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Fostering Growth in the Blue Economy by developing an action plan for innovative European aquaculture VET and harmonized qualifications

D9.5 Action plan for European VET innovation and the harmonization of qualifications

WP 9 Dissemination & exploitation

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Summary

An action plan for VET innovation and the harmonization of European Aquaculture qualifications has been developed. The plan gives recommendations for how to "harmonize" aquaculture VET in 5 north European countries cage farming salmon and trout.

Northern Europe
For northern Europe countries farming salmon and trout, aquaculture technology supply companies should join the farmed fish producers and the VET providers to form an **Aquaculture Skills Foresight Forum (ASFF)** to develop common occupational standards (knowledge and skills) and a framework of shared learning outcomes, which can be updated annually thereafter, to inform future NQ revisions.
Such an aquaculture VET initiative shall be unique and progressive in several ways:

1. The creation an Aquaculture Skills Foresight Forum (ASFF) to lead the harmonization of north European occupational standards and learning outcomes, led by the fish producer and technology supply companies.
2. The formalization of a north European aquaculture VET provider network composed of nationally respected VET providers. Collectively, they should develop the resources and pedagogy needed to support flexible work-based learning and skills development, in close partnership with their aquaculture company partners.
3. The development of the capacity within aquaculture companies for mentoring, farm-based skills instruction and contribution to a quality assured assessment and formal VET delivery, supported by their VET provider.
4. The development of up to date aquaculture VET resources, shared by the VET provider network, and their industry partners:
5. The development of a work-based learning pedagogy that encourages 'investigative work-based learning' and the development of important transversal skills, including problem solving and team working.

The ASFF should lead the alignment of aquaculture occupational standards for commercially marine cage farmed fish in Northern Europe. This should culminate in an 'Occupational Map' for the European salmon- and trout farming sectors, identifying current occupations and occupational standards for high priority roles.

Southern Europe
To date, there has been limited development of formal VET in the south and east of Europe to reflect industry requirements for an upskilled workforce that would enable the Sea bass/Sea bream sector to survive in a highly competitive marketplace. Partnerships that start implementing the proposed action plan for northern Europe, should try to seek to establish contacts with counterparts in the south and east of Europe to explore collaboration.

There should be a major drive to encourage a multilateral meeting of all stakeholders in the VET arena – industry, national regulating bodies, providers (private and public colleges and universities) already involved in marine VET – enhanced by participation of European aquaculture VET experts and Commission representatives.

The second potential game changer at this point in time is the commercial restructuring of the three largest Sea bass/Sea bream production companies into a single organization in Greece. If this new dominating corporate entity can be encouraged to prioritize training for its workforce then there would be a major stimulus for the provision of modern workplace-based VET, supported by theoretical classroom instruction.

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Chapter 1: Introduction

In Europe today, the aquaculture industry directly employs approximately 80,000 staff, and an additional 20.000 in the supply sector. The EU seafood market sources 10% of its fish from EU aquaculture, 25% from fisheries and 65% from imports (SEC 2011, 883), a figure which could be reduced through an increase in European production. Globally, fish represent 50% of all consumed protein and levels are anticipated to rise to 65% by 2030, reflecting a growth rate of 6.6% per annum. Conversely, despite ambitious national targets for growth in the EU, the industry is stagnant. The lack of personnel with the correct skills and qualifications is becoming widely recognized as one of the main obstacles to sustainable growth in production.

Throughout Europe at farm level, workforce development is heavily reliant on local recruits, many of whom are inexperienced and unqualified, changing the workforce profile. This is typified by Norway, where approximately 45 % of their salmon husbandry operatives have not completed any relevant education leading to a national qualification (NQ) ("fagbrev"). In other salmon producing countries, a small minority hold a National Qualification (NQ), and some lack an NQ delivery system for husbandry operatives. Whilst traditional full-time college VET is well established in some countries, most notably in Norway, for most mature recruits it is inaccessible. Concurrently, the industry is becoming increasingly sophisticated. According to some technology supply companies, a lack of specialist training in operating the more advanced equipment and technologies has led to inefficiency and fish losses.

With a general lack of flexible and accessible work-based VET; the industry has been catering for their workforce development needs, relatively unassisted. Company based training schemes (non-formal VET), which are not quality assured, and do not lead to nationally recognized certification, have proliferated, through necessity.

A system for the delivery of accessible, innovative 'individualized' work-based learning leading to NQ completion that is "harmonized" is missing. The processes for the recognition of prior learning (RPL) and unitized learning resources is not aligned to a shared framework of industry endorsed learning outcomes. The continuous assessment of practical competence in the workplace does not directly involve employers and contribute to NQ assessment results that are understood and respected within northern Europe. Consequently, work-based VET pathways and qualifications should gain parity and learner mobility should be promoted, aided by European tools, namely EQF and ECVET.

Through innovative VET development activities, informed by the major farmed fish producers in northern Europe, new innovative learning activities should try to catalyze a concerted effort between industry and the VET providers, to equip the workforce with the knowledge and skills required to farm fish safely, efficiently and responsibly.

The marine cage-based producer companies need access to a more flexible VET system to reduce the time staff spend attending courses and improve NQ attainment rates. Therefore, work-based learning systems need to be prepared or improved to better meet the needs of unqualified entrants, who often lack confidence. In addition, talented qualified husbandry operatives need a pathway to the higher VET level, to prepare them for progression to more demanding farm site manager roles.

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Concurrently, the industry leaders want to promote collaboration between farm sites within each company, as well as between companies, in realization that the biggest problems they face, require coordinated action at industry level, as exemplified by successful sea lice control in several regions of Norway. Therefore, the creation of a more flexible VET system, based on a framework of 'shared learning-outcomes', should support future learner mobility, consistent with the sector's vison for a collaborative culture based on knowledge exchange and continuous learning.

More specifically, on a technical level, the future work-based VET system should equip the more progressive members of the aquaculture workforce with a deeper knowledge of fish biology, health and welfare and the skills to operate sophisticated digital systems for fish stock management and feeding. The industry also seeks to convert some of its inhouse training (non-formal VET), to formal VET, that can be delivered and accredited by the public sector VET system.

