within these.
2. Nonetheless, one can remark that Technology, Consumer topics, Environmental issues and Sustainable feeds were of key interest.

Shellfish



1. For Shellfish, the balance is slightly different – no interest in feeds.
2. The top Thematic Area was Technology/Systems but with an overall balance of the others, save Knowledge Management

Overall, one can observe that these views support the division of the aquaculture value chain into the different Thematic Areas and that their validity is justified.

2. SCENARIOS FOR GROWTH

The scenarios for growth and development incorporated many of the comments and observations returned from the consultation exercise, basing the growth projections on a combination of base data:

- 1) Identification of **challenges to resolve**
- 2) **Outline (sectoral) projections** for growth from each workshop
- 3) **Application of productivity improvements** (livestock, feeds, equipment, employment)

Sectoral challenges were identified, accompanied by action plans (to find solutions) to meet these challenges.

On these bases, the type and levels of growth foreseen were calculated for each sector, assessed and refined in a special workshop and then reviewed by the Thematic Working Groups – including sectoral professionals. These scenarios are included in the section ‘Unlocking the Potential’ of the ‘Future of European Aquaculture’.

These can be summarised as follows:

- **Coldwater marine** – growth of 4%/year, salmon to remain as main product, increases in productivity, trends towards integrated multifunctional and offshore farming.
- **Freshwater** – growth of 1.5%/year, trout and carp will remain as important products, productivity improvements, product diversity for niche markets, new activities and recognition/expansion of ecosystem services.
- **Shellfish** – growth of 1.3%/year, increased multi-functional activities, offshore farming, higher hatchery activities
- **Mediterranean** – growth of 4%/year, productivity increases and diversification, new species becoming important,

The effects on each sector were also estimated, in terms of:

- 1) 2030 production levels and value
- 2) How many jobs in the production sector and upstream/downstream services
- 3) How much space would be needed to match the production forecasts
- 4) Hatchery outputs needed
- 5) Feed demand

The consolidated figures were translated into the overall vision for 2030, equating to 4.5 million tons of sustainable food products, worth 14 billion euros, and supporting more than 150,000 direct jobs

3. RISK ANALYSIS

The Thematic Working Groups were also asked to achieve an analysis of the risks that would affect achievement of the factors required for success, separated as Strategic, Operational and Hazard Risks, which gave the following results:

STRATEGIC RISKS

- **Competition:** From aquaculture production in other regions/countries - oversupply to markets, lower profitability, lack of raw materials, ‘boom and bust’ conditions
- **European and National Policies:** Inadequate regulations (raw materials, drugs, additives, feed ingredients), new environment/planning policies limiting production growth and/or investments
- **Public Perception and Consumer Concerns:** Negative perceptions of aquaculture products with particular regard to quality, safety, environmental impact and sustainability
- **Financial/Economic Risk:** Global and European macro-economics – inadequate financing capacities,
- lack of investors in production/services, lack of investment in RTDi

OPERATIONAL RISKS

- Sectoral competence and skills: Lack of skilled personnel and training opportunities
- Knowledge Management: Ineffective knowledge transfer pathways from research to industry/policymakers
- Lack of funding/research required to implement SRIA and Plans for Action: Insufficient investments in programmes and personnel to achieve SRIA

HAZARD RISKS

- Climate Change: Increases in number and strength of storms could lead to damage, flooding, cage breakage and increased escapees; increases in sea temperature/climatic variability causes increase in disease prevalence; scarcity of fresh water- business collapse; species maturity/reproduction affected - decreases in fry production, robustness and growth;
- Disease: Lack of control measures for existing diseases, appearance of new diseases - stock losses, restrictions on the movement of live aquatic animals and/or fresh products, market collapse
- Food safety - Public health: Potential negative effects on consumers (e.g. shellfish toxins/viruses, fish feed ingredients) – lack of consumer confidence could lead to loss of market- collapse of profitability

With this information in hand, the Targets, Goals and sub-Goals for each Thematic Area were confirmed by the Thematic Working Groups for their relevance to achieving the overall Vision and the sectoral forecasts.

The combination of:

- 1) The draft Vision and Strategic Research Agendas of the Thematic Working Groups
- 2) Dedicated State- of-the Art research knowledge (Technical Leaflets and expert knowledge)
- 3) Up-to-date knowledge of the policy and legislative positions
- 4) Consultation with expert groups in the sectoral workshops
- 5) Identification of challenges, needs and actions plans
- 6) Scenario development and risk analysis

provided the solid base for finalising the Strategic research and Innovation Agenda developed by Aquainnova.

4. THE STRATEGIC RESEARCH & INNOVATION AGENDA

With the recognition of the structural components of the aquaculture value chain, combined with the Thematic Areas identified, more than 400 expert stakeholders contributed to the development of the Vision and the Strategic Research and Innovation Agenda within the Aquainnova project.

The full details are contained within the public document 'The Future of European Aquaculture'.

As a summary, the following targets and key goals were identified and agreed by Aquainnova, following the Thematic Areas of European aquaculture.

a) PRODUCT QUALITY, CONSUMER SAFETY & HEALTH

Target: 'Sustainable, cost-effective competitive advantage can be obtained through the production of high quality, healthy, nutritious and safe seafood' was the key message, accompanied by the need for scientific support data and communication efforts.

Goals to achieve this target:

- Maximise the health benefits of aquaculture products
- Ensure the continuing safety of aquaculture products
- Deliver high quality European aquaculture products that meet consumer expectations
- Understand the dynamics of European seafood markets

Conclusions: from the identified sub-goals that respond to the goals above, alongside technical objectives (practical tools, hazard identification), an improved understanding of market dynamics, labelling needs and quality definition forms a core element of the responding to the targets. An improved reputation of aquaculture, by achieving quality and communication, is integral to this approach.

b) TECHNOLOGY & SYSTEMS

Target: "To advance aquaculture industry technologies and systems so that Europe can become an environmentally and economically sustainable net supplier of seafood, characterised by a safe and attractive working environment." Complementing the previous target, this recognised the need to obtain technological development but also that this improves the working environment.

