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*Fostering growth in the Blue Economy by developing an action plan for Innovative European Aquaculture VET and harmonized qualifications*

# D6.1 Qualitative analysis of aquaculture industry skill gaps and VET needs
# D6.2 European salmon farming industry's VET needs
# D6.3 An analysis of the European aquaculture industry's VET needs

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## WP 6 Industry needs & VET demand

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# Summary

The country specific results are collected in this report. In the south of Europe aquaculture VET programs leading to national qualifications are weak or don't exist at all. In the north of Europe, Norway and Scotland are the only countries that have aquaculture VET programs that are operative. The programs are different, but both lead to a national qualification at level EQF 4 and 3. North of Europe may support developments of aquaculture VET in the south of Europe if they are initiated by organization's in the south.

The variation between the countries are huge, so huge that it is not much sense in start comparing the countries. Due to this D6.1, D6.2 and D6.3 have been merged together in one report. Cyprus, Greece, Croatia, the Faroes, Finland and to some extent Italy don't have any aquaculture VET system that leads to a national qualification pathway. In Spain there is an operative system available at regional level in autonomous regions. Ireland and Iceland are trying to establish an aquaculture VET system based up on the apprenticeship model. The modern apprenticeship system in Scotland is based up on a combination of e-learning courses and work-based learning where all the practical training is provided by companies alone. Students cannot get any training without having a job, and they may only get work-based training inside the company they are working. The later reduces the possibilities the staff to get a new job in another company. In Norway there is a wide geographical network consisting of 14 aquaculture schools offering work-based training. Approximately 50% of those schools offer onsite based training courses to staff from industry. There is very limited usage of e-learning in aquaculture VET in Norway.

The analysis of skills needs and demand for VET are thus organized in descriptions of the country specific needs including recommendations for how to proceed with development of aquaculture VET. In addition, 17 videos have been produced to highlight the main findings for Norway, Scotland, Iceland and Ireland. Industry consider e-learning to be "positive" in the sense that it may reduce costs and create additional flexibility. However, there is few, if no at all, reflections around how appropriate it is and how well it actually may work out in a pathway leading to a wide and basic national qualification. The only option for a 16-17-year-old person in Scotland is to study and learn the aquaculture theory as an individualized training activity occurring on and through a computer screen. There isn't for instance any social interaction or networking with other students.

## Work-based learning in a blended delivery format

In 10 countries, except for Norway and Scotland, the number of employees in the farming industry are relatively low. They are in addition spread out in large rural areas in the costal zones. This makes it challenging to set up a sustainable aquaculture VET system without making up a partnership between the regulating bodies, the potential organizations that may offer aquaculture VET and the farming companies itself. The European Aquaculture Federation FEAP, representing the national farming associations in 22 countries, has only 2 persons employed in permanent positions. They are too small to have any significant role in aquaculture VET development, which must be done together and by directly engaging the big industrial farming companies that have access to human as well as financial resources. The companies in Norway and at Iceland highlight how importance work-based learning is and consider 6 months to be an absolute minimum to get relevant practice. The training periods must be so long that students may take part in an operation out at the farms several times. That is the only way to learn sophisticated operations. The format of the training must reflect that both industry and the training bodies are operating in rural areas where islands, mountains, fjords and mountains may

create challenges, whereby mixtures of blended learning delivery formats combining on-sit training in class rooms, e-learning to offer improved flexibility and synchronous based video training to handle the geographical challenges, are appropriate.

### Industry-VET provider partnerships

In all 12 countries are the aquaculture VET schools' small organizations. They will employ just a few aquaculture teachers. The largest one, IGAFA in Spain, employees 12 aquaculture teachers. Many schools have less than 4-5 aquaculture VET teachers. At Iceland there is one aquaculture teacher! If those schools shall take part in pilot projects with national or international funding, there is challenging for the schools to replace a teacher. The schools are located in rural areas to and it will often take long time to recruit a teacher. However, industry does not report that the aquaculture schools partner up with them in order to get help with teaching during periods with projects.

### Marine cage-based farming industry in the north of Europe

Programs for exchange of staff and students during training activities are considered to be important by farming industry. In the north of Europe almost all the industry is positive with respect to sharing information and learning from each other. Industry indeed encourage aquaculture VET schools to try to apply training methods that stimulate and increase the cooperation between companies and between farms. Those that don't share will do to many errors and start losing a lot of money during the international competition. In the south of Europe, however, the situation is nearly the opposite. The willingness to learn from each other and share information is limited or not existing at all. Many companies are not willing to spend money on education and training of an employee, if that person may increase his/her competence and skills and indeed get a new job in another, competing farming company. Thus, projects that is going to develop aquaculture VET in the future must due to this observation, be organized in different ways in the north and south of Europe.

The best way to develop aquaculture VET is through development of apprenticeship-based models and systems applying work-based learning. Farming company's direct involvement is crucial here due to

- Keeping the aquaculture VET studies updated with industry technical developments
- Let key personnel help schools during training activities and work-based learning
- Organizer internships and apprenticeship for staff in collaboration with their studies
- Engage and government officials to put aquaculture education on the agenda and organize a pathway leading to an approved and recognized national qualifications (NQs)
- Connecting education across borders and contribute to the harmonization of an NQ in North Europe.
- Start applying for mobility grants to exchange students and staff between farming industry companies in Northern Europe.

Aquaculture VET offered in Norway and Iceland targets both husbandry operatives and site manager positions, equivalent to EQF 4 – 4,5. After a period of work, the best staff will be recruited into positions as site managers. In Scotland, they have separate programs for husbandry operatives, EQF 3, and site managers.

## Marine cage-based farming industry in the south of Europe

There has been limited development of 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.

The priority recommendation to the European Commission is that there should be a major drive to encourage a multilateral meeting of all stakeholders in the Greek VET arena – industry, EOPPEP, 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 stakeholders in the Mediterranean countires 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, leaving the industry in an unchanged situation. This includes for instance lack of expert staff, absence of career development pathways, inability to implement research findings and technical advances from elsewhere in the European aquaculture industry.

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 – 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, to be supported by theoretical classroom instruction.

Recognition/accreditation by public sector regulators, for instance 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.

# Table of Contents

## Table of figures

## Norway BlueEDU aquaculture industry results

BlueEDU is an Erasmus Plus Sector Skills Alliance LOT 1 Project (2016-2019), which aims at fostering growth in the Blue Economy by developing an action plan for Innovative European Aquaculture VET and harmonized qualifications. A demonstration action, in combination with a group interview and a survey, were developed to evaluate the opinions of managers leading 520 workers in fish farming industry in Mid-Norway.

NTNU and the Guri Kunna VET school have collected and gathered information from a representative group of regional mangers within the aquaculture industry in Mid-Norway. The purpose was to investigate and document the situation regarding workforce qualifications and skills and their influence on recruitment issues.

This Norway report summarizes the opinion survey results based up on the analysis of data gathered during 5 meetings with 3 large and one medium sized fish farming company. Each meeting was at maximum 60 minutes long. The data were collected by applying the one2act EVAL tool and targeted both farming and processing managers. The goal was to collect data that had a high response rate, but without spending too many hours on collecting the data. By investing up to 5 hours with work (one hour per meeting), it was possible to collect data and feedback from 100% of the group for more than 40 questions. The results are presented in 34 graphs (figures) that are grouped together in five main areas:

Area 1. Company basic information
Area 2. The company's competence composition
Area 3. The company's recruitment needs
Area 4. The company's future need for new competence
Area 5. Conditions: locally - nationally - internationally

Within area 2, our results show that the managers consider skills like work quality, business orientation, proactivity, collaboration and independence to be more important than learning (figure 2). This shows that aquaculture VET programs are important, but still not at the top of the list of work force skills that the fish farming industry must deal with on a daily basis.

Within area 3, our results help identifying key challenges for rural areas in the costal zone, though this type of data is not directly linked to how to organize aquaculture VET courses. Our results show that there is a significant shortage of workforce within the aquaculture industry today. This is a consequence of the fast expansion in the aquaculture industry during the recent years, whereby it has been necessary to recruit many more people to work in the fish-farming sector. Indeed, capacity building must support modern aquaculture VET programs in order to catch up and provide aquaculture qualifications to those who lack them. Our data shows that lack of access to aquaculture VET courses is considered to be a relatively small challenge by the fish farming companies today. Skills based up on own work experiences is still supposed to be important during the next upcoming years in the fish farming industry, though this may change fast due to technological developments and grow of industry that require a higher degree of specialization of the work force.

During the next five years the Guri Kunna aquaculture VET school is expected to educate 200 persons that have got national recognized qualifications within aquaculture. During the same period 109 people will retire from the fish farming industry, 53 within processing and 56 within farming. It take 4

years to educate a person with appropriate aquaculture qualifications, whereby there will be lag in the public educational system when the industry grows fast.

50% of the managers don't know what the potential consequences of unmet need for skills in their company will be. 1 out of 5 company managers' replies that the shortage of employees with aquaculture qualifications will hinder or reduce the expansion of the production and processing capacities in their company.

Within area 4, the managers report that 53% of the aquaculture industry applies the apprenticeship system as their most important strategy for recruitment of a workforce that has got their aquaculture qualifications. 1 out of 3 companies (34%) prefer to outsource work operations as their second most important strategy. This is even more important than raising the competence of their employees (29%) such that they get documented aquaculture qualifications, or hiring new employees (27%).

To recruit new staff through the apprenticeship system is considered to be an easy and safe operation. Outsourcing is today a well-known strategy within the farming companies, which prefer to specialize on increasing their production of farmed salmon and trout. They apply it on many work operations, whereby it seems to be applicable as their second most important "recruitment strategy", when they lack personnel with qualifications.

To raise the competence of their staff through aquaculture VET programs is the third most important strategy for recruitment of personnel with aquaculture qualifications. The importance of this strategy is at the same level as hiring new personnel.

The two most important types of vocational education and training programs are aquaculture, which is part of the "agriculture, fishing and forestry" program (selected by 66% of the managers), and the "technical and industrial production" program selected by 49% of the managers.

For short time training activities, are internal courses and training an important mean of increasing the competence of the workforce as selected by over half of the managers. Experienced staff will support and train the staff that has less experience.