This ambition closely reflects European policy directives for the development of VET as a 'first choice' and the conversion of non-formal VET, to quality assured formal VET within work-based apprenticeships. As it is industry led, the shared framework of learning outcomes should inform the updating of national NQs and ease future learner and VET staff exchange through Erasmus+. Aquaculture VET developments should be underpinned by an analysis of occupational profiles for fish husbandry operative and site manager levels and future proofed by technology supply companies, whereby ESCO can be reliably updated. Currently the definition of standards for the cage farming the most significant farmed fish production sector is deficient, and ESCO officials should welcome such an opportunity.

The VET providers should align their work-based NQ delivery systems and curriculum content to satisfy current industry needs, endorsed by the leading European farmed fish producers and technology supply companies. Aquaculture is of growing importance in all European countries, and as the workforce are widely dispersed, this necessitates the development of innovative systems for work-based learning and assessment which require time to develop, pilot and refine. The VET providers recognize that this is best achieved collaboratively, leading to the formation of formalized north European partnership of VET providers that can develop shared resources and pedagogy and can continue to support the industry following project completion, re-energizing their aquaculture VET portfolios.

Chapter 2: Digital and green skills

Modern marine cage-based production systems require the application of technology by effective farm teams in order to grow fish efficiently, to high welfare standards and with minimal environmental impact. Farmed fish production processes and aquatic environmental monitoring relay heavily on digital skills, including; data monitoring, analysis and reporting. Fish are observed by using cameras in the rearing environment, allowing feed distribution rates to be controlled remotely according to observed feed responses and fish health to be visually monitored. Consequently, digital skills are paramount and with the advent of remote operated vehicles within aquaculture, being developed to growing range of husbandry and farm maintenance operations, this trend is set to continue.

New work-based learning system should address digital skills in several ways. The generic digital competence of work-based learners could be developed through routine data entry tasks initially, before working with stock records and the assessment of fish growth and food conversion under instruction on-farm. This should progress to feeding with remote cameras and environmental monitoring and data analysis. The on-farm instruction and experience could be complemented by tutor supported introductory data handling activities, presented and supported online. In addition, learners should constantly consolidate their general 'digital confidence' through their active involvement with assessment evidence record keeping within the e-portfolio system and online learning.

Green skills must be integral to the sustainable aquaculture philosophy at the heart of new aquaculture work-based learning system. Core mandatory modules on the aquatic environment, fish biology, fish health and fish feeding and nutrition, should impart the knowledge and understanding for effective management of the farm operation to minimize food waste and environmental impact and maximize fish health and welfare. This could be delivered through tutor supported online and on-site learning and re-enforced by farm routines and practices when learners are in their workplace. The conservation of wild salmon could be addressed by including study trips salmon sport fisheries, to allow learners to explore and investigate the consequences of farmed salmon escapees and ineffective sea lice control.

When maximizing fish production efficiency and fish welfare whilst minimizing environmental impact through the application of advanced equipment and technologies, there are many factors to reconcile and daily practical problems to solve. This requires good team-work, leadership, communication, collaboration and problem-solving initiative. The industry has requested VET programs that place more emphasis on the development of transversal skills. This could be approached through practical problem-solving group tasks, some naturally occurring, and others simulated. The learners on-farm performance in these group learning situations could be observed by a supervisor responsible for providing feedback and assessment evidence for the above transversal competences that employers value so highly. Inclusion of an e-portfolio system should potentially encourage learner self-reflection on their transversal skills development, followed by employer validation and ultimately assessment by the tutor. On farm mentors, who are not the learners line managers/supervisors, and the program tutor should be available to advise and guide the learners' personal development.

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Chapter 3: Action plan for northern Europe

The needs analysis carried out by the BlueEDU partnership consulted stakeholders in 12 European countries marine cage farming to establish the skills gaps, VET supply deficiencies and future VET needs. Some good 'non-formal VET' was revealed by the larger producer companies who have sophisticated inhouse training schemes driven by legal compliance, consumer driven quality assurance systems and company Standard Operating Procedures (SOPs).

The action plan shall develop and pilot well-supported aquaculture work-based learning that dove-tails with inhouse training schemes (non-formal VET) to develop pathways to NQ attainment for unqualified operatives. The learners non-formal learning and competences must be recognized at the outset, and their development priorities defined. The target audience includes husbandry operatives who need training and a qualification and qualified operatives preparing to upgrade to a management role. The system behind an action plan should personalize delivery, driven by individual learning and assessment plans and supported by appropriate ICT and learning technologies.

The Aquaculture Skills Foresight Forum

Aquaculture technology supply companies should join the farmed fish producers and the VET providers to form an **Aquaculture Skills Foresight Forum (ASFF)** to develop common occupational standards (knowledge and skills) and a framework of shared learning outcomes, which can be updated annually thereafter, to inform future NQ revisions.

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roles. Through negotiation, the activities of the ASFF should support and dovetail with aquaculture standards development ongoing at national level. Subsequently, with the support of stakeholders from countries out-with the partnership, this may evolve into a wider European initiative to include southern and eastern European aquaculture occupational standards, making it easier for them to partner the north within future formal VET development initiatives.

With the active involvement of the technology supply companies, the ASFF should be sustained in order to anticipate future skills needs. Its remit should evolve to support and promote mobility (learners and skilled labor) fostering a culture of knowledge exchange facilitated by ECVET. The north European aquaculture VET provider network should help formalizing and continue to address future skills gaps as they emerge, leading to a more responsive VET system and widely respected NQs. The 'shared framework of learning outcomes' and prioritization of skills development by the ASFF, should drive the harmonization of the curriculum across the four partner countries, and keep the VET system current. To these ends, the shared development of learning resources, work-based learning pedagogy and tools will be sustained.