Goals to achieve this target:

- Ensure environmental sustainability through technological innovations and application of new knowledge
- Have efficient technologies to support continued growth
- Improved management systems and technology to ensure profitability
- Assure ethical, safe, healthy production by new technology

Conclusions: the specific sub-goals answer these goals through the development of new systems and technologies for automation, reduction of waste, pathogen detection, integrated production systems and improved management of nutrients and wastes.

c) MANAGING THE BIOLOGICAL LIFECYCLE

Target: "Improved competitiveness can be achieved from product specificity, targeted production environments, skill improvement and professionalism – plus clear societal and political support". Although this broad target does not appear to be very 'biological', support from biological improvements will clearly manifest itself in improved aquaculture processes and competitiveness.

Goals to achieve this target:

- Establish predictability of the biological processes
- Genetic improvement of livestock traits – affecting productivity, health and welfare, referring specifically to selective breeding actions
- Improve broodstock management – control of reproduction and sex of progeny
- Manage the lifecycle of selected 'new' species of high economic importance

Conclusions: a wide range of actions are proposed, most of which respond to improving the predictability of aquaculture performance. All stages of the lifecycle are affected by these goals where selective breeding for traits, better broodstock and progeny management and diversification (new species, integrated rearing systems...) respond quite specifically to the target and the Vision.

d) SUSTAINABLE FEED PRODUCTION

Target: “Efficient feeds – based on sustainable resources – that are formulated for efficient production, fish welfare and environmental respect, will make aquaculture one of the most efficient food producers”. Reflecting the concerns on traditional nutrient availability, the goals also address the need to maintain the nutritional quality of the product by RTD and innovation.

Goals to achieve this target:

- Have a solid knowledge of the fish nutritional needs and expand the number of raw materials that can be used
- Develop new manufacturing technologies for improved quality, cost-effective feeds
- Minimise (growth inhibition and other) effects of alternative dietary materials
- Understand and model nutritional responses
- Resolve strategic research problems in fish nutrition

Conclusions: the issue of manufacturing fish feeds that are not only recognisably sustainable but also fulfil the nutrient requirements without affecting fish health and welfare is a major challenge. The approach suggested is to combine the identification of new ingredients, formulated to needs and made efficiently. The number of different aquaculture species, many of which are carnivorous or omnivorous by nature, makes this particularly challenging – notably for cost-effective formulation and predictability.

e) INTEGRATION WITH THE ENVIRONMENT

Target: “Aquaculture in 2030 will produce nutritious food with less environmental footprints than any other food production for humans”

Goals to achieve this target:

- Establish the fundamental knowledge for assessing the acceptable levels of aquaculture waste assimilation in ecosystems
- Develop technology to minimise the biogenic influence of aquaculture
- Understand (and minimise) impact of synthetic agents used in aquaculture
- Understand (and have appropriate knowledge for) the interactions between farmed and wild stocks
- Develop tools to assure the best environmental governance

Conclusions: this thematic area recognised that aquaculture may influence but is also affected by the environment. Technological work is proposed for best siting, farm management and utilisation of wastes so as to minimise potentially negative effects. In some cases, fundamental knowledge is lacking and this needs to be combined with better tools for planning and quantification of potential effects. A close interplay between scientific and management knowledge with planning and legislation is needed.

f) KNOWLEDGE MANAGEMENT

Target: “European aquaculture will be seen as a sustainable activity from environmental, economic and social points of view”, grounded on scientific knowledge, consumer confidence and industrial strength. Knowledge and innovation (capacity) will be integral to the competitive advantages of the European aquaculture industry.

Goals to achieve this target:

- Manage knowledge efficiently and effectively (within the sector)
- Ensure the availability and efficient use of aquaculture research infrastructures
- Collect and collate evidence for informed communication for the benefits of the European aquaculture sector
- Foster and build human capital

Conclusions: as a horizontal thematic approach, this component of Aquainnova looked to give an approach to support development, communicate knowledge and make best use of resources, infrastructure, services and human capital. Accent on evidence-based communication needs and efficient knowledge management recognises that this is not being adequately achieved today.

Fostering human capital references the encouragement and framing of career development, supported by lifelong learning efforts. Effective knowledge transfer mechanisms are highlighted for improving competence at both personal and workforce levels.

g) AQUATIC ANIMAL HEALTH & WELFARE

Target: “Improving aquatic animal health and welfare will result in increased productivity, building on environmental and welfare standards, by the production of high quality, robust animals”.

Competitive advantage will be obtained by knowledge gained from investing in fish health and welfare aspects.

Goals to achieve this target:

- Improvements through better understanding of host-pathogen interactions
- Access to vaccines and immunomodulators
- Minimise threats from existing, emerging and exotic diseases
- Develop and use best practices to optimise disease prevention and treatment efficacy
- Understand stress/welfare better so as to incorporate welfare as a core component of production management

Conclusions: maintenance of fish and shellfish health requires different approaches, due to the differences in the rearing procedures. Health products and treatments are governed by strict legislation and the introduction of new therapeutic agents is a long process. Accent on better understanding of interactions, prevention and efficacy measures are seen as essential measures. Efficient production management has to include welfare maintenance as a core component.

h) SOCIO-ECONOMICS, MANAGEMENT & GOVERNANCE

Target: “For the innovative development of European aquaculture, it is necessary to create [appropriate] economic, social, management, political and governance conditions”. This key message comes from recognition of the need to have conditions that allow aquaculture development and that legislation or other interventions to not unfairly diminish the potential of the activity.

Goals to achieve this target:

- Effective governance to achieve the ‘level playing field’ for aquaculture within and outside Europe
- Establish an enabling environment for innovation and growth
- Understand better the social and economic dimensions of aquaculture – at different scales

Conclusions: The work of this Thematic Group was focused on whether the conditions exist in Europe for successful development of European aquaculture from the socio-economic point of view. While several of the sub-goals are quite general in nature, the overlying principles were that the social and economic conditions are driving forces for success. Actions were identified to respond to the needs for simplification, to assure a level playing field for competitiveness and that, additionally, socio-economic benefits need identification and communication.

5. PRIORITISATION OF ISSUES AND RESPONSES

Early in the project, it was realised that, since the Working Groups were developing their work separately, there would evidently be overlap in certain topics. However, it was decided that the integrity of their products should be respected prior to consultation.