VET courses offered to industry that leads to national recognized qualifications, have a strong position in the industry market in Norway. More than 75% of the managers report that their companies to a large degree support long-term training leading to a national recognized journeyman certificate. It provides a wide scope of basic set of skills on which companies can rely for a broad range of their working activities. Candidates that have got this journeyman aquaculture certificate may work in several types of work operations and activities within the fish farms, making them attractive for companies where the activities to some extent follow the season.

1 out of 3 companies make up arrangement at the company level such that their staff may take a journeyman certificate when they are in full job. The rest of the companies claim that they do it to some degree. The companies want their staff to study to a journeyman certificate as an integrated part of their job.

75% of the managers report that courses addressing "Technical subjects with a continuous applied and integrated practice" are the most important ones. This reflects the needs in an industry characterized by fast technological developments. This is followed by courses leading to a

“management, organization and cultural understanding” as the second most important area, selected by 46% of the managers, reflecting that the industry has become an international actor. 34% of the managers report that the digital skills of the employees should be enhanced, which is consistent with the number of managers indicating that digital skills are important (section 2.7.). The reason is that ICT is applied to control and operate a lot of the fish farming equipment and operations. 27% of the managers mention that language training is important. The working language inside the companies is Norwegian, whereby the foreign staff needs to get trained to speak and read that language.

Our results shows that the fish farming industry is much stronger on carrying out applied research tasks compared to setting up long term research programs involving PhD students from universities. 48% of the companies mention that they collaborate with other fish farming companies in order to carry out developments, despite that they are competitors on the same market when selling their fish.

Thus, the in company development in fish farming industry in Mid-Norway is driven by strong collaboration between companies and the research environment. The companies choose to collaborate with each other even though they are competing on the same market when selling their products. In addition they support the aquaculture VET schools by offering students access to practice and training involving modern equipment.

Within area 5, there is an overwhelming agreement that both each company and the fish farming industry sector will be influenced by external changes during the next 3 to 5 years. Our data shows that that the managers perceive that the company will be influenced by new technology to a larger extent than the fish farming industry itself. However, they perceive the opposite with respect to new legislation and regulations. That is, a smaller number of managers believe that legislation is a factor of change in company than the industry.

## Method

In this study the Guri Kunna VET schools conducted group interviews and collected data from 41 managers that lead 520 staff in the aquaculture industry. In the fish farming companies respondents were site managers, while in the processing companies they were production line managers.

There are five main areas targeted by the questions in the study:

Area 1. Company basic information
Area 2. The company's competence composition
Area 3. The company's recruitment needs
Area 4. The company's future need for new competence
Area 5. Conditions: locally - nationally - internationally

The following companies have participated in the survey: Salmar, Lerøy Midt, Måsøval Fiskeoppdrett and Marine Harvest.

Collecting basic information about the companies has been attempted by sending an e-form by email to senior executives for the fish farming company (area 1). Unfortunately, to collect this information with this method did not work for the fish farming companies as the response rate become too low.

In the other four main areas (number 2 to number 5), the data has been gathered by using one2act Eval[1], an immediate response system, which has been developed by Norwegian University of Science and Technology (NTNU)

In "conventional" surveys, it is common for questions to be sent asked via email or phone. Other methods include one to one interviews and online survey systems such as Lime Survey[2], SurveyMonkey[3], QuestBack[4] or other similar systems.

The background to our methodology is that none of these methods are hassle-free in terms of efficiency, participation and "accuracy" in the surveys, and here are several issues one should note:

- There is no guarantee that relevant subjects will be reached using the usual methodology for such investigations.
- The relevant subjects might not answer.
- An online survey may potentially reach a large number of respondents, but experience shows that it requires a lot of motivational activity and marketing to get a sufficient number of responses.

In our survey, we have collaborated with the largest actors in the Mind-Norway region. We have selected to combine group interviews together with immediate response technology in order to mitigate several of the shortcomings of the other methods. These group interviews are conducted at one of the company's regular meeting arenas and the target group has been middle managers in the companies that then respond to the survey based on their knowledge of competence among their subordinates. Central to our method is that we conduct dialogue with the group before and immediately after the answer itself. Each group interview includeing the colelction of data, lasted up to 60 minutes. Our theory is that one will then have a greater opportunity to uncover and correct misunderstandings and differences in interpretation of the questions. It may also be that the answers to the questions reveal the need for additional questions, and this is also possible with this method.

## One2act EVAL System

One2act EVAL is a quick evaluation system that uses respondents' own internet enabled devices (smartphones, tablets, laptops and other standard web browsing capable devices) to respond to surveys and evaluation questionnaires. The system was designed to be used in educational settings but it is quite generic and the application scope is much larger. In a typical scenario, the presenter uses EVAL teacher client to define the questions, control various aspects of the response collection and to access the results while the respondents use a web app to connect to the service and reply to the answers posed by the teacher. In the current version there are three types of supported questions: multiple choice questions which may or may not have a specified correct answer, rating or Likert questions with scales from two to seven alternatives and open text questions.

Each evaluation or survey questionnaire gets a session code upon uploading onto the server. The session code is used to allow the students to easily connect to the set of questions desired.

[1] www.one2act.no
[2] www.limesurvey.org
[3] www.surveymonkey.com
[4] www.questback.com

The answers are immediately aggregated making possible instant feedback and discussion based on the responses. Thus the presenter can dismiss misunderstandings and misconceptions very early on one hand and on the other she can adapt the discussion according to the feedback from the respondents.

Depending on the situation it is possible to run a re-vote on several questions or ask additional ad-hoc questions.

EVAL is part of one2act response technology services. At the core of the system there is a server that hosts the central database and provides the interfaces suitable for specific use-cases. The server communicates with the clients using REST interfaces.

In Figure 1 are depicted screenshots from the user interfaces of both the teacher and the student clients of the EVAL system.

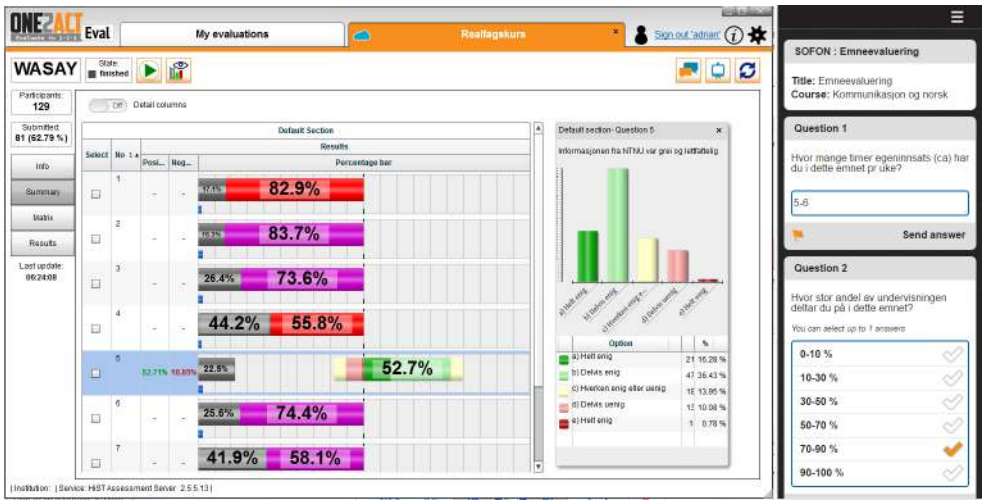


Figure 1: Eval user interfaces: teacher client (left) and student client (right)

## One2act EVAL teacher client

The presenter can use the EVAL software to create, control and monitor sessions. Each session has associated a set of questions that can be of various types.

EVAL teacher client is an application developed in Flex and ActionScript and it runs on the Adobe Air runtime. The application provides several perspectives that are suitable for the typical tasks of the user.

Among the perspectives provided by the user interface there are:

- Session management perspective – allows the user to manage and control multiple sessions
- Editor perspective – allows the creation and uploading of the questionnaires
- Monitoring perspective – allows the teacher to see the results as soon as they are sent by the students
- Presenter perspective – facilitates discussion with the students about the results through visualizations that are suitable to be displayed to all participants.

### The one2act student client

The student client is a web app written in HTML and JavaScript that communicates via Ajax with the REST API provided by the server. The one2act student client is compatible with all modern browsers that consistently make use of current web standards.

Using the one2act web app, the respondents can join sessions that were prepared by the presenter and respond to the questions. If the presenter allows it, they can choose to participate anonymously.

## Area 2: The Company's Competence Composition

The second area of questioning dealt with the company competence profile and the skills of the workforce.

The set of questions refers to 20 skills and they have been grouped in 8 categories:

2.1. Work quality
2.2. Business orientation
2.3. Proactivity
2.4. Collaboration
2.5. Independence
2.6. Learning
2.7. Digital literacy
2.8. Communication

The managers were required to indicate how important a skill was for employees and managers using the following scale: to a small degree, to some degree, to a large degree, I don't know, not relevant. Figure 2 shows the results aggregated in categories and ordered by the degree of importance.