Partnership delivery teams should be formalized at company, national and European levels. National VET providers should provide development support to team leaders within producer companies responsible for mentoring, skills instruction and providing witness testimonies on learner competence. Robust self-evaluation informed by the collection and evaluation of feedback from learners, employers and VET practitioners, could underpin a cycle of continuous improvement. Learning and development should be supported by a range of on site and remote teaching practices, including; shared synchronous delivery by subject experts delivered by combining 'video-conference', 'e-learning', onsite training and real and simulated problem-solving activities, undertaken within a group learning context. This should help the development of important transversal skills requested by industry.

Work based learners should receive personalized support, initially based on an RPL reflecting a central premise of Erasmus+, the enhanced recognition and validation of their skills and qualifications. Learners should post assessment evidence within proven 'e-portfolio' assessment systems that are accessed by witness testimony providers and assessors, resulting in a robust and reliable continuous assessment process. Experienced unqualified staff should be encouraged to 'fast track' towards NQ completion and/or higher VET progression, cost effectively.

The improvements to accessibility, relevance and the quality of learning support should improve the confidence and attainment of work-based learners. The proportion of qualified husbandry operatives in the industry will increase in the partner countries, and qualified operatives should be better prepared to progress to management roles within a culture that promotes the integration of work-based learning with knowledge exchange and collective problem solving.

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Important components within a work-based innovative pedagogy

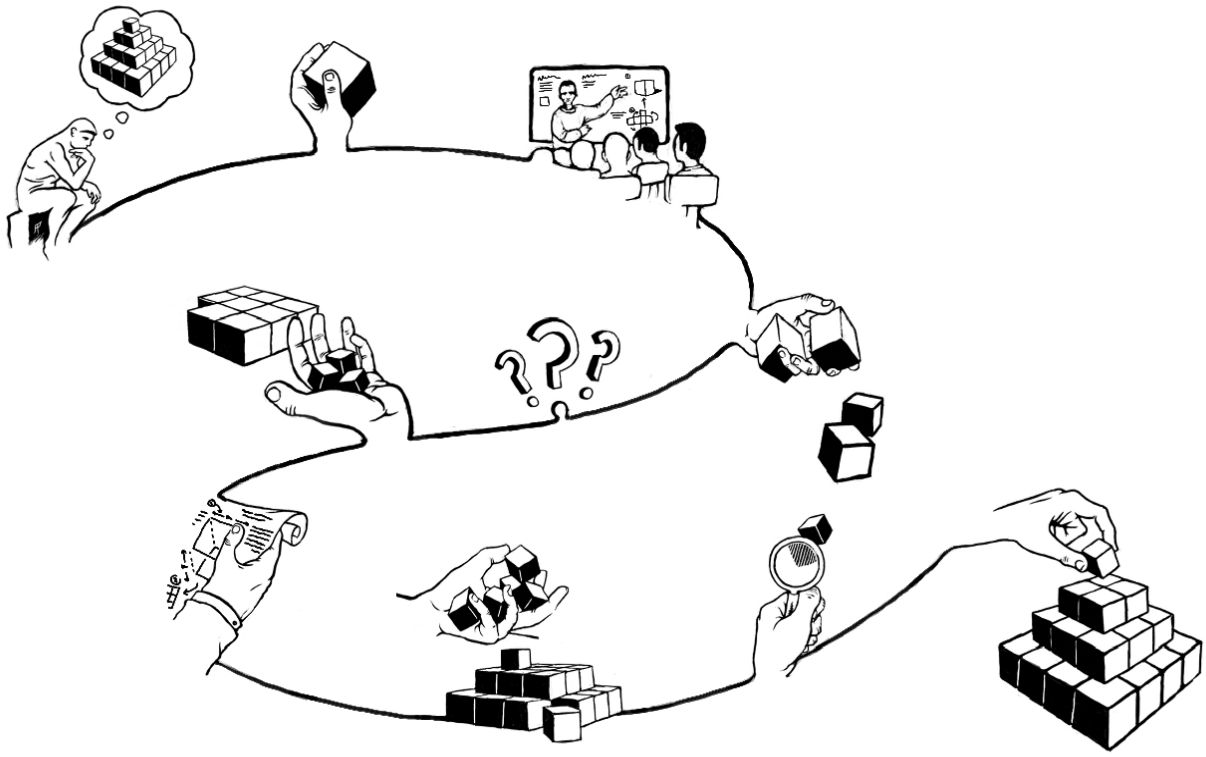

Figure 1: The action plan could apply the following proposed innovative and investigative aquaculture VET methodology for flexible delivery concepts of work-based training to farming industry in 5 north European countries offering marine cage farming.

Important components of this collaborative learning process should be:

- Specification of an aquaculture problem to challenge learners ("the pyramid"), delivered in the form of orders from a fish farming company or supplier industry to be completed to a deadline.
- Division of the process into subcomponents, arranged in an "industrial-like" production flow with episodes of theoretical learning immediately followed by application.
- Access to ICT and multimedia learning material, modern learning tools and/or interactive learning services that initiate a support discussion between learners.
- Quality assurance of the subcomponents or sub processes to ensure the specification in the order has been followed.
- Verification by farm personnel of whether the quality of the process, product or outcome is according to specifications in the order verify, before adoption.

Examples of processes, products and outcomes: Counting the number of sea-lice and reporting the results to the regulating bodies, preparing a plan for de-licing, carrying out de-licing etc.

The European dimension of aquaculture vocational education and training

Most north European farmed fish are reared in marine cage systems. Therefore, producers face the same challenges due to similarities in operations and the technology deployed, irrespective of the country. As the need for 'advanced training' in new technologies grows, a European response informed by a dialogue with the farming- and technology supply companies and agreed European occupational definitions, would be more effective than addressing common issues in isolation, nationally. (Erasmus+)

A more innovative aquaculture VET system, based on a shared framework of learning outcomes, can make Life Long Learning and qualifications more accessible to disparate learners in remote and often rural communities. The full range of skills and resources needed to support the level of VET innovation required are commonly unavailable within one organization, and therefore, the creation of a formal north European network of VET providers should overcome this constraint, enabling the pedagogy, learning resources and tools to develop more rapidly.