The final results from the Thematic Working Groups provided 33 Goals accompanied by 144 sub-Goals. It was commented that if all the work identified was done as separate projects, the sector would have to wait a very long time to be able to develop.

Consequently, the position taken was that Aquainnova had to prioritise – from all of the goals/sub-goals provided – which were the most important topics to resolve and which were the best for the sustainability and competitiveness of the different sectoral components of the aquaculture value-chain.

Furthermore, when asked to prioritise their own proposals and conclusions, the TWGs found this extremely difficult to achieve within small groups – given the different interests, experiences and, hence, priorities of individuals. It was seen as essential for the integrity of the working groups and all working on Aquainnova, that the integrity and transparency of this process be respected.

Consequently, the task of prioritisation was given to the participants in the Consultation Workshops; for continuity and consistent referencing on a comparative basis, this was based on the preliminary proposals of the TWGs (see Methodology description). This exercise, achieved separately within each consultation workshop, was kept confidential – so as to avoid potential influences on subsequent workshops or prioritisation exercises.

a) MAIN OBSERVATIONS

Clear differences exist between the shellfish and fish rearing sectors, the former being largely dependent on external influences, not using feeds, subject to different markets and having a different economic structure (dominated by small family-managed production units). Fish farming is more controlled, uses formulated feeds for the majority of its production and is corporate in nature. Similarly, significant differences were seen for freshwater vs. marine fish farming and also within the latter, where priorities were somewhat different for the Mediterranean vs. cold water sectors. The full details are contained in the Aquainnova Workshop Conclusions (Deliverable 39) but the overall position is summarised as follows:

1. While it is possible to provide a general overview on aquaculture, its diversity in terms of culture medium (freshwater vs. marine), climate (cold, temperate, warm), species (shellfish vs. fish, marine vs. freshwater) means that, while one can identify common issues, there are many distinct characteristics of the sub-sectors that influence the priorities identified.
2. Shellfish culture and fish farming are even more different due to the manner in which they are operated and the degree of control that operators are able to impose on the farming procedures.
3. The scale of operation (e.g. large company/SME/Family firm) appears to be less important in the opinions provided, although this influences – particularly in highly productive systems – a higher reception towards technology (e.g. Norwegian salmon farming).
4. Clarity in the definition of goals and sub-goals is of key importance – particularly when addressing a multi-stakeholder audience – where language competence can also be an issue.

Nonetheless, overlapping issues (sustainability, environmental friendliness...) often appear as broad rather than specific priorities.

5. Professional opinions often referred to operational and market issues, as might be anticipated, while scientists focused on research and technical issues.
6. In the priority ranking exercises, 70-80% of the votes given were allocated to the top 15 topics (out of 39), moving to 80-90% for the top 20.

(1) PRIORITIES FOR FISH FARMING

The following top-ten ranked priorities were put forward for European fish farming.

TA	Goals	Description	Ranking %
TA4	Goal 1	Formulation of feeds on solid knowledge & sust. raw materials	8%
TA2	Goal 1	Ensure environmentally sustainable industry by innovation	6%
TA8	Goal 1	Ensure good governance - level playing field	6%
TA7	Goal 1	Improve fish health through understanding - vaccines....	5%
TA1	Goal 4	Better understand consumer perceptions	5%
TA2	Goal 2	Develop efficient technologies to support growth	5%
TA2	Goal 3	Ensure profitability through improved management and technology	4%
TA1	Goal 3	Deliver high quality aquaculture products....	4%
TA5	Goal 5	Tools for environmental governance	4%
TA3	Goal 2	Genetic improvement of traits	4%

The provision of sustainable feeds was the top priority for fish farming and one can note that several priorities are less direct research but more the establishment of conditions that will support development and innovation.

Environmental sustainability is seen as a top priority, where new tools are needed for governance, alongside improvements in understanding fish health.

Consumer-related issues, that will assure market success, are also highlighted (better understanding and quality) and many pointed to improved communication efforts as being essential for public acceptance of the profession.

Since the above table is an aggregate, one should also note that within the different sectors (see Deliverable 39), the following accents were highlighted in prioritisation:

1. Freshwater fish farming

Higher preference given to:

- Environmental aspects
- Introduction of 'New' species
- Perceptions of products and the profession

2. Coldwater fish farming (Marine)

Higher preference given to:

- Development of technologies
- Genetic improvement of traits
- Good reputation of the sector – improved communication

3. Mediterranean fish farming (Marine)

Higher preference given to:

- Issues concerning the consumer and public awareness
- Effective use of knowledge, technology and improved management

(2) PRIORITIES FOR SHELLFISH PRODUCTION

The following top-ten ranked priorities were put forward for European shellfish production

TA	Goals	Title	Ranking %
TA5	Goal 5	Tools for environmental governance	14,3%
TA2	Goal 1	Ensure environmentally sustainable industry by innovation	11,3%
TA1	Goal 2	Ensure the continuing safety of aquaculture products	8,7%
TA7	Goal 2	Apply epidemiological principles to reduce disease threats	8,7%
TA3	Goal 2	Genetic improvement of traits	8,4%
TA8	Goal 1	Ensure good governance - level playing field	7,4%
TA8	Goal 2	Enabling environment for innovation	4,4%
TA7	Goal 1	Improve animal health through understanding	3,5%
TA6	Goal 1	Manage knowledge effectively	3,3%

This ranking reflects both the nature of the shellfish profession and the concerns of the shellfish producers, whose dependence on the quality of the local environment for successful production and marketing is paramount – also references the Importance of continuing safety of the products.

Assuring environmental governance and sustainability are clearly the 2 top concerns.

Innovation is recognised as being necessary for development and particular attention was given to improved knowledge management and networking.

Improved understanding of health and genetic improvement of traits reflect concerns on exposure to existing and new diseases.

(3) PRIORITISATION CONCLUSIONS

The prioritisation exercise was, without doubt, the most challenging component of the consultation exercise since the participants' interests, by sector or by interest, are directly reflected in this. The results therefore reflect, in part, the professional qualities and experience of the workshop participants.

Nonetheless, the results are seen as a clear guideline for further debate and discussion. The Aquainnova workshops were very successful and since their achievement, similar exercises have been achieved within other 'aquaculture' actions and projects, notably the Aquamed project (using the Aquainnova proposals) in a special meeting for this purpose (November 2012). The Marelife forum (Bergen: March 2013) also intends to use a similar approach for Northern aquaculture.