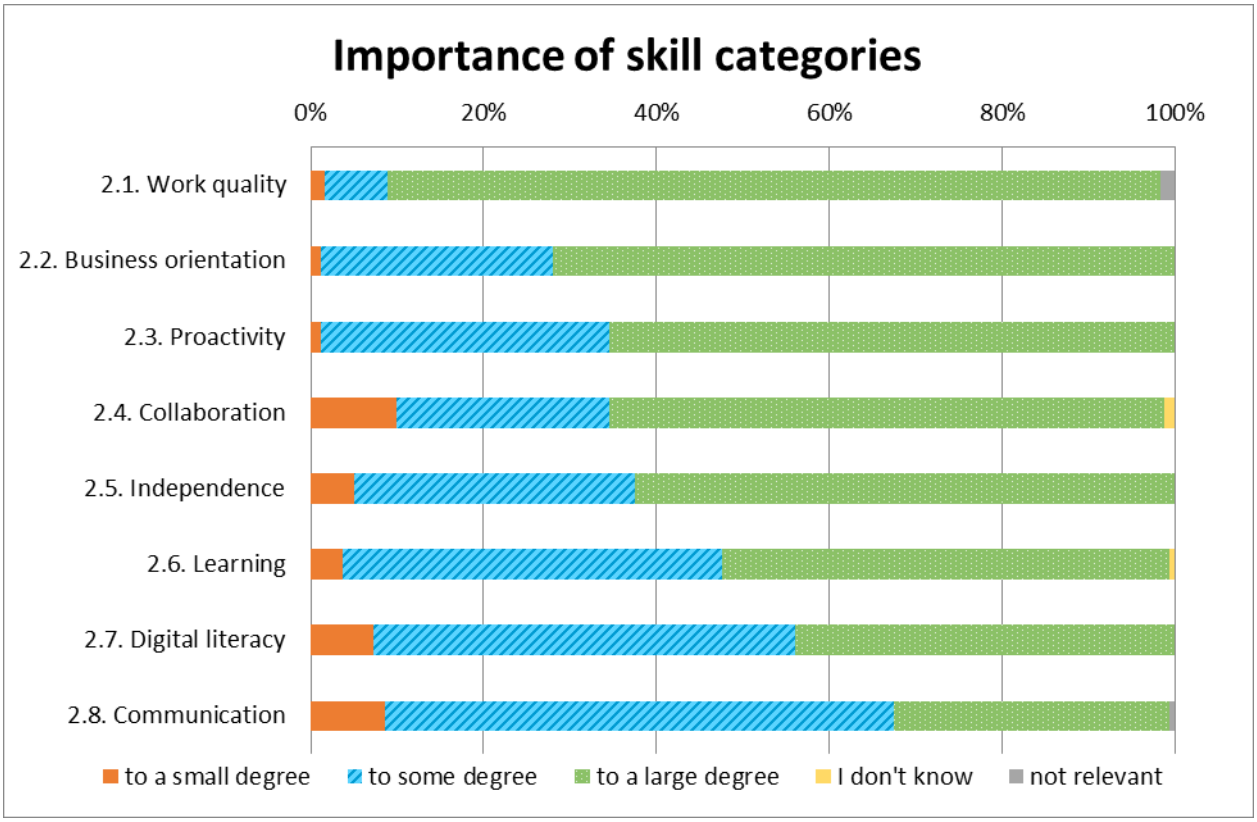


Figure 2: Importance of skill categories

The top most important categories are “work quality” (2.1.) and “business orientation” (2.2.). Almost 90% of the managers consider skills in the “work quality” category very important and over 70% of them consider skills in “business orientation” category to be very important. Over 60 % of the managers consider skills in the categories “proactivity” (2.3.), “collaboration” (2.4.) and “independence” (2.5.) to be important,

These answers indicate that the employees and managers need to be very well prepared and knowledgeable of their craft. Moreover they need to be able to work both independently and in collaboration with others and they must be able to take initiative and be proactive. The reason is that the fish farming industry is challenged by new problems that must be solved on a daily basis.

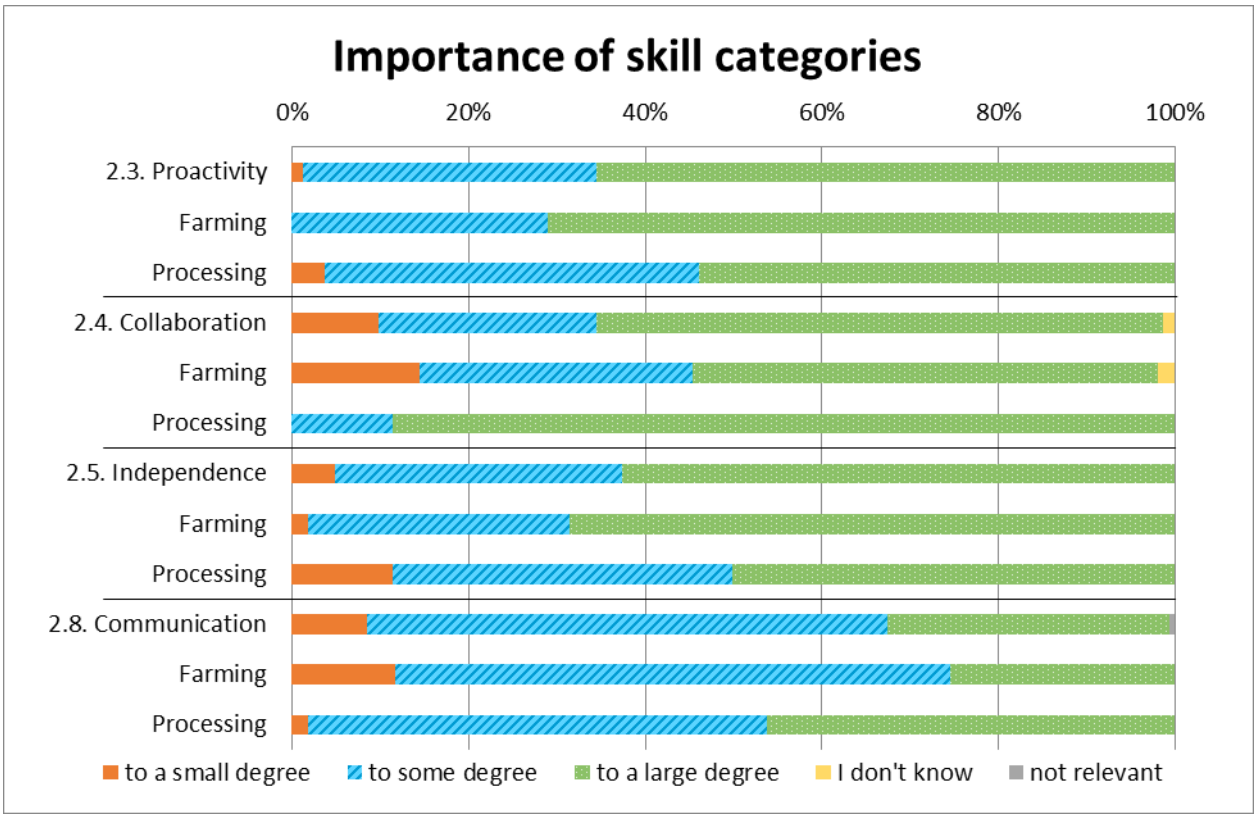


Figure 3: Skill categories with largest differences between farming and processing

## 2.1. Work quality

In the "work quality" category were included the following statements:

2.1.1. know well the actual craftsmanship
2.1.2. can work safely (avoid accidents)
2.1.3. has professional pride

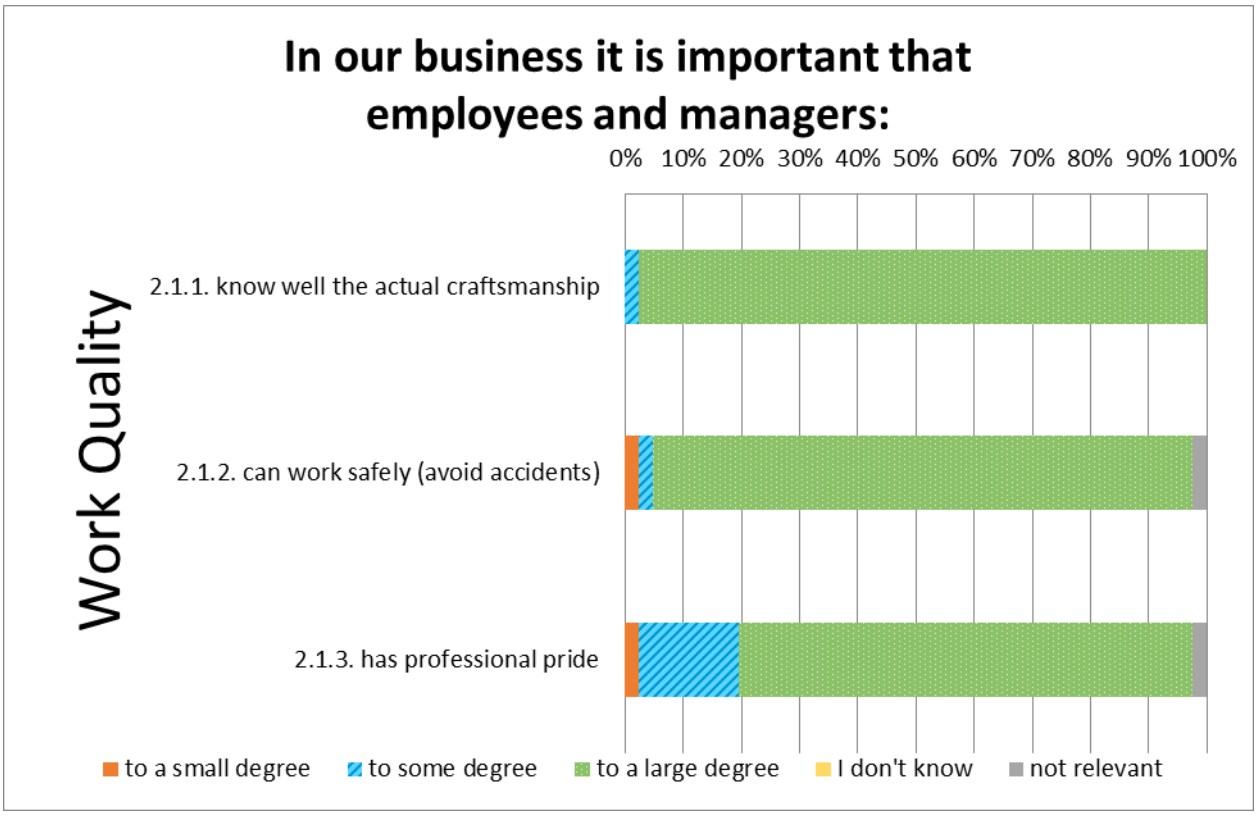


Figure 4: Work quality skills category

The craftsmanship and the safety are considered paramount elements required in the skillset of the workforce. 78% of the managers consider professional pride as an important element.

The consequence of the results depicted in the first two bars (2.1.1. and 2.1.2.) for vocational education and training (VET) practices, is that a workplace based learning approach should be applied.

If VET is going to target, address and include professional pride, then that must be done by establishing a close partnership between the companies and the VET schools. It will be challenging to just apply VET as a stand-alone tool to target this area.