Catalyzed by shared development of resources and work-based learning pedagogy supportive informal practitioner networks should be formalized, accelerating the development of innovative, ICT enabled VET which can ultimately be shared through collaboration. (Erasmus+). Translation in to the appropriate languages would offer an open access VET resource base, enabling higher quality standards to be maintained through sustained collaboration. (Erasmus+)

Workforce development should have significant marketing benefits for aquaculture. The industry is led by multinational companies who own farms in Norway, Scotland, Iceland, The Faroes and Ireland. By professionalizing the European workforce based on agreed occupational definitions, a responsible attitude towards animal welfare, the environment, food safety and sustainable development can be achieved more convincingly. (Erasmus+). As fish consumers become increasingly discerning, those producers providing the highest levels of reassurance and certification should grow their share of the global market. In addition, production efficiencies will be improved making north European producers more competitive globally. Based on current labor productivity, each percentage point of current EU consumption produced internally through aquaculture would create between 3,000 and 4,000 full-time jobs (STECF-OWP-12-03). Although aquaculture is a relatively new industry within the EU economy, it has the potential to boost growth and jobs in vulnerable EU coastal and inland areas.

Such an action plan should provide clarity regarding key occupational definitions and qualification pathways that are accessible to unqualified work-based learners, helping them to prepare for aquaculture positions in Europe, promoting mobility (ET 2020). Consequently, the action plan will contribute to the achievement of 75% employment among the 20-64 years old age group, through improved mobility. (ET 2020).

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Finally, the methodology developed to define occupations for the key north European marine cage farmed species, could be replicated, leading to the development of a European wide occupational standards for the entire aquaculture industry, including the important 'non-salmonid' marine species hatchery sector.

Methodology for creating transnational cooperation

To date, there has been no attempt to create transnational cooperation or a coordinated strategy to address the growing aquaculture workforce development challenge in Europe. The creation of the Aquaculture Skills Foresight Forum (ASFF) will catalyze cooperation starting in northern Europe by establishing new networks of VET providers and aquaculture companies. In time this should extend to southern Europe, through dissemination during the latter stages of projects developing, testing, evaluating and implementing the action plan, enabling the VET sector to remain well informed by industry and responsive to their needs, beyond the life of the project.

The ASSF should include leading marine cage producer and technology supply companies in order to ensure that changes in aquaculture technology are anticipated and new skills requirement recognized and analyzed, to inform the VET sector. Through a formal affiliation between the ASFF and the European Aquaculture Society, industry and VET provider networks will interface with the aquaculture research community, to provide a new knowledge transfer opportunity from the research community to industry. This should lead to modifications to aquaculture practices, which aquaculture VET programs can reflect with minimal delay.

Assisted by the ASFF and their networks, VET providers should be able to design and promote opportunities for long duration mobility (minimum 6 months as requested by large farming providers) within their programs. This may be funded through subsequent bids to the Key Action 1 programme that will secure the resources to initiate mobility partnerships for learners and VET staff. To date, the industry's exchange activities have been restricted to senior managers only. By extending mobility to those students studying at a site manager and husbandry operative level, industry leaders should as a direct consequence help promoting a 'collective aquaculture problem solving' approach at the operational level. Active transnational networks should help and enable the shared vision of aquaculture VET staff and learner mobility to take root and grow. This should help supporting the 'knowledge exchange ethos' strongly advocated by industry and will involve the VET providers, enabling them to regularly up-date their VET programs and resources.

In addition, the action plan should encourage aquaculture VET providers in the partner countries to collaborate in order to develop digital resources within a shared managed learning environment (MLE), allowing them to communicate innovative VET delivery ideas and gather feedback from peers on porotype resources before piloting them with learners. During the piloting phase, learners should be able to access tutor inputs and support from a recognized subject expert from another country, as well as communicating between each other, within the MLE. A virtual aquaculture learning community couild evolve, initially supporting northern European work-based learners, but extending over time to include southern Europe. This may bolster the growing networks in northern Europe and the leading aquaculture companies' knowledge transfer agenda driven by the industry led ASFF.

Specific methodology

Establishing the Aquaculture Skills Foresight Forum - ASFF

The core membership should consist of representatives from major aquaculture companies and VET providers, to ensure a strong linkage between the ASFF remit and innovative VET development They could be joined and supported by a technology supply companies and ESCO representatives.

Develop common competence framework (CCF) for marine cage based farmed production

The CCF for aquaculture production should be developed for the husbandry operative and site manager levels for cage farming. The process should be led by a stakeholder experienced in the development of definitions (knowledge, skills and competences) for each occupational level.

Develop framework of shared learning outcomes (FSLOs)

Following agreement on the protocols to be adopted for describing learning outcomes (LOs), the FSLO should be developed with reference to the CCF for husbandry operative and site manager and EQF levelled to differentiate VET from higher VET. The VET providers should help mapping their existing NQs, LOs and curriculum to the FSLO, to establish the gaps.

Investigate and make up a map available learning resources

e-learning quality and technical standards must be established to ensure compatibility with each partners Managed Learning Environment. Available and compatible 'e-learning' content from different sources and stakehodler should be sourced and mapped to the FSLO.

Develop work-based learning (WBL) innovation pedagogy

VET providers must work in partnership with industry representatives on the ASFF to devise the WBL innovation pedagogy and develop their respective roles through WBL pilots, including; the use e-learning', practical skills development, learner support, 'e-portfolio' and the formal VET assessment process.

Aquaculture VET resource development

With reference to the mapping above, learning and assessment resources must be developed to address gaps. The resources should support a 'VET provider and employer partnership-based delivery model' to improve NQ completion by work-based learners.

The European Quality Framework (EQF)

The standard setting stage should address two EQF levels, the husbandry operative (EQF3) and the site manager (EQF4). The Framework of 'shared learning outcomes' (FSLO) should be EQF levelled and all outcomes aligned with the appropriate occupational level. Thereafter, learning resources, assessment systems and pedagogy should be developed and piloted for marine on-growing and freshwater hatchery husbandry operatives.