In conclusion, the prioritisation exercise has provided guidelines for all components of European aquaculture; while some may disagree with the conclusions, the results are nonetheless based on the opinions of the workshop participants – who were not aware that this exercise was to be achieved. Participation could also be said to be a key influence – those who wanted to and could participate were able to have their say.

It is intended to promote repeating the prioritisation exercise in the future, in both European and National meetings, so as to refine and/or confirm the results obtained.

6. PLAN OF ACTION

The achievement of the Vision of European Aquaculture in 2030, with associated goals and sub-goals within the SRIAs of the thematic areas, will depend on the mobilisation of the different actors and resources to achieve these.

Aquainnova recommended the following:

- Coordination of efforts throughout the entire value chain
- Identification of financing mechanisms (public and private) for aquaculture growth & development
- Identification of funding (public and private) for RTDi activities, including demonstration actions
- New networks and communication channels to stimulate and accompany knowledge transfer

As indicated previously, actions are not just limited to research and innovation and include any activity needed to achieve the goals and sub-goals of Aquainnova; these include policy requirements, knowledge transfer, networking, training and sectorial management.

Within the scope of Aquainnova, initial priority actions were developed by the Thematic Working Groups, as start to an integrated plan of action that would respond to the goals/sub-goals identified.

A list of actions (interpreted as project possibilities) were defined by the Thematic Working Groups so as to capture the key information and data needed, including:

1. Action description (subject)
2. Action type (RTDi, Policy, Knowledge transfer, Other)
3. Expected results
4. Timeline to results (Short, Medium, Long)
5. Funding Estimate

In several senses, this structure mirrored the analysis achieved for the EC projects in the Technical Leaflets, using thus a common basis for action/project analysis and reflecting a cost-benefit analysis of action plan delivery, demonstrating benefits for the investment in RTD and the relevant sectoral interests.

This part of Aquainnova did not set out to be an exclusive or prescriptive list of actions but more to be a starting point for decision on what needs to be achieved. As noted, different activities can be used to provide overlapping responses to a common goal.

By listing the suggested approaches alongside estimated costs and timelines (see Deliverable 40), it is possible to assess each action proposed from the perspectives of success and cost/benefit. This approach will contribute to improved recommendations on investments that are designated to respond to the goals and actions identified and provided leverage to funding agencies/RTOS active in aquaculture research.

Developing further the Plan of Action reflects that this is not static and is dependent on further commitment of those who have contributed to Aquainnova as well as other members of the profession, the RTOs and the administrations and funding agencies in Europe.

7. MOVING FORWARD

As elaborated by Aquainnova in the Goals and Sub-Goals of the Thematic areas, the following targets have been identified:

- Improve competitiveness through product development following customer needs, targeted production environments and a high level of professionalism and skill evolution
- Use knowledge and innovation to build cost-effective competitive advantages
- Create the economic, social, management, political and governance framework conditions that will enable the innovative growth and development of a sustainable aquaculture sector
- Produce and provide high quality, healthy, nutritious and safe fish and shellfish products that meet consumer demand
- Adopt cutting-edge knowledge management practices to support state-of-the-art technological development
- Achieve targeted production levels with less environmental footprints than any other type of food production for humans
- Use sustainable fish feeds that will make aquaculture one of the most efficient producers of safe, high-protein and nutritious food products
- Advance aquaculture industry technology and systems that are environmentally and economically sustainable
- Improve health and welfare so as to rear high quality, robust aquatic animals
- Provide a safe, attractive, challenging and rewarding work environment

These targets, if achieved, will confirm that Europe is a global leader in the commercial, research and service sectors that comprise the European aquaculture value-chain. New opportunities can be created, not only in Europe but also through the international dimension of aquaculture, where new technologies and services will reinforce Europe's international position.

EATiP, as coordinator of the project and as a Technology Platform dedicated to the sustainable development of European aquaculture, wishes to not only promote the 2030 Vision and the SRIA but also to assist implementation of the Plan of Action.

Successful implementation depends on successful communication and dissemination of the Vision and SRIA(s) produced through Aquainnova, to which EATiP is committed. Outside of the scope of Aquainnova, translations of the 'Future of European Aquaculture' are being prepared in Spanish and in Hungarian. Web pages of the document, enabling automatic translation are also under preparation.

Additionally, since 2012, the role of European Technology Platforms is under review; while recognising that the rationale for ETPs remains valid, ETPs will be required to provide insights into market opportunities and needs and identify the pathways for the commercial deployment of research results, promoting innovation.

EATiP, its partners and the participants in Aquainnova have demonstrated that European aquaculture is in a position, through research and innovation, to enable European companies to achieve competitive advantage in both European and global markets. This will be the most significant contribution of Aquainnova as a stimulus to achieve the research and innovation required by European aquaculture.

8. SYNERGY & COOPERATION

a) RELATED TECHNOLOGY PLATFORMS

Contacts were established with several regional and national aquaculture Technology Platforms that have been created (e.g. Centro Tecnológico Gallego de la Acuicultura in Spain) or under development (e.g. Hellenic Aquaculture Technology and Innovation Platform). Several of these have adopted the Thematic Area structure within their own actions and have taken the prioritised needs further in their own actions and developments.

In addition, the Vision Documents and Strategic Research Agendas were provided to the partners of the BECOTEPS⁶ project – *an action that looked to reinforce synergies and identify gaps in the Strategic Research Agenda of Knowledge-Based Bio-Economy Technology Platforms* -, within which the EATIP had a participative position. During the Aquainnova timeline, project progress was given to the BECOTEPS partnerships and participation was assured in different 'BioEconomy' fora, workshops and conferences

Other European Technology Platforms that were active in BECOTEPS included 'FOOD FOR LIFE', 'Plants for the future', 'Sustainable Farm Animal Breeding and Reproduction' and 'Global Animal Health'. This position allowed other synergies developed, notably the evolution of the Animal Task Force.

b) INTERNATIONAL COOPERATION

The European Community is a leader in global seafood trade, of which at least 65% is imported, predominantly from neighbouring European countries (e.g. Norway and Turkey) and Asia (e.g. Vietnam, Thailand...). Modern commercial aquaculture is greatly indebted to technologies developed or perfected in Europe, however, successful applications of these technologies have been realised outside Europe often with little or no matching returns to the European sector.