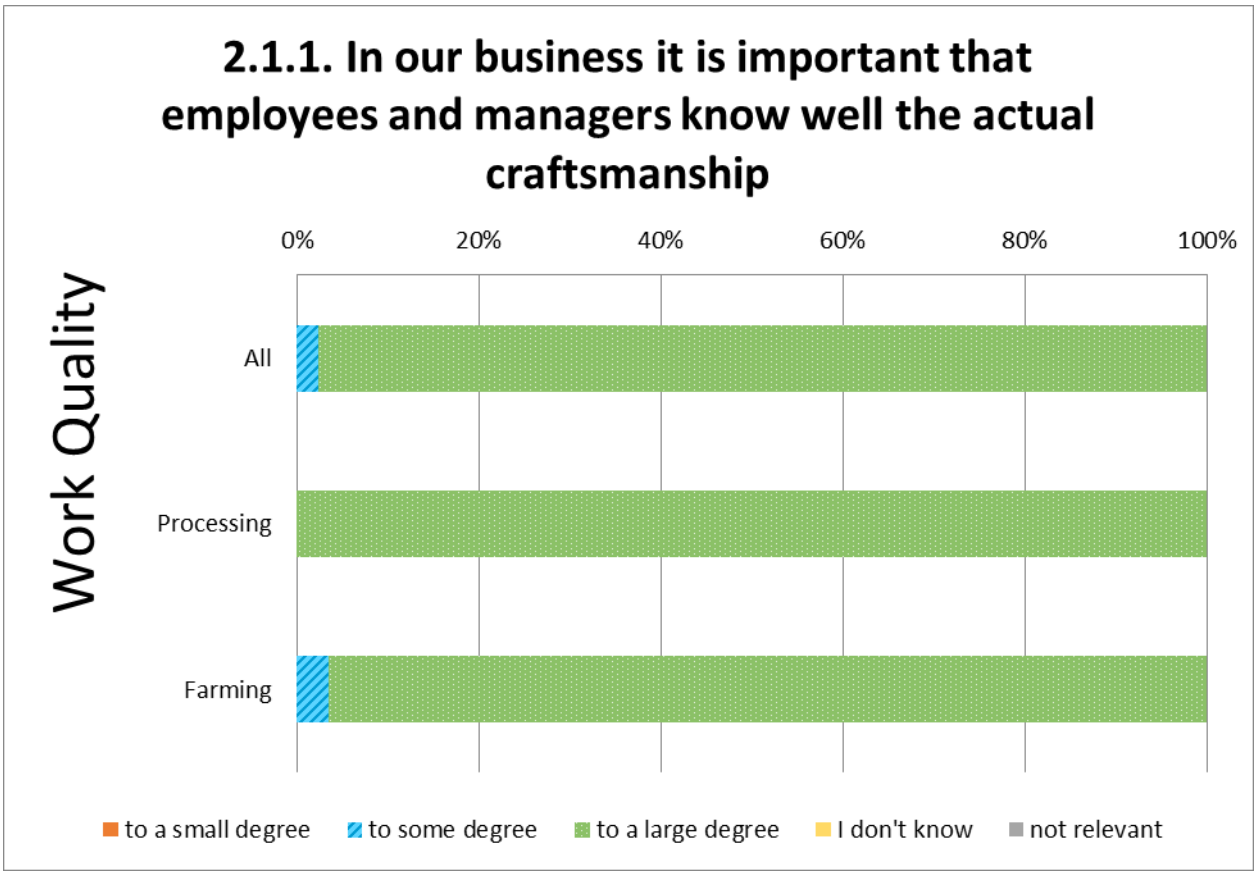


Figure 5: Skill 2.1.1. detailed comparison - processing vs farming

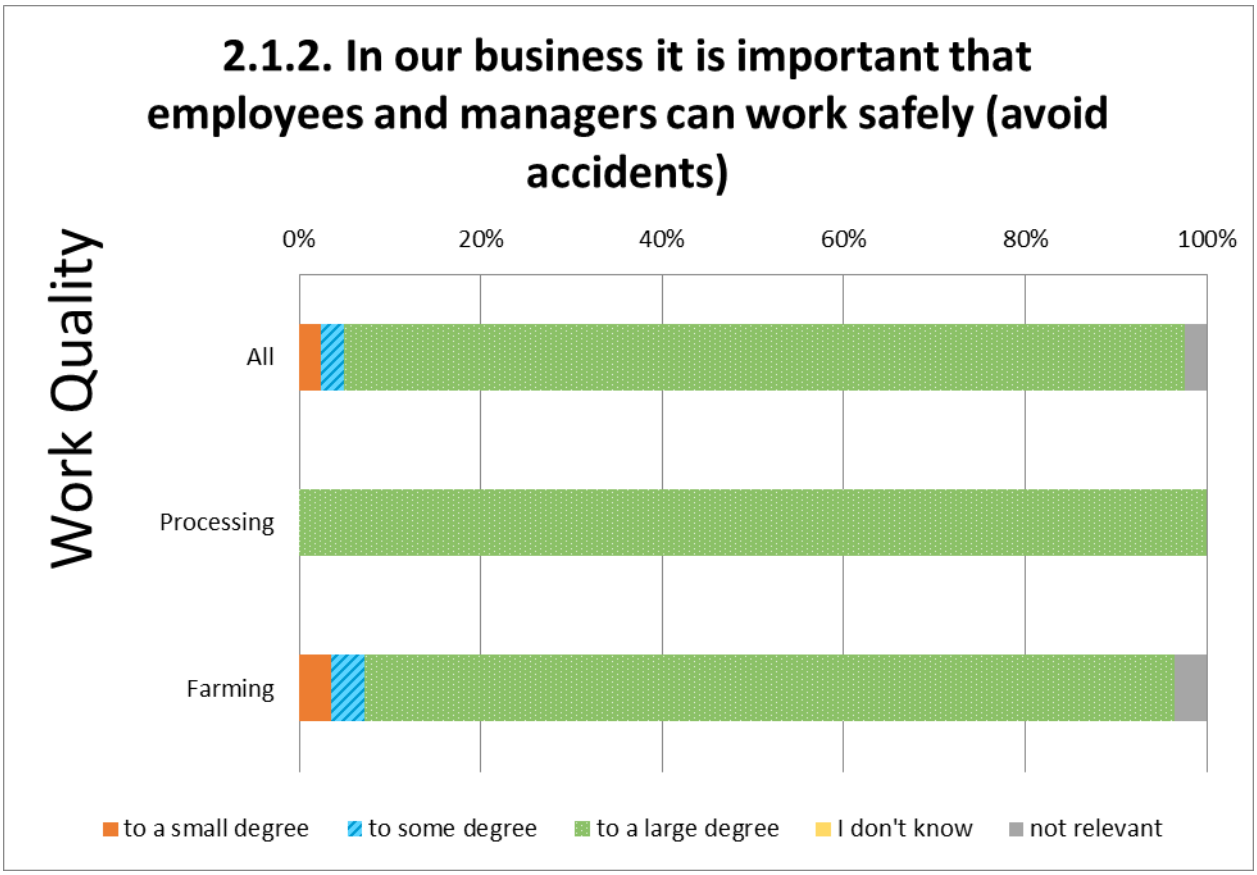


Figure 6: Skill 2.1.2. detailed comparison - processing vs farming

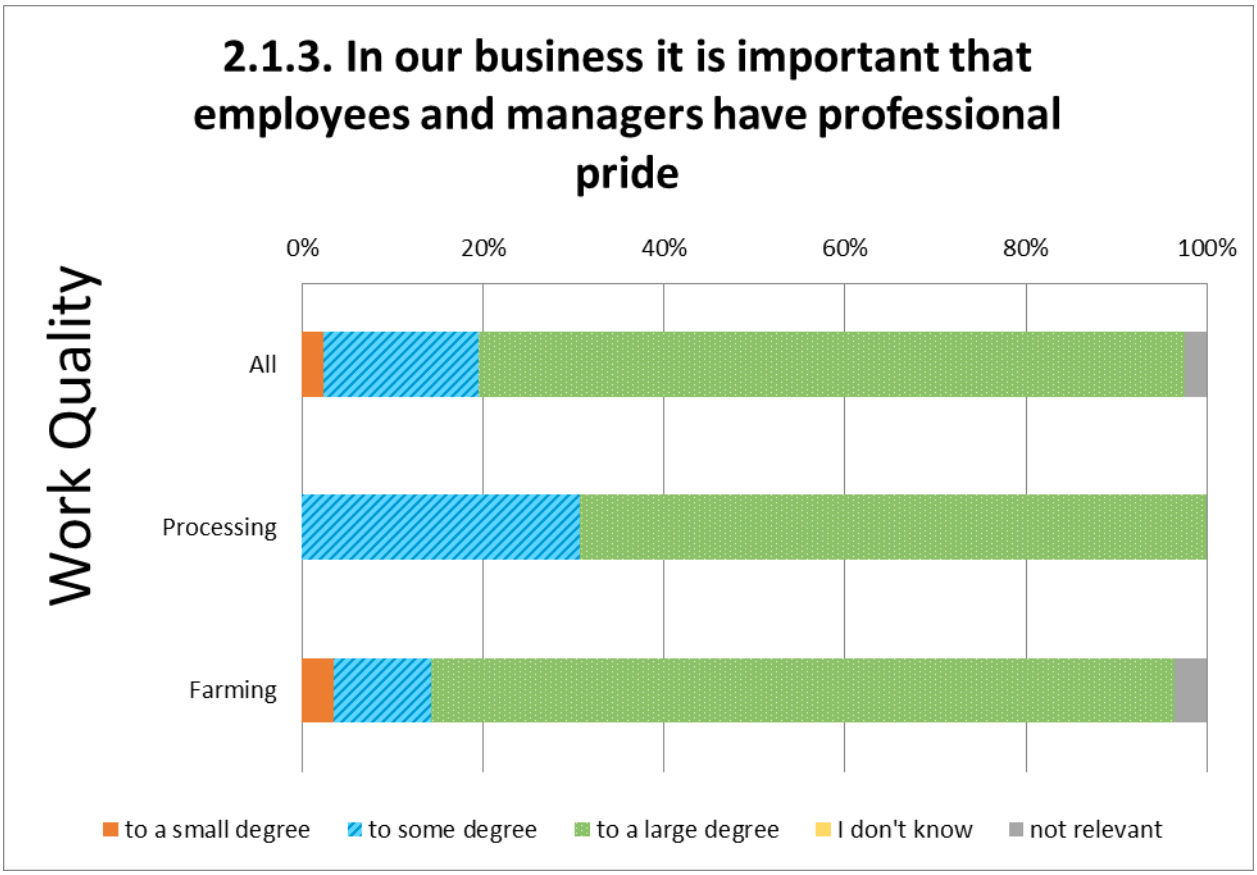


Figure 7: Skill 2.1.3. detailed comparison - processing vs farming

## 2.2. Business Orientation

In the "business orientation" category, the following statements were included:

2.2.1. is loyal to the company/organization

2.2.2. have a good understanding of the business beyond his/her own work

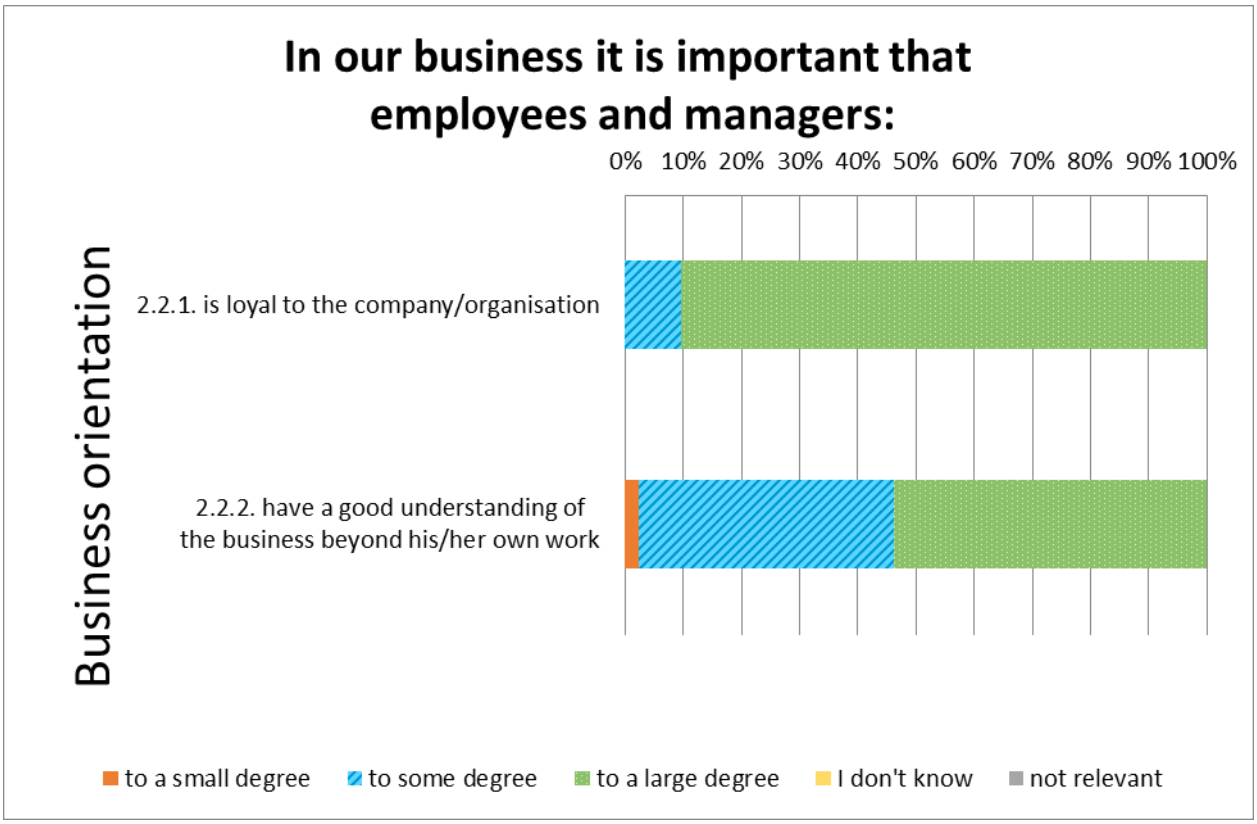


Figure 8: Business orientation skills category

Loyalty towards the organization is considered to be very important by 90% of the managers. Slightly more than half of the managers consider it is very important to have a wider perspective in the understanding of the production in the fish farming company. At the marine cages, staff works in teams. Each person in the team specializes in one or several job activities. However, at the same time each person should know the most important components in the job operations that the colleague is specializing on. In this way, work and job operations may go on if staff is absent from work. A modern VET program may underline and highlight the dependency between different production stages and work operations.

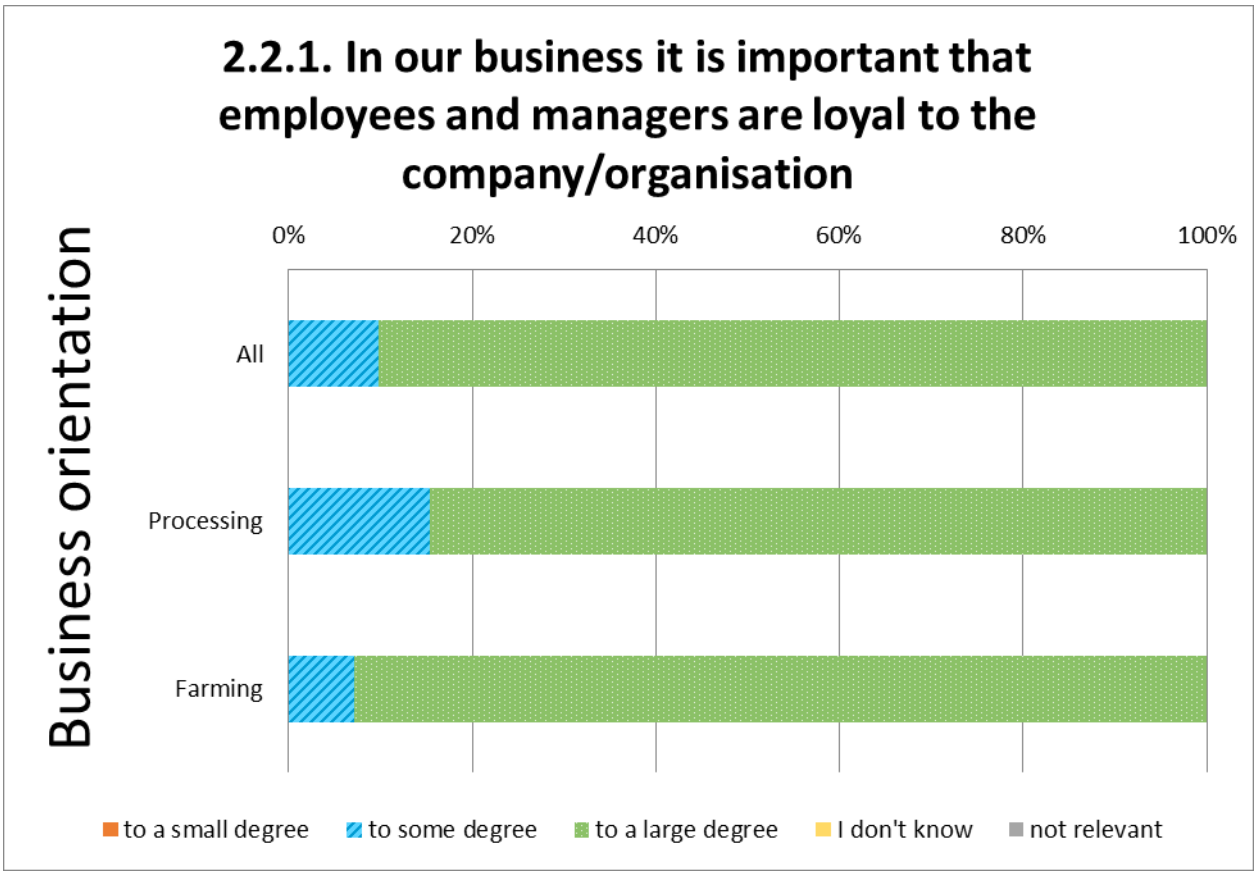


Figure 9: Skill 2.2.1. detailed comparison - processing vs farming

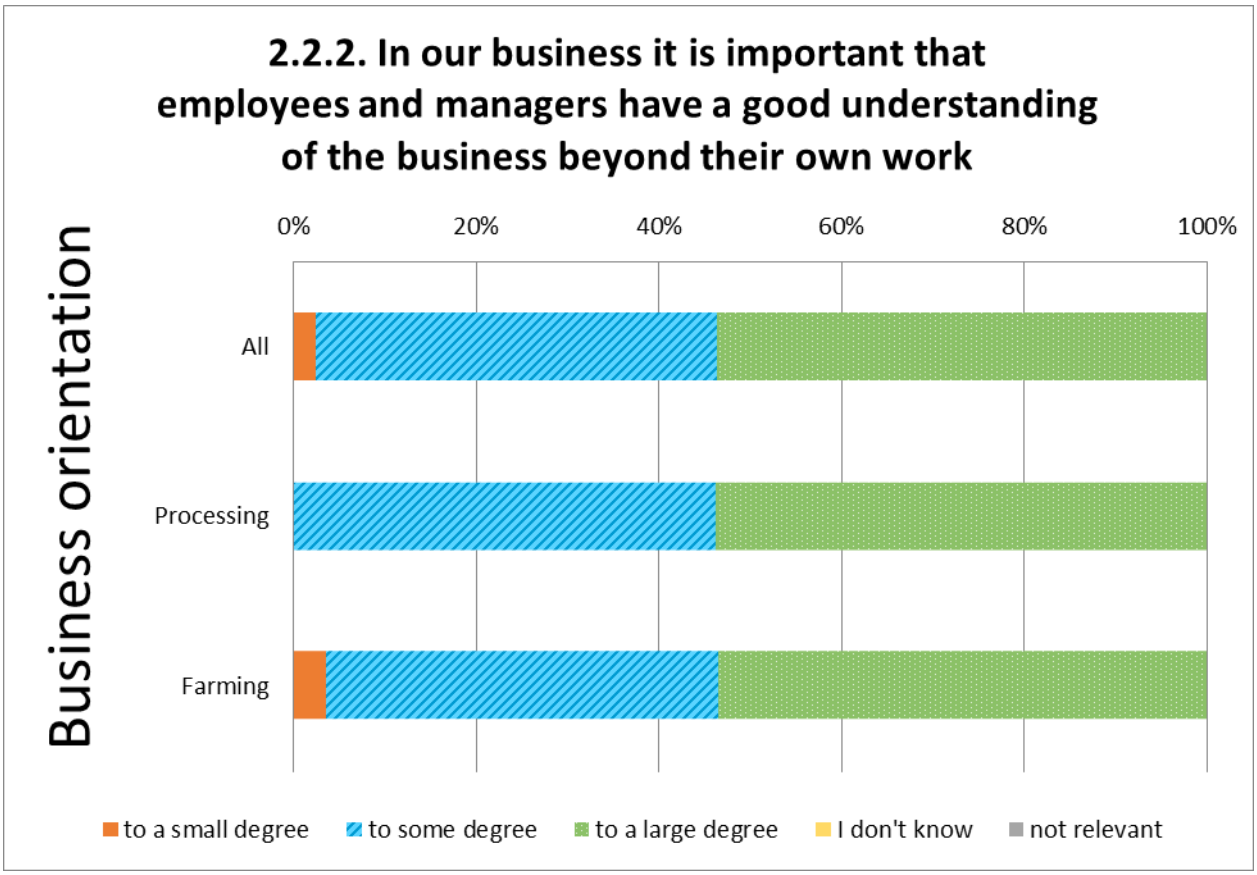


Figure 10: Skill 2.2.2. detailed comparison - processing vs farming

## 2.3. Proactivity

In the "proactivity" category were included the following statements:

2.3.1. can see what work is needed to be done without asking anyone

2.3.2. have the ability to come up with ideas and propose changes

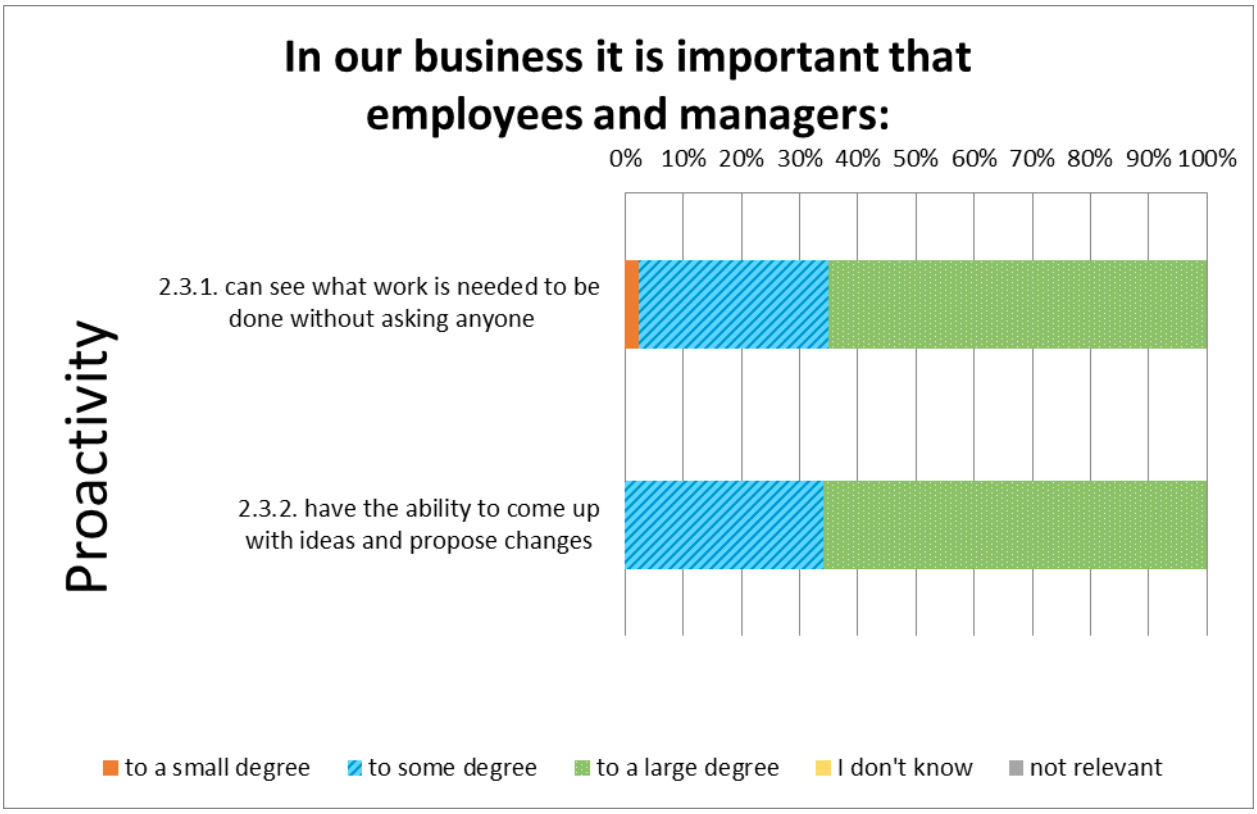


Figure 11: Proactivity skills category

65% of the managers consider that it is very important that the employees are able to recognize and solve upcoming cases and problems in the production on their own or together with a colleague. Same high percentage considers that it is very important to be able to actively contribute with ideas and propose changes meant to improve the situation or solve the problems.

Such skills can be trained in targeted courses, but currently they are not part of the journeyman certificate in Norway. This will require training from experts outside of the traditional VET system.