Whilst the industry common competence framework to be devised by industry may lead to some modification of the modular content, the following structure is anticipated: There should be 6 core mandatory modules that all EQF3 learners will need to undertake and a set of 7 modules (options strand) designed for the marine on-growing operatives containing and 6 modules for the freshwater hatchery operative. Modules should be composed of learning outcomes derived from the industry's 'common

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competence framework' (CCF) with a nominal 40- hours of learning and assessment activities per module, but flexible according to each learner's prior knowledge and experience, to determine the actual time allocated. The shared modules should be validated by a National Awarding Body responsible for certification.

Who are the sectoral stakeholders?

The stakeholders for the action plan fall in to two main categories; the aquaculture industry (producer and supply companies) and the VET sector (providers, regulators and agencies).

The **industry** stakeholders include both fish producer and technology supply companies providing advanced equipment and technology in all 5 north European countries marine cage farming salmon and trout. Both must be represented on the Aquaculture Skills Foresight Forum (ASFF), initially established to lead the development of the aquaculture Common Competence Framework (CCF). The technology supply companies will ensure the CCF embraces current advanced operator and digital skills for a wide range of farm equipment. Currently, as they train their customers at their own cost, they have a vested interest. An improved VET system would help them to improve the effectiveness and efficiency of their training service in the future, as better prepared learners will be more receptive to 'equipment specific' on-site training, to the benefit of all.

Some industry representative organizations, including national fish producer organizations and agencies have skills foresight responsibilities at national level. Therefore, stakeholders such as the UK Sector Skills Council (Lantra), Skills Development Scotland (SDS) and the Scottish Aquaculture Innovation Centre (SAIC), are well placed to support the development of current competences and dissemination to the wider industry.

The **VET sector stakeholders** have a strong interest in an action plan due to the impact on aquaculture VET and the potential for proven practices to support of VET systemic change. Stakeholders mst be chosen to support collaboration and dissemination to VET providers within each partner country and between countries, in support of the European drive for high quality, industry-relevant apprenticeships and work based learning systems. Due to the value placed on the recognition of informal learning and the individualization of learning plans, the inclusion of RPL/APL is of great interest to some agencies, including the Scottish Credit and Qualifications Framework (SCQF) team, who have an interest in developing more effective RPL/APL processes.

Some stakeholders could have a specific role in the action plan, as exemplified by the national VET Awarding Bodies responsible for the validation and revision of NQFs to meet industry needs. This includes the Scottish Qualifications Authority (SQA) and Quality and Qualifications Ireland (QQI) who are responsible for industry consultations during the imminent revisions of their NQFs. In Iceland, the aquaculture VET system is embryonic and emerging, whilst Norway are completing a national review of their system for work based NQF delivery and attainment. Consequently, in both countries the VET regulators and agencies have an interest in new findings and outputs, which could inform certain aspects of their ongoing VET systemic change.

European instruments and standards to build on

The action plan must fully contribute to key European educational innovative, exemplified by Open Educational Resources (OER), in order to meet the needs of 21st Century skills, thus addressing the objectives of the Opening Up Education initiative "Opening up Education: Innovative teaching and learning for all through new Technologies and Open Educational Resources" (European Commission 2013). The ways in which VET can be developed and delivered to increase European excellence and competitiveness should be explored, by opening up educational resources to the widest possible community of learners. The action plan must meet the strategic priorities set by the European Commission in developing OER within the context of the "Re-Thinking Education: Investing in skills for better socio-economic outcomes" initiative (European Commission, 2012) and more precisely by addressing:

- Priority 5: Scale up the use of ICT-supported learning and access to high quality OER that are directly linked to the development of the new LOs and the new aquaculture curriculum
- Priority 6: Revise and strengthen the professional profile of teaching professions as a result of training of VET practitioners (teachers and lecturers) and aquaculture company mentors and assessors to help them to adopt e-learning and assessment

Furthermore, the action plan must contribute to the further development of ESCO standards in the field of aquaculture. In their current form the ESCO standards for aquaculture are of limited value. During the initial standards development process for aquaculture, the production of farmed fish in cages received a 'light touch'. The technology for farmed fish production has evolved rapidly during the intervening period and the proposed Common Competence Framework (CCF) and the Frame work of Shared Learning Outcomes (FSLO) must provide a technically up to date definition of knowledge and skills for the salmon and trout cage rearing and the hatchery phases. This can then be incorporated within the ESCO standards, updating them and adding the depth and detail currently lacking.

The EQF should be applied by the VET providers when levelling the FSLO. It should be an essential tool for differentiating learning outcomes sitting at supervisory/management level from those at the operative level. Once complete, the EQF levelled outcomes should then be used to form coherent learning modules for inclusion within the programs. In the case of Scotland and Ireland, the Scottish Quality Authority (SQA) and Quality and Qualifications Ireland systems in operation nationally are already aligned to EQF levels which will allow the proposed CCF and FSLO to inform the imminent update of Scottish and Irish NQs. In the case of Iceland, the learning outcomes levelled at EQF3 (operative) should be abstracted to inform their new Apprenticeship framework which should adopt features of the Norwegian Apprenticeship model. To date, Norway have had a VET system geared to the preparation of work-based learners for a final theory and practical exam. However, the NQ system is under review in order to replace the need for 5 years of relevant experience with improved workplace-based training and only one year of experience from industry. The forthcoming Norwegian review process will provide valuable information to inform the changes expected nationally over the next 12-24 months. A continuous assessment process could be adopted, underpinned by EQF levelled learning outcomes shared within Iceland, Scotland, Ireland and The Faros. In summary, the application of EQF levelling should allow the common ground between the 5

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national systems to be maximized, which should ultimately pave the way to the establishment of ambitious long duration mobility programs.