While Aquainnova actions focused primarily on Europe, collaborative and cooperative points were examined with 2 other EC FP7 projects concerning aquaculture; these were targeting the consolidation of alliances in the programming of research activities in the Mediterranean (Aquamed) and in Asia (Asem –Aquaculture 09).

The Mediterranean aquaculture sector demonstrates large differences between the individual countries, particularly on the North-South interface, as well as research capacities. Aquamed has looked into establishing common actions for Mediterranean aquaculture, including the encouragement of the development of a regional multi-stakeholder platform. Aquainnova has made several contributions to Aquamed – including its 'products' and the methodology for multi-stakeholder workshops. The Coordinator has attended several project meetings, giving feedback on Aquainnova progress and achievements and suggestions for integration of Aquamed activities within both Aquainnova and EATiP.

Asia's actual and potential growth in aquaculture is due to its climatologic, geographical & workforce conditions, as well as a tradition for farming the aquatic environment. However, serious challenges to producing countries - in respect of sustainability, social equity and suitable technology - are recognised. Several of the EATIP members were active in the AqAsem⁷ project that initiated the structure of a dedicated aquaculture platform of cooperation under the ASEM (Asia Europe Meeting) banner. Aquainnova has contributed its positions to the Asem –Aquaculture 09 project and, through EATiP, is assisting the progress of this project.

⁶ BECOTEPS – the Bio-Economy Technology Platforms join forces to address synergies and gaps between their Research Agendas (Grant Agreement 226526)

⁷ 'AqAsem' - a Specific Support Action (INCO-CT-2004-502505) – see www.asemaqaculture.org

The development of aquaculture in sub-Saharan Africa has been problematic and at much slower rates than seen elsewhere in the world. A FP7 project entitled 'SARNISSA' looked at establishing 'Sustainable Aquaculture Research Networks in Sub-Saharan Africa'. In spite of evident structural differences, it was hoped originally that cooperative efforts between Sarnissa and Aquainnova could provide synergistic actions. Sarnissa finished its action around the same time that Aquainnova started and its main activity, at the end, was a web-based problems-solutions forum. Since this was more focused in individual expert inputs, Aquainnova was unable to contribute much to this work.

The following actions were achieved within Aquainnova:

- Common meetings with Aquamed and Asem –Aquaculture09 to examine synergies and review [the potential for] common actions.
- To apply common methodologies where possible in related work.
- To assess the incorporation of the multi-stakeholder platforms proposed (particularly Aquamed) in the structure of EATIP, so as to avoid unnecessary duplication.
- To incorporate background data on each project within appropriate websites

Since the main focus of Aquainnova was for European actions related to the development of European aquaculture, the closest cooperation occurred with the BECOTEPS and Aquamed project actions. Nonetheless, since Aquamed and Asem –Aquaculture09 continued after the end of Aquainnova, cooperative actions are continuing and positive results are foreseen, particularly in relation to the establishment of medium-long term Mediterranean multi-stakeholder aquaculture platform activities.

9. KNOWLEDGE MANAGEMENT & TRANSFER

It has been recognised that efficient knowledge transfer from European research is held back by a range of factors that include: cultural differences between the business and science communities, lack of incentives, legal barriers and fragmented markets for knowledge and technology (Improving knowledge transfer between research institutions and industry across Europe: embracing open innovation – Implementing the Lisbon agenda (COM (2007) 182 final)).

Aquainnova paid particular attention to knowledge management procedures, basing its approach on that developed for the MarineTT⁸ FP7 project. This refers to the means (and success) of knowledge transfer and the uptake of results from European Aquaculture research projects. 106 Technical Leaflets were developed for aquaculture-related RTD projects, where outputs and impact were assessed. Targeted compilations of these were prepared for each consultation workshop, being published in parallel on the web.

Additional contributions to this approach included the Thematic Vision documents, draft Strategic Research Agendas and associated background papers which were provided to all Aquainnova contributors – Thematic Working Group members and Workshop participants; in many senses, this was integral to transferring RTD knowledge to those who were unaware of the results and may be able to use the outputs as well as an appreciation of the status of EC-funded aquaculture research. From these actions alone, a much higher awareness of thematic progress and individual project information has been generated.

Special attention was given to consumer groupings, accessed through the European Consumer Organisation (BEUC) – a special compilation, covering selected 'consumer' topics was prepared and presented, allowing an appreciation of the issues affecting consumer acceptance and appreciation of aquaculture.

Aquainnova used a procedure of knowledge collection-analysis-transfer, focusing on knowledge that would have an impact on the sustainable development of aquaculture. Significant progress in rendering project results available and accessible has been achieved.

⁸ <http://www.marinett.eu/>

The main problem encountered was to distil the massive amount of detailed information into a more simple and accessible format. Expert analysis was used to facilitate this, through the preparation of Knowledge Output tables for each project (see Deliverable 46) and a prioritisation exercise.

Nonetheless, Aquainnova has also highlighted the difficulties of assessing the impact of research results post-project; this appears to be a structural issue within EC project design, since each project has a finite timeline and, unless followed up, is not charged with measuring its own impact.

Aquainnova has thus made specific recommendations, which include:

- Transfer potential and actions must be considered from the beginning of any research project. Analysis of Knowledge Outputs should take place as and when they are completed to allow for sufficient time and resources to be dedicated to Knowledge Transfer within active projects.
- There would be more impact from research if researchers worked closer with industry to fully understand end-users priorities and needs.
 - Mid-term project reviews could assist this aspect, highlighting promising results and preparing dissemination/communication actions with appropriate assistance.
- Research consortia should be provided with more requirements, guidelines and assistance to carry out knowledge transfer.
- Retrospective knowledge/result/impact collection and knowledge transfer is challenging unless those involved in such FP projects have a clear mandate and that EC projects, even when finished, are required to cooperate.
- Financing specific knowledge transfer actions (post-project) based on evaluated outputs and impact could be considered

In many senses, Aquainnova has been able to transfer successfully different components of knowledge associated to European aquaculture, be this the results of RTDi, policy developments or a better understanding of how professional aquaculture works and the problems or issues that face the operators. This has been achieved by

- the preparation of a wide range of thematic documents on issues and needs
- the preparation of accessible RTDi summaries, identifying outputs and impact
- the opportunity for debate and discussion with European aquaculture representatives, policy-makers, stakeholders and experts
- the expansion of the debate to include issues such as governance and forecasts, forcing reflective discussion as opposed to predisposed presentations

This position has encouraged genuine knowledge transfer within the Thematic Working Groups and the Workshop participants, numbering well over 400 individuals. Outside of this, it is difficult to measure the efficiency of knowledge transfer since it is based on distance consultation of the information provided.