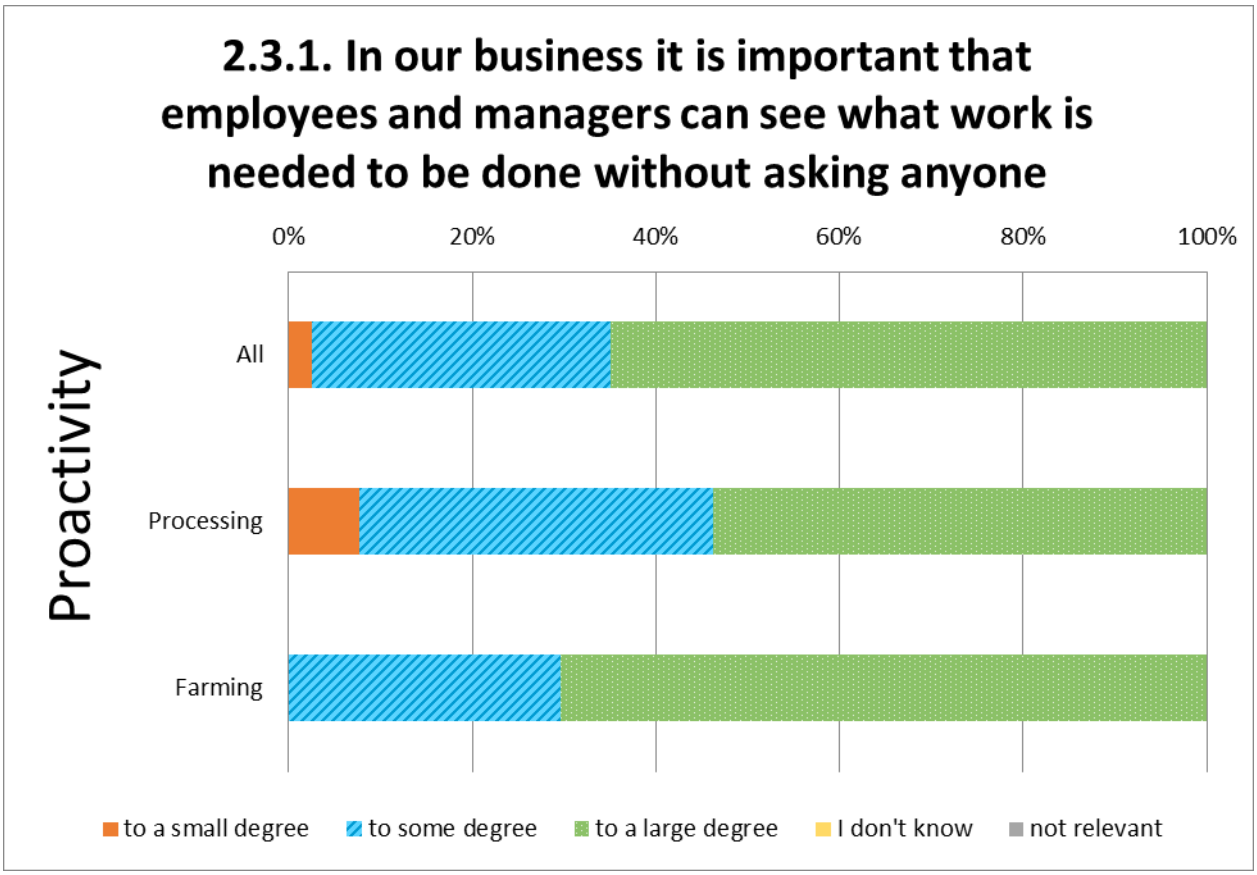


Figure 12: Skill 2.3.1. detailed comparison - processing vs farming

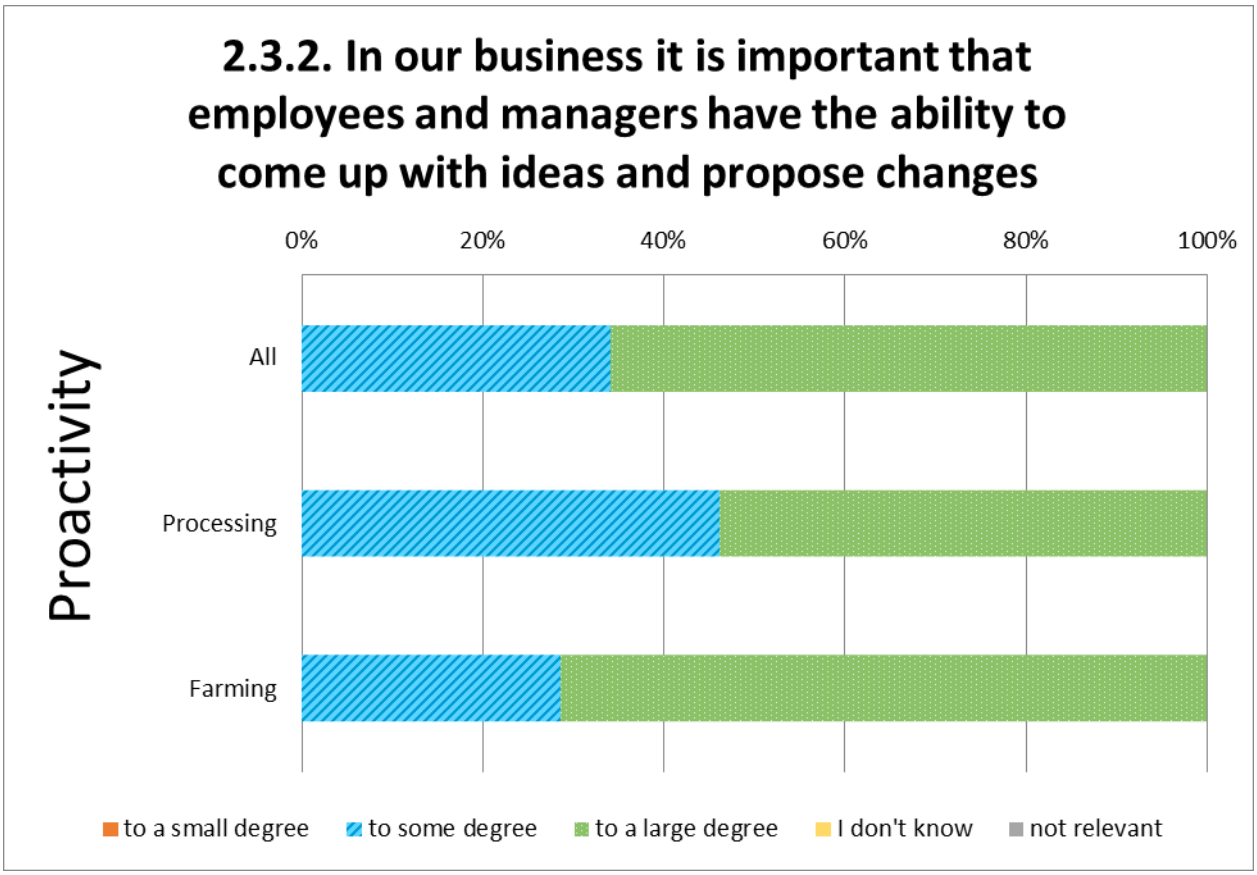


Figure 13: Skill 2.3.2. detailed comparison - processing vs farming

## 2.4. Collaboration

In the "collaboration" category the following statements were included:

2.4.1. collaborate well with others

2.4.2. can work with colleagues from different countries

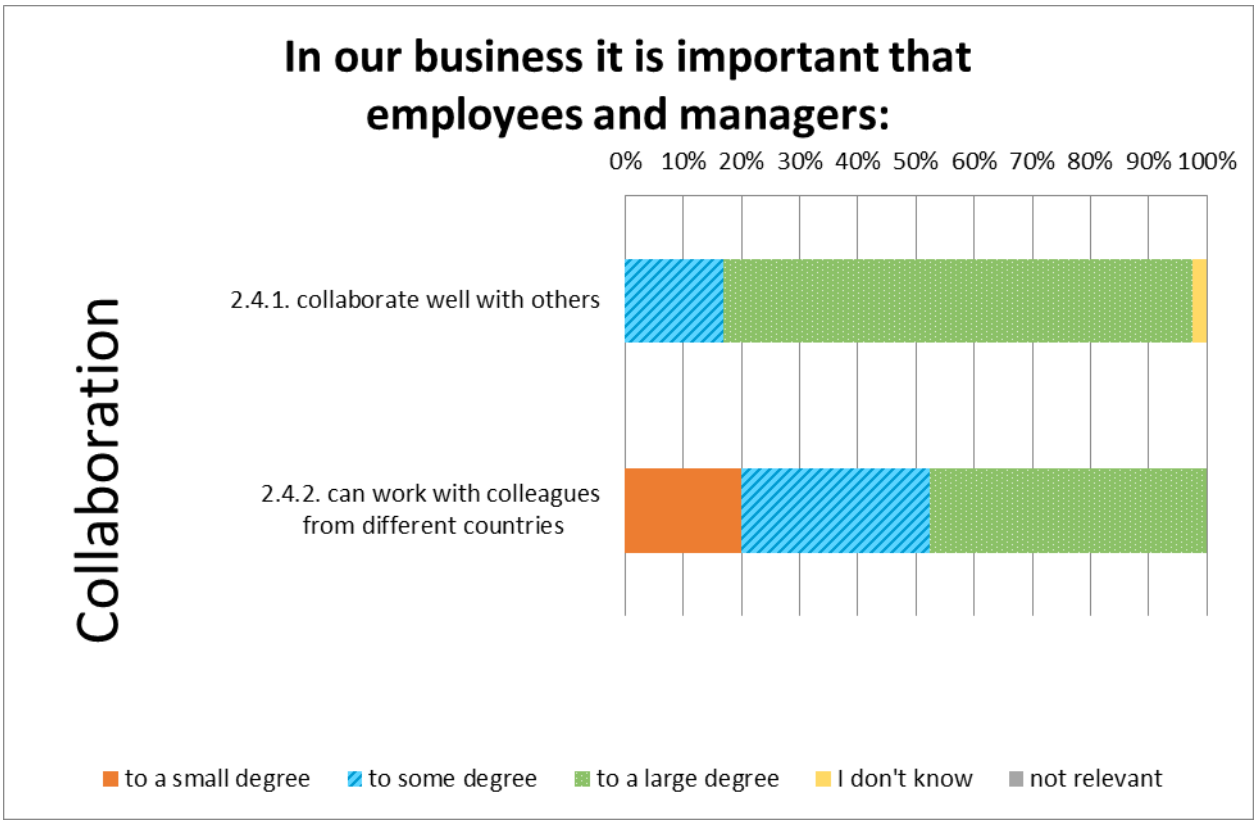


Figure 14: Collaboration skills category

Collaboration is a very important aspect as indicated by 80% of the managers. The second statement in the category referred to collaboration with colleagues from other countries and also here 80% of the managers consider this to be important (46% very important, 34% some importance). In Norwegian aquaculture the workforce is quite diverse especially in the processing sector, whereby the second statement reflects this fact.

These data shows that VET courses should be organized in such a way that they strengthen collaboration between different productions teams in the same company in order to learn and transfer knowledge from each other. Additionally this will help building a common understanding of the business and the production processes. Further investigation should look into the usefulness of setting up collaboration activities between companies in the same sector, such that this may support transfer of knowledge and experiences in order to improve the production.