Once the alignment and harmonization of learning outcomes described above is completed, there will be less need for ECVET processes, as the respective NQFs in the 5 partners countries will share many of the same learning outcomes. However, if this harmonization is delayed or less comprehensive than anticipated, ECVET processes should ensure that work-based learners and apprentices can have learning outcomes gained in the host country validated, recognized and transferred to the home NQ framework on return from a long duration mobility experience.

The mature quality assurance systems of Norway, Iceland, The Faors, Scotland and Ireland have been complied with by VET partners delivering aquaculture VET in the past and reflect the principles of quality assurance embedded within EQUAVET. The EQUAVET framework should be used as a benchmark, when evaluating the respective QA requirements of each national system during the preparatory stages.

Recognition and validation of knowledge, skills and competences

The proposed ASFF should develop a common competence framework (CCF) for marine cage-culture and hatchery operations at husbandry and site manager levels. At husbandry level this should inform the development of a 'Framework of Shared Learning Outcomes' (FSLOs), which should ensure consistency with each partners NQ framework. Collaborative links should be forged with all relevant national initiatives, including the review of the Scottish aquaculture 'occupational map' by the Scottish Aquaculture Industry Lead group (AILG 2030) and the imminent update of the NQ framework Level 5 in aquaculture in Ireland. A two-way communication flow should be established, for alignment between national and European standards as they evolve.

All work-based qualifications should be piloted and underpinned by the FSLO to inform the assessment strategy and processes applied by the 5 partner countries. This could open up to enable KA1 long duration mobility programs to be supported in the future. The proposed industry-VET delivery teams could include aquaculture company managers and supervisors. They could contribute with an essential role within the assessment of performance-based learning outcomes (LOs) directed by their VET provider partner responsible for managing the assessment (validation) and quality assurance process. They should be best placed to make judgements of competence in relation to the CCF, once they have received appropriate staff development. The VET providers should take direct responsibility for validating all knowledge based LOs, by applying the mature assessment processes available within their national VET systems. As Iceland and The Faroes will be initiating a formal aquaculture VET system, they will be assisted by VET practitioners from Norway to ensure that their new NQ aligns with the FSLO and follows the European principles of transparency.

Each VET provider participating should be involved in the development or revision of the work-based NQs framework, informed by information from the European CCF and FSLO created by the proposed action plan. In addition, the participating fish producer company members of the ASFF should also take part in

NQ framework revision and updating in their respective countries, ensuring consistency, as national reviews are industry led or informed

Since most learners on forthcoming pilot programs will be experienced husbandry operatives, processes for the recognition and accreditation of prior learning (RPL/APL) could be applied from the outset. The learners' informal and non-formal learning should be validated, in addition to recognizing and recording their existing skills and competences within an e-portfolio. The CCF and FSLO should provide the standards against which validation decisions are made by qualified assessors in the short term. This be displaced in time by the ultimately the NQs framework in each country as they are revised and created, in Iceland's and The Faroes case. Subsequent learning and assessment should be tailored towards meeting individual needs, targeting the knowledge and skills gaps revealed by RPL/APL

During the work-based learning pilots the learners should be given a voice within the evaluation of delivery. Their formal feedback should be gathered through on-line surveys and interviews to capture their deeper insights, integral to the internal evaluation process in forthcoming projects. Such a biannual process should ensure that learners are providing formal feedback frequently for their VET providers to respond to. This should impact positively on the quality of their learning experience.

Expected impact on stakeholders

The **future work-based learners** will have access to a well-supported VET pathway and NQ attainment. The delivery system, founded on the RPL/APL to recognize and accredit their existing skills and knowledge will provide many the confidence they need to enter formal VET, and succeed. Well-structured individualized learning plans and learner support that reflect company SOPs, will build familiarity, helping them to gain a sense of rapid progress, culminating in their NQ attainment and career progression. Future learners will have the opportunity to join long duration mobility programs facilitated by harmonized NQs in the partners countries and the drive for knowledge exchange by their company leaders. Their learning experience and European career opportunities will be enhanced as a result of the opportunity to gain NQs that are known and respected by the leading farmed fish producers.

The **VET providers** will have a higher quality work-based learning system to work within, underpinned by current NQs and **i**mproved VET partnership delivery teams. Selected industry managers and supervisors will have an important role within the learning support and assessment process. VET practitioners will have continued access to high quality, up to date aquaculture learning and assessment resources which are currently deficient or completely lacking for some topics, and the opportunity to exchange good practice within a growing community of European peers. Due to the closer partnership with industry and their encouragement of unqualified staff to embark on a well-supported NQs pathway, their work-based learning delivery and business will grow.

The **farming industry** will have a more highly qualified and technically competent workforce. Consequently, they will be well-motivated and as a direct result of their learning experience, better able to work collaboratively with peers within their company, and with other companies. Having gained important, technical and transversal skill, including; communication, team work and problem-solving, they

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will be better equipped to address those aquaculture problems currently vexing the industry, more collaboratively. In addition, their inhouse staff development schemes (non- formal VET) will be bolstered by the introduction of well contextualized learning resources and e-portfolio assessment processes that can gather evidence towards NQ attainment efficiently, fast tracking those with skills and knowledge previously gained informally. With guidance and support from their VET provider, a lot of non-formal VET arising from uncertificated -inhouse training will be recognized and validated. Following some modest refinements and the formalization of assessment processes, inhouse training schemes will become an integral part of a formal VET pathway that culminates in NQ attainment.

The Common Competence Framework (CCF) underpinning national NQ revisions, will lead to the harmonization of NQs. This will have a major positive impact on the aquaculture sector nationally and throughout northern Europe, by generating a better understanding of the value quality assured qualifications, leading to increased confidence in the north European workforce's knowledge and skills. The ability of farming companies to apply common competences to solve real problems and conflicts collectively, will be fundamental to maintaining the industry's 'social license' to operate and keeping the trust of its consumers.