The main knowledge-based output of Aquainnova is a comprehensive Vision for European Aquaculture in 2030, backed up by detailed Strategic Research Agendas for each Thematic Area, accompanied by the Plans of Action for identified Goals and Sub-Goals.

Effectively, this provides a roadmap for research and innovation in aquaculture where successful knowledge management will be a key component.

This overarching document provides a base position of the ideas and knowledge generated by Aquainnova itself as well as pointing readers towards the source material, all of which is available on the Aquainnova/EATiP website.

E. POTENTIAL IMPACT OF AQUAINNOVA

The potential impact of Aquainnova, its results and their manner of achievement, is important since most of its objectives have been met through the execution of the project. As foreseen in the Description of Work, Aquainnova delivered a structured and operational platform – using recognised expertise from a multi-stakeholder base – that worked transparently and publicly to deliver a consensual Vision for European aquaculture in 2030, accompanied by a Strategic Research Agenda to achieve this.

The impact of these project products will be to assist the preparation of future aquaculture research and innovation policies at European and National levels.

Furthermore, within the revised Strategy for European Technology Platforms⁹, it has been put forward that the mission of ETPs is to:

- provide a coherent business-focused analysis of research and innovation bottlenecks and opportunities related to societal challenges and industrial leadership actions: *a strategy function*;

This has been achieved within the background work of Aquainnova and the analysis demonstrated in the ‘Future of European Aquaculture’

- mobilise industry and other stakeholders within the EU to work in partnership and deliver on agreed priorities: *a mobilising function*;

This has been achieved initially with the mobilisation of over 400 stakeholders within the Thematic Working Groups and the Consultation Workshops so as to work in partnership

- share information and enable knowledge transfer to a wide range of stakeholders across the EU: *a dissemination function*.

This has been achieved with the production of the new project summaries on EC research projects, shared as special compilations or as individual documents, disseminated publicly and to expert groups, accompanied by distribution of the ‘Future of European Aquaculture’

Consequently, the products of Aquainnova not only respond to the original project objectives, their impact will go further in assisting – as described in the ETP 2020 strategy – the programming and implementation of Horizon 2020, by reference to aquaculture.

1. IMPACT ON POLICY

At the time of achieving Aquainnova, different policy developments were taking place at European level. For the aquaculture profession, the main one was the reform of the Common Fisheries Policy and its related instruments (Common Organisation of the Markets for Fisheries and Aquaculture Products (COM) and the European Maritime and Fisheries Fund (EMFF)). Prior to Aquainnova starting, the Commission published a new Communication to give a ‘boost to the sustainable development of European aquaculture’.

During Aquainnova’s timeline, Commission DGs (DG MARE, DG RESEARCH, DG SANCO, DG ENV) were informed of the project’s progress and regular updates were given the Working Groups and Plenary of the Advisory Committee on Fisheries and Aquaculture. Commission staff have attended both Aquainnova management/working meetings and the consultation workshops.

As the content of the ‘Future of European Aquaculture’ was being developed, these were also communicated to meetings of EU Member State Fisheries/Aquaculture representatives (through presentations and documentation) at special meetings held on CFP reform under the EU Presidency (Netherlands 2010, Hungary 2011). Presentations on Aquainnova development were also made to special aquaculture workshops at the European Parliament and to the Fisheries Committee.

In the later stages of Aquainnova, its outputs were communicated at workshops organised on the new Common Fisheries Policy and the development of Strategic Guidelines for the development of European aquaculture.

⁹ European Technology Platforms 2020 – Draft Strategy – European Commission working document

Perhaps the highest impact of Aquainnova in this area comes from highlighting the issues affecting the development of European aquaculture so that these can be accounted for within the reformed Common Fisheries Policy, where aquaculture is now seen as a key pillar of activity. Although not yet approved at the time of reporting, several of the recommendations and objectives of Aquainnova are accounted for within the proposals for the COM and the EMFF.

Prior to Aquainnova starting, EATiP was involved in the BECOTEPS project (2009-2011), which produced a White Paper on the Bio-Economy, where the Bio-Economy Technology Platforms joined forces to address synergies and gaps between their Strategic Research Agendas. Although the project was completed before the preparation of the 'Future of European Aquaculture', the results of the start-up work were shared with this project and several of the primary positions were communicated within this White Paper. The impact of this position was to place more firmly and identifiably, aquaculture within the appreciation of contributors to the Bio-Economy. Furthermore, the coordinator of Aquainnova contributed to a working group for the preparation of a paper on «Skills needs in the future bio-based economy» which was published in June 2011.

An additional impact of this approach was to render many of the aquaculture professionals and scientists that contributed to Aquainnova more aware of the issues and questions raised by the appreciation of the Bio-Economy and its role in European economies and society.

2. IMPACT ON RESEARCH

While it is early days to measure the impact of Aquainnova on research activities, it is clear that the scientists & technologists who participated in the project, either in Thematic Areas or in the workshops, became more aware of industrial and policy issue and, thus, the relevance of RTDi within the policy and legislative spheres. The use of these 'meeting points' has already contributed to the formulation of new projects and new consortia – as responses to calls (KBBE 2012, 2013) or as SME-ASSOCIATION measures. References to the 'Future of European Aquaculture' as a guideline of identified issues and research requirements have started already.

In the months following completion of the project, the EATiP Secretariat has received >15 enquiries concerning project formulation/creation on the basis of the content of the Aquainnova Strategic Research Agenda.

It is anticipated that this document will have a strong short and medium-term impact on the direction of industry-oriented research programmes.