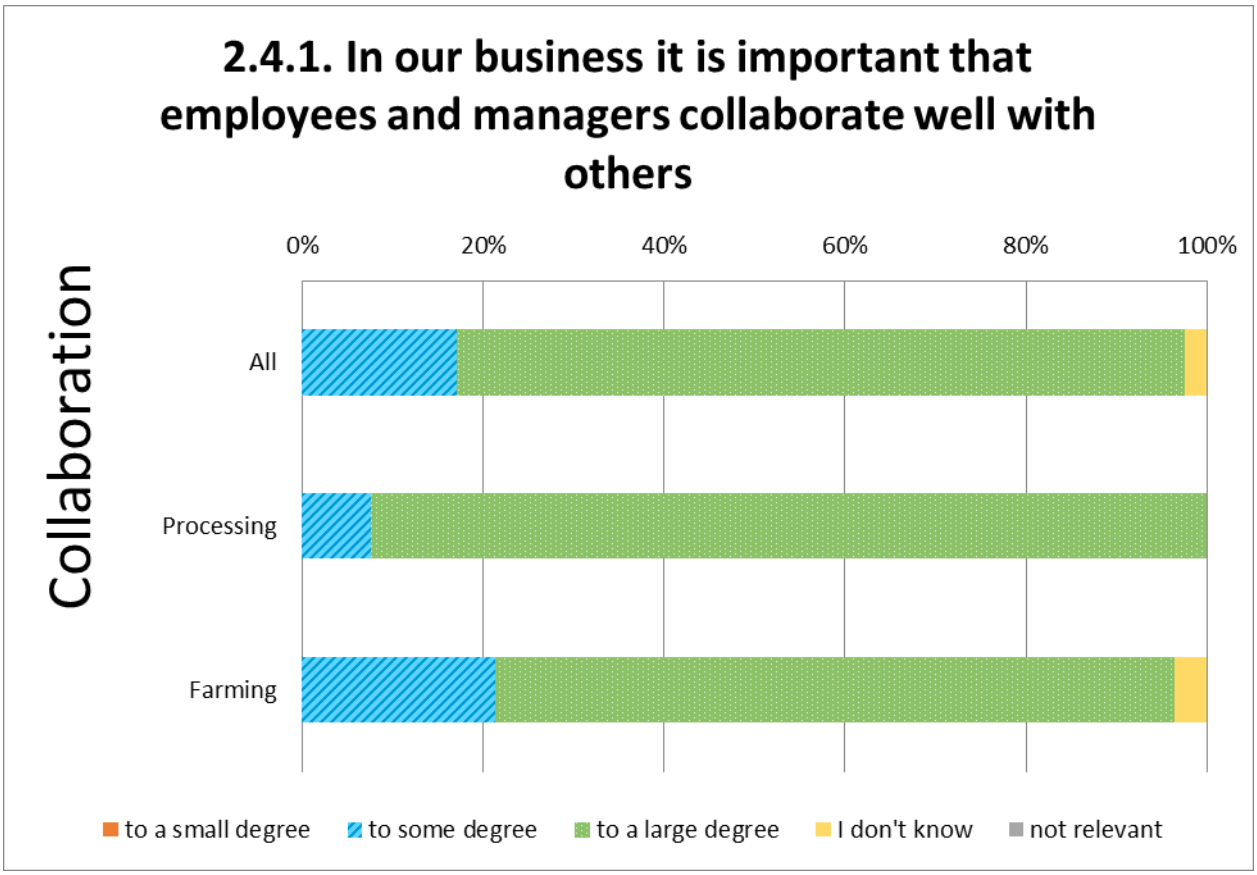


Figure 15: Skill 2.3.1. detailed comparison - processing vs farming

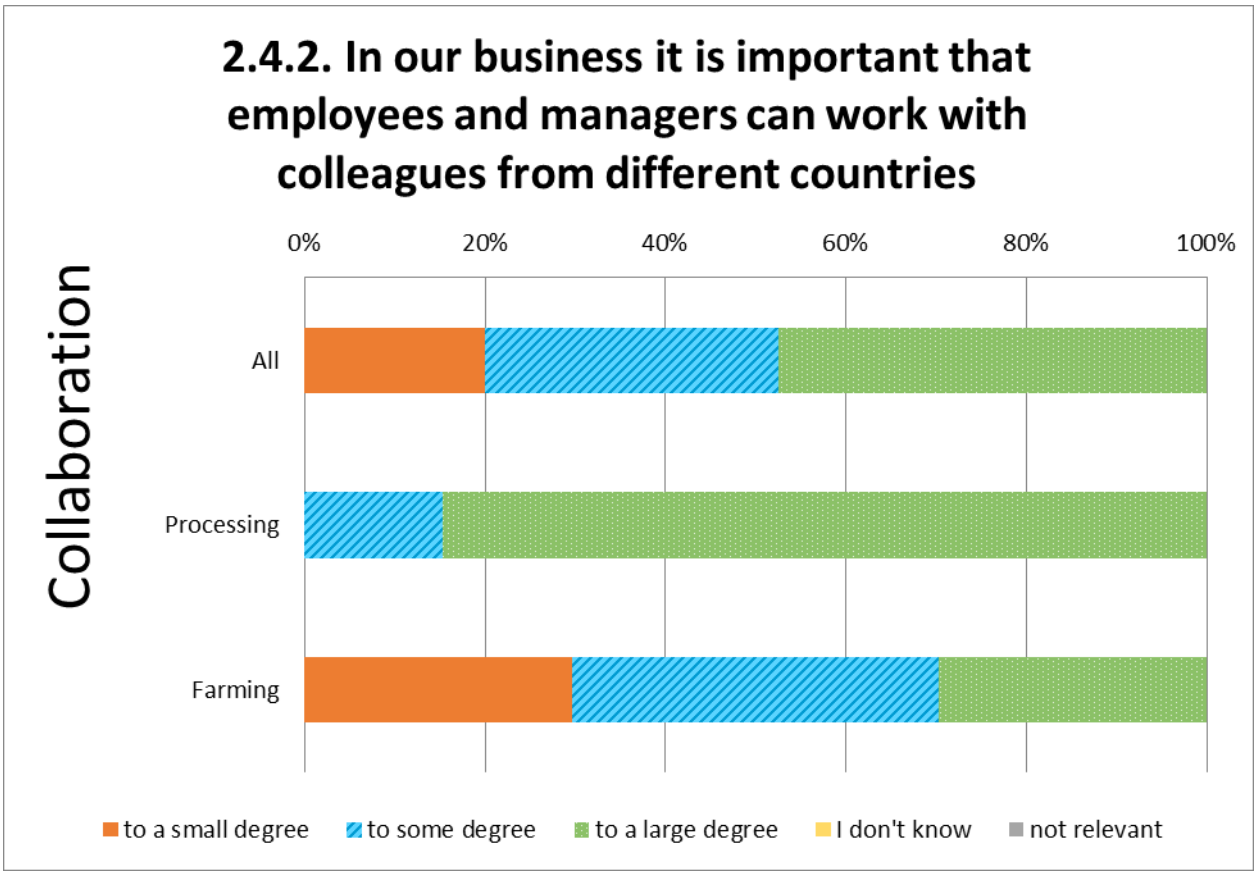


Figure 16: Skill 2.4.2. detailed comparison - processing vs farming

## 2.5. Independence

In the “independence” category the following statements were included:

2.5.1. can plan their workday on their own

2.5.2. can coordinate with others

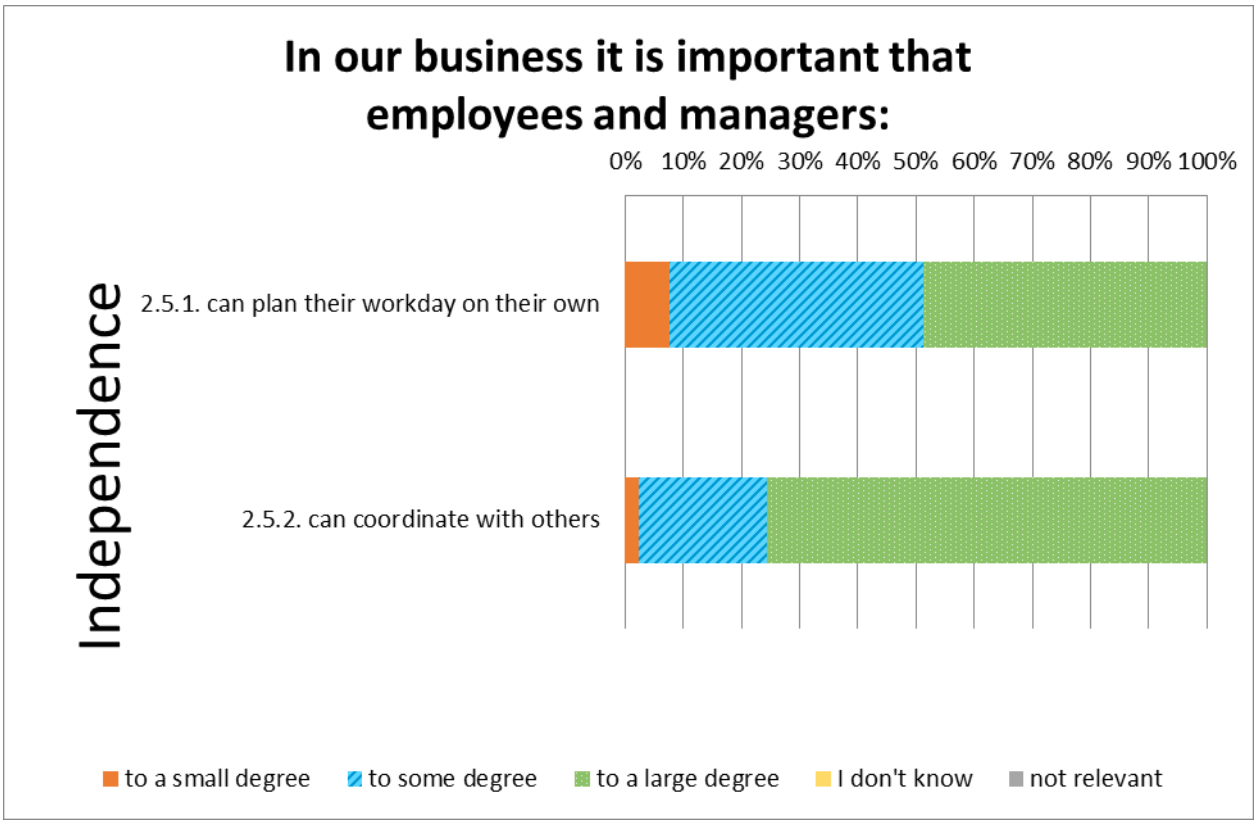


Figure 17: Independence skills category

75% of the managers consider very important that the employees are able to coordinate with others in the workplace. Approximately half of the managers consider that it is very important for employees to be able to plan their own workday. The results need further investigation, as there are significant differences between farming and processing work. To which degree may they have the ability to control their own working schedule?

Planning and coordinating with others are an important part of the journeyman certificate training. The results show that this must be kept and improved in the future VET programs.

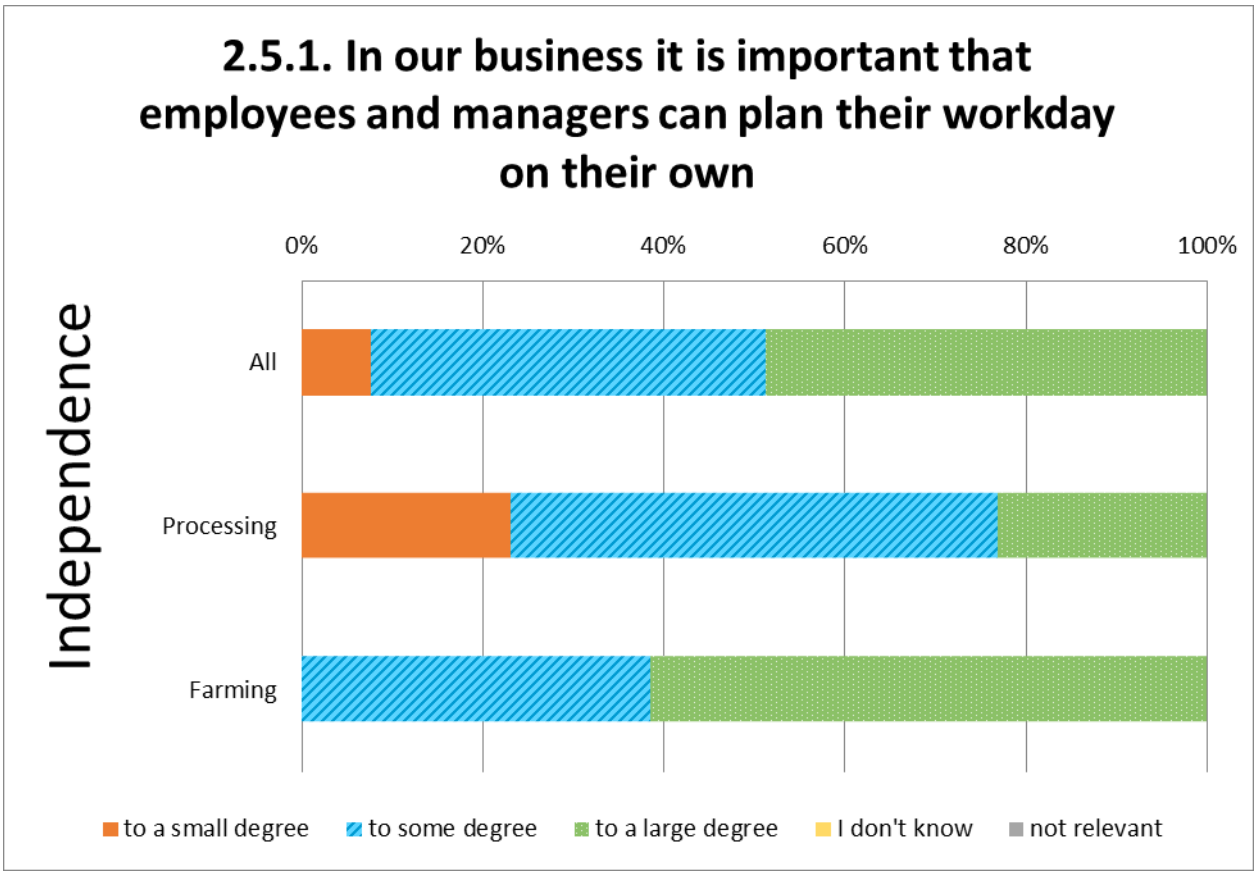


Figure 18: Skill 2.5.1. detailed comparison - processing vs farming