Sustainability of work-based learning delivery

The VET providers in each country must sustain and grow the delivery of work-based learning and NQs within their national markets, accessing whatever public sector funds are available, complemented by fees, and/or private sector contributions. This will enable the providers to recruit aquaculture VET staff to keep pace with the demand for work-based learning, as well as learning technologists required to maintain and develop the shared MLE resources. The dynamic north European learning community established during the ASFF, will generate momentum and continue under the leadership of the VET providers post project. VET providers will become dependent on improvements to their national work-based delivery models and European peer support. The benefits will include; the deployment of shared learning resources, lecture inputs by subject experts via 'on line conferencing' and international peer learning activities.

Ongoing cooperation will be further consolidated through the advent the north European long duration mobility programs, advocated by the leading farmed fish producer companies. Consequently, the relationship between European aquaculture VET providers, initially founded on a shared work-based learning delivery system and resources, will be strengthened and sustained through subsequent staff and learner KA1 mobility programs and knowledge exchange.

An 'exchange system' must be investigated and established to allow VET provider associated members to access and download quality assured learning resources, equivalent to their annual contribution. This will incentivize the continuation of collaborative development of digital learning resources and pedagogical good practice sharing. Industry must make financial contributions based on a levy system, with contributions that are proportionate to the benefits received, using measures that corelate with the volume of VET activity that they access.

Finally, the drive for collective problem solving advocated by industry leaders will synergy the learning culture, including the application of investigative learning targeting real aquaculture problems. Therefore, once the pilots have proven these benefits, their continuation at national and international level will be perceived as essential by stakeholders. This will accelerate industry development as 'high-tech', environmentally responsible food producing sector, that is driven by a resourceful, qualified and professional workforce.

Links towards other sectoral initiatives

There are several north European aquaculture workforce development initiatives offering collaborative opportunities and synergies.

In **Norway** a review of the national work-based system and NQ pathways for those in work, but unqualified, has begun. The current delivery model is restrictive, as staff need 5 years of experience to qualify, and alternative ways to hasten learners' progress to the final exams are being evaluated. The reliance on continuous assessment and effective RPL/APL systems that allow learning to be tailored to individual needs may increase, hence the relevance of action plan to VET policy makers.

In **Scotland** the Scottish Aquaculture Industry Lead Group (ILG 2030) established by government in 2017 have committed to update the Scottish 'aquaculture occupational map' which will lead to a subsequent review of the NQs framework. This work mujstparallel the creation of the CCF, under the auspices of the ASFF, providing the opportunity for collaboration and formal linkage between the two representative groups.

In **Iceland** there has been a concerted industry driven effort in 2018 to establish aquaculture VET, influenced by the Norwegian VET system. This had stalled, however, as a result of aquaculture growth plans and Norwegian investment in the Icelandic industry discussions have restarted and, in the spring of 2019, the industry and VET sector plan about to establish a committee to oversee aquaculture VET development, which should converge with the ASFF.

In **Ireland** the QQI level 5 in Aquaculture is due for review and there is great interest in the inclusion of a traineeship pathway. This is partly as a result of demand being generated by the significant new community partnership initiative emerging on the west coast called the "Marine Park".

National roll outs of results

Selected Associated Partners, industry associates and stakeholders will be instrumental in national roll outs, building on dissemination and piloting of results through projects. The approach taken will vary according to; the scale of the industry and VET sector, the balance between VET regional autonomy and national control and the strength of demand for aquaculture work-based apprenticeships and NQs framework, generated during an expected piloting period.

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In **Norway**, the aquaculture teaching staff of the 14 Upper Secondary Schools delivering aquaculture NQs meet annually, providing an ideal opportunity for 'roll out' to more northerly regions providing work-based learning. Dissemination activities must build on their interest in collaboration expressed during BlueEDU VET research. The opportunity to improve to their work-based learning pedagogy and access to current learning resources must be promoted, fostering collaboration between the autonomous Norwegian counties to service the growing VET demand nationally.

In **Iceland** the industry is relatively small, but expected to grow rapidly, generating a strong demand for aquaculture VET. Regional study centers must be enrolled in those specific regions designated for aquaculture development, to provide a 'hub' for VET delivery to the local fish farm staff. The Icelandic Fishery School in Grindavik must facilitate the roll out of aquaculture VET resources and pedagogy, promoting a proven blended learning pedagogy and by developing VET staff designated to support delivery at each hub. Conferencing technology will be deployed for some knowledge delivery and aquaculture short courses provided by the Fishery School, in partnership with each regional center to service the growing demand.

In **Ireland** Marine Harvest (MH) and the ETBs (Galway and Roscommon) must team up with the appropriate ETB branch in each of several fish producing regions. This will enable the proven blended delivery model to be rolled out to the more remote farm sites, promoting access to unqualified staff, employed by MH and small family owned salmon farms with 25-40 personnel. This modest expansion will generate the demand necessary to sustain delivery by the ETB nationally of a new apprenticeship (known as a Traineeship in Ireland).

In **Scotland** through their national reach and influence, the Scottish Rural College - SRUC are uniquely placed (in the south, middle and east at the Scottish mainland) to promote the revised work-based learning system that dovetails with established company staff development programs, to create new formal VET pathways that can improve the attainment of aquaculture NQs. This must be undertaken in partnership with the University for the Highlands and Islands (UHI) who have a strong aquaculture apprenticeship legacy in the north of Scotland (Inverness) and are keen to improve effectiveness, efficiency and uptake.

Appendix 1: Detailed overview of aquaculture VET needs in northern Europe

Figure 2. Aquaculture VET and higher aquaculture VET needs in northern Europe.

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Appendix 2: Detailed overview of harmonized aquaculture VET in northern Europe

Figure 3. Harmonization of aquaculture VET needs in northern Europe.

Chapter 4: Progression in aquaculture VET in southern Europe

Background

The industrial Sea Bass and Sea Bream farmed production is located widely across the Mediterranean Seas, including many remote and isolated islands. Most operators try to recruit husbandry staff from local areas, with few qualifications in fish farming skills but enjoying some seafaring expertise and a willingness to learn new occupational competences. But whatever the level of 'general' competence in recruits and staff, there is a recognition by industry managers/owners that the skills situation is sub-optimal. Typically, for many staff, a willingness to work in isolated locations and to work under pressure was identified as a major 'qualification'. Awareness of national qualifications or of providers of qualifications at a vocational level, are limited. The typical 'qualifications' mentioned are generic skills such as boat handling, crane operation, equipment. However, there is an emphasis on the 'on the job' training from the supervision and guidance from site managers to recruits.