3. IMPACT ON THE PROFESSION

In a sector that has been based on the successful transposition of research into the field, most of the successful European companies have links to their national research organisations – institutes or universities. Many of these are (or have been) involved in RTDi projects, targeting their individual needs or problems. Inevitably, the financial crisis throughout Europe has dramatically affected the potential for SME contributions. Aquainnova has nonetheless highlighted the needs for research and the need for industrial involvement. One of the main impacts in this respect has been to render a higher appreciation of work that has been achieved already (Technical Summaries) and the range of possibilities of achieving research at the European level (communication of programmes, calls).

Providing knowledge of and rendering accessibility of the SMEs, in particular, to participation within the different programmes operated by the Commission has been integral to Aquainnova. This will continue as a core action of EATiP following the project.

'The Future of European Aquaculture' has been endorsed by many Associative structures and communicated to their SME/corporate members. Continued communication activities will be assured following completion of Aquainnova by EATiP and its membership.

Enabling RTDi efforts on aquaculture remains the highest priority for EATiP.

4. DISSEMINATION AND COMMUNICATION

Aquainnova, by definition, is a support action based on dissemination and communication, but its audience and targets changed with the evolution of the project's activities.

Initially, the project's actions were towards the team that was developed within the Thematic Working Groups, followed by the participants in the Stakeholder consultation workshops.

Finally, wider dissemination/communication actions targeted stakeholders who had not participated in the project but whose activities could be influenced by the project's results, products and proposals. This included the consumer organisation grouping underneath the European Consumers' Organisation (BEUC).

Outside of the 19 meetings organised for the Thematic Working Groups, Aquainnova counted 79 separate dissemination activities during its timeline, excluding meetings where a short update was made or where documents were simply distributed (e.g. Advisory Committee meetings, Working Groups meetings of the FEAP and other meetings where stakeholders were present for another purpose).

The challenges and targets were different during the course of the project.

a) RAISING AWARENESS

The first challenge for dissemination was to **raise awareness of the project and its ambitions**; this started before the project was initiated (during negotiation period) and the first presentation was made at Aquaculture Europe in August 2009. Similarly, EATiP Membership was informed of the project's implementation (newsletters, meetings) while the networks of FEAP, EAS and AquaTT engaged in similar actions. The project flyer and presentations were the main tools employed.

This was also useful in creating memberships of the Thematic Working Groups.

b) PROJECT PROGRESS

Once the project started, dissemination actions were more to **inform of progress and project status** but were very limited in the first year (flyers, presentations on project background). Once the development of technical leaflets had been started, it was also realised that some time would be needed before these were all finished; consequently, preparations were prioritised as a function of the workshops (so freshwater ones were done before shellfish, as an example).

This was achieved increasingly following March 2011, once draft documents had been received from the Thematic Working Groups and a draft Vision had been prepared.

c) ENCOURAGING PARTICIPATION

The next stage was to **attract participants to the workshops**, which was achieved using draft materials and using partner networks (FEAP, EAS, AQUATT, EUROFISH); by the time of the workshops, draft Vision and Research Agendas had been formulated. In addition, awareness had increased of the reform procedures engaged for the Common Fisheries Policy and related instruments.

d) ENGAGING FEEDBACK

Workshop participation was, due to facilitation methodology, limited to +/-50 people; draft workshop reports were published to engage feedback while reports were also made within other fora – notably Aquaculture Europe (2011), meetings of FEAP and AquaTT (AquaTnet). By the autumn of 2011, the fish workshops had been completed and results were being communicated.

The highly positive feedback from the workshop participants had a knock-on effect in requests for information from the EATiP secretariat.

Workshop reports were published in the Eurofish magazine (>3000 readers) and summaries were also sent in newsletters. Nonetheless, the feedback tended to be specific (topic/sector oriented).

As the results of consultation were received and the draft documents were being finalised, more presentations of Aquainnova's work were possible and it was possible to give more concrete data than before.

This was achieved with EFARO (European Fisheries and Aquaculture Research Organisation) at their Annual Meeting in 2012, which also led to similar methodologies being applied to the Aquamed project.

Limited feedback was obtained from other meetings (e.g. BioEconomy conference, North Atlantic Seafood Conference) but was hampered by not having the overarching Vision document to hand.

a) COMMUNICATION OF THE VISION

The 'final' draft Vision/SRIA was prepared in June 2012 so as to obtain final feedback with the Thematic Working Groups and the EATiP Board; this allowed for refining the document to meet expectations, which was completed during July/August for printing and web-publication.

Inevitably, the hard copy document of 'The Future of European Aquaculture' and the completion of the background documents and deliverables provided the core materials for dissemination of the conclusions of Aquainnova.

'The Future of European Aquaculture' was then presented to Aquaculture Europe 2012, with copies available at the stands of the European Commission, EUROFISH, EAS, AQUATT, INVE, BIOMAR and a dedicated presentation on the project was made at the conference, explaining the methodologies and the conclusions. >600 copies were distributed.

Additional presentations were made at workshops held in the European Parliament, the Scientific Committee on Agriculture Research, the ICES Annual Meeting and 4 other aquaculture-related workshops.

No less than 10 workshops/conferences were attended by Aquainnova representatives for communication and dissemination of this document in the last 2 months of the project. Over 2,000 copies have been distributed through a range of means, targeting different stakeholders in aquaculture.

1. Each Member Association of the FEAP has received a minimum of 20 copies, for local/national communication purposes
2. 600 copies were distributed at Aquaculture Europe 2012, primarily for scientists and attending stakeholders (producers, industry suppliers..)
3. Additional communication and Vision copies to European Parliament debates on aquaculture, the EUROFISH Annual General Meeting (Ministries/Research Institutes), the Fisheries and Aquaculture Department of the FAO, the GFCM, the European Commission (DG MARE, DG RESEARCH...), EATiP and FEAP Membership.

To date (March 2013), the Vision 'page' (contains the PDF Flipbook file) has been viewed some 3,300 times on the website since it was published in September 2012.

A video montage (sited on YouTube) provides the story of Aquainnova, alongside the development of the Vision within Aquainnova and policy actions during the timeline of the project,

Actions will continue to communicate the Vision and the related documents and products of the project; led by EATiP and its Members, dissemination and communication efforts will continue.