Occupational profiles for operatives and site managers are generally in place, relating to company standard operating procedures as defined in in-house manuals, including HACCP handbooks. Support for the development of a current and updated portfolio of aquaculture national occupational standards was endorsed, while recognizing that the designing of in-house training with reference to company SOPs had been effective in driving staff compliance and consistency.

Workplace-based training – 'face to face' – is a standard approach, supplemented by specialist courses provided by external providers. However, neither appear to be formally certificated and do not appear to include a formal assessment process. Successful completion of in-house and external courses, however measured, appears to generally affect payment grades and career progression.

Husbandry skills identified as competences which were most needed to be improved included health and safety, fish feeding, fish health management, equipment maintenance and digital competences, fish harvesting and processing.

Supervisor feedback on work performance alongside formal on-site provider and manufacturer training was noted as preferred learning styles. Apprenticeships appear not to be recognized as a training route.

Partnerships that start implementing the proposed action plan for northern Europe, should try to seek to establish contacts with counterparts in the south and east of Europe to explore collaboration. The implementation of a framework for formal aquaculture VET qualifications in the Mediterranean region, aligned with current European concepts of accreditation and delivery, is a BlueEDU research recommendation to the European Commission. A major drive to encourage a multilateral meeting of stakeholders in the Mediterranean arena is a proposed priority. It could include industry, The National Organization for the Certification of Qualifications and Vocational Guidance (EOPPEP) in Greece (the 4th largest production country in Europe) and private and public VET schools and colleges and universities involved in marine VET. Enhanced by the participation of European aquaculture VET experts and Commission representatives, the key stakeholders would be advised regarding the optimal way forward, and avenues to avoid, based on the experience of other countries.

To date, there has been limited development of formal VET in the south and east of Europe to reflect industry requirements for an upskilled workforce that would enable the Sea bass/Sea bream sector to survive in a highly competitive marketplace. The emergence of an industry-led initiative to create a shared

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NQs should be welcome, and if adopted by governmental regulators and the established (public and private) VET providers, this could become a major game changer that attracted EU funding support.

To directly apply results from forthcoming pilots in the north to the industry and VET sector across southern and eastern Europe will be challenging due to differences in scale of the industry and VET legacy. The national industry representative organizations - FGM in Greece, Apromar in Spain, API in Italy and CIPA in France should be consulted to gauge their interest in future collaboration with the north. In response to needs in the Mediterranean region, project results from the north of Europe should be shared with national aquaculture representatives, to:

- Identify major Sea bass/Sea bream producer companies with cross-border operations and an interest in VET development.

- Convene a European level meeting of interested parties to establish the level of company interest in collaboration with European partners in the north to help formalize aquaculture work-based VET systems.

- Identify VET providers in the south/Mediterranean interested in partnering receptive providers in the north for specific collaborative development work and/or staff/learner mobility exchanges.

To these ends, an action plan partnership should start by developing an informal relationship with the most significant south European aquaculture VET projects currently, including:

- The Federation of Greek Mariculture FGM in Greece and the colleges being approved as certifying bodies for work-based qualification and the accreditation of instructors and teachers to deliver Diplomas on a large scale to the Greek Sea bass/bream sector

- The Larnaka based initiative in the realm of the 'Blue Economy', with strategic objectives of transforming the city into a regional center in 'Education, Training and Research'.

- The 'Blue Career Centre of the Eastern Mediterranean & Black Sea' at the University of Cyprus providing prospects for young jobseekers to support businesses in finding the right staff with proper qualifications for the blue sector. E-learning courses are planned for maritime sector (cruise tourism), for offshore oil and gas sector, marine aquaculture and for fish tourism and echo tourism).

Recommendations for the Mediterranean area

The essential framework for putting in place a rational, efficient, national framework of aquaculture VET qualifications, aligned with current European concepts of accreditation and delivery, appears to be in place. However, there has been limited development of actual VET courses that reflect industry requirements for the delivery of an upskilled workforce to enable the Sea bass/Sea bream production sector to survive in the highly competitive marketplace of the Mediterranean.
The emergence of an industry-led initiative to create a national set of qualifications (supported by EU funding) is a welcome initiative, which – if responded to by the governmental regulators and the established (public and private) VET providers – could be a major game changer.

Multilateral meetings at national level

There should be a major drive to encourage a multilateral meeting of all stakeholders in the VET arena – industry, national regulating bodies, providers (private and public colleges and universities) already involved in marine VET – enhanced by participation of European aquaculture VET experts and Commission representatives

This would provide in depth expertise to advise the national stakeholders of the optimal way forward, based on experience in other nations, and to clearly identify activities or avenues of effort which should be avoided.

Such a colloquium/conference/symposium would also raise the level of transparency of a potential collaborative 'way forward', and with public commitments to actions, would avoid the historical lack of 'sustainability' of EU funded projects – following completion the impact of many projects has simply evaporated. This has left the industry in an unchanged situation with lack of expert staff, absence of career development pathways, inability to implement research findings and technical advances from elsewhere in the European aquaculture industry.

Larger farming industry companies

The second potential game changer at this point in time is the commercial restructuring of the three largest Sea bass/Sea bream production companies into a single organization in Greece. If this new dominating corporate entity can be encouraged to prioritize training for its workforce then there would be a major stimulus for the provision of modern workplace-based VET, supported by theoretical classroom instruction.

Recognition/accreditation by public sector regulators (in particular EOPPEP) of industry defined courses and qualifications (diplomas, etc.) would raise the labor market value of VET activities across the board and stimulate further investment by both providers and industry. International collaboration would be an additional encouragement for the transformation of the upskilling of the Greek aquaculture workforce.

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