The Vision document has now been translated into Spanish and Hungarian; the Spanish version will be printed in 2013. At present, it has been proposed to prepare additional versions in French, Italian and Greek enabling further impact.

5. EXPLOITATION OF THE RESULTS

The results of Aquainnova are numerous and are publicly available for exploitation, principally by all who are engaged in aquaculture, be this in the field, in RTDi, in civil society and in formulating policy. The combination of using recognised scientific experts with experienced industry representatives has not only given credibility to the documentation but has also opened wide access to dissemination of the concepts and methodologies developed so as to obtain consensus views for the future of European aquaculture.

The success of the workshops, the approach and methodologies used, has led to the adoption of the techniques applied in several other EC and national projects; notably by Aquamed, the FEAP, several national associations and institutes/universities; awareness of the productivity obtained by using this approach has been spread mainly by Aquainnova participants.

Several of the key points raised in the 'Future of European Aquaculture' have been taken up in both National and European actions, relating to policy and RTDi project developments. This will continue, notably through the voice of the new European Advisory Council on Aquaculture that will be created in 2013.

As further examples, the views on the identified challenges for progress have been integrated into the background for the Commission's suggestions for Strategic Guidelines for the upcoming National Plans for Aquaculture in the reformed Common Fisheries Policy.

It is also known, through communications to the Aquainnova team, that new project proposals – building on the sub-goals of the Thematic Areas – have been formulated.

EATiP itself hopes to take forward several of the issues raised by Aquainnova, notably in terms of obtaining better feedback on project impact (results/outputs) and improving knowledge transfer mechanisms, particular towards the industry and professional components. This will be discussed further in upcoming months.

Access to the results of Aquainnova, principally through the publication and dissemination of core deliverables, will be assured by EATiP which recognises that several of these, principally relating to forecasts, scenarios and recommendations, will need to be reviewed on a regular basis. This will be part of the work programme of EATiP in the future.

Consequently, while Aquainnova's results and products are public, EATiP and its membership will continue to promote the concepts developed in Aquainnova and to communicate the conclusions and recommendations in the future.

F. AQUAINNOVA PRODUCTS

- All of the 'Aquainnova' documents are available at the EATiP Website – www.eatip.eu
- The Aquainnova section is available at <http://www.eatip.eu/Default.asp?CAT2=0&CAT1=0&CAT0=0&shortcut=100>
- The Aquainnova logo (incorporating its colour scheme for publications) is



1. THE FUTURE OF EUROPEAN AQUACULTURE (DEL 41)

A 42 page summary document containing “Our Vision: A Strategic Agenda for Research & Innovation”

- Available in printed form from the EATiP Secretariat
- On-line at www.tinyurl.com/eatipvision and at the EATiP Website as a viewable or downloadable Flipbook (searchable PDF & Flash Formats)

2. VIDEO

Video presentation explaining EATiP and Aquainnova – background to development and progress of the project and EATiP ambitions for promotion of the Vision, the SRIA and the Plan of Action – accessible at <http://eatip.ttime.be/default.asp?SHORTCUT=599>

1. DETAILED ACTION PLANS (DEL 40)

Developed at the end of the project, on the basis of the work of the Thematic Working Groups and the results of the individual Workshops, the Actions Plans (by Thematic Area) propose and define how the goals identified by Aquainnova can be met.

2. TECHNICAL LEAFLETS (DEL 22/26)



106 new Technical Leaflets - <http://www.eatip.eu/default.asp?SHORTCUT=410>; available through search engine (key words), on Thematic Area pages and in the Library section.

Compendia compilations available as one-off print-runs for Workshop participants.

Special compilation for consumer organisations (Del 43)

3. CONSULTATION WORKSHOPS (DEL 36-37-38-39)

Background Information and Reports available on individual Workshops through the Consultation section of the website - <http://eatip.ttime.be/default.asp?SHORTCUT=277>

4. PRESENTATIONS

European Aquaculture in 2030 – a typical presentation developed during the last year of Aquainnova - <http://prezi.com/ygexpjrul9ne/a-vision-for-european-aquaculture/#>

5. AQUAINNOVA FACT SHEET (DEL 32)



Aquainnova

FACT SHEET

At a Glance

Title:	Aquainnova, Supporting governance and multi-stakeholder participation in aquaculture research and innovation
Programme:	FP7, Cooperation, Food, Agriculture and Fisheries, and Biotechnology (KBBE)
Instrument:	Coordination and Support Action (Supporting)
EC contribution:	€988,954
Duration:	February 2010 – July 2012
Coordinator:	European Aquaculture Technology and Innovation Platform (EATIP)
Third parties:	Federation of European Aquaculture Producers, European Aquaculture Society, SINTEF, EUROFISH, AquaTT
Web:	www.eatip.eu

The Challenge

Aquaculture in the European Union encompasses the production of a wide range of fish and mollusc species and is a true pan-European production activity, which has grown rapidly from a cottage industry in the 1960s into an industrial sector that is composed of multi-national companies, SMEs and family firms. While aquaculture appears to be integrated within the Common Fisheries Policy, there is no real Europe-wide policy for aquaculture development, and its growth occurred within a relative vacuum for strategic development.

In 2002, the European Commission developed a 'Strategy for the Sustainable Development of European Aquaculture' which was the first attempt to provide a European plan for development and this was reviewed to provide more impetus in 2009. Nonetheless, it is only recently that European States have developed clear national strategies or policies for aquaculture development. This effort has been largely supported by the European research community, with its many institutes and universities dedicating specialised departments to carry out R&D activities for the benefit of the sector.

Commission funding has stimulated European and international cooperation across the research community and, in recent years, through CRAFT and collaborative projects, has encouraged closer contact between the small-to-medium enterprise (SME) and research players. Today, the Seventh Framework Programme (FP7) has a clear mandate to progress this approach. Therefore, Aquainnova has been devised to examine and identify research areas and that could be supported by the industry in its own right.

G. LIST OF BENEFICIARIES OF 'AQUAINNOVA'

Name, Affiliation and Contact email.

1. EUROPEAN AQUACULTURE TECHNOLOGY & INNOVATION PLATFORM

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c) EUROFISH

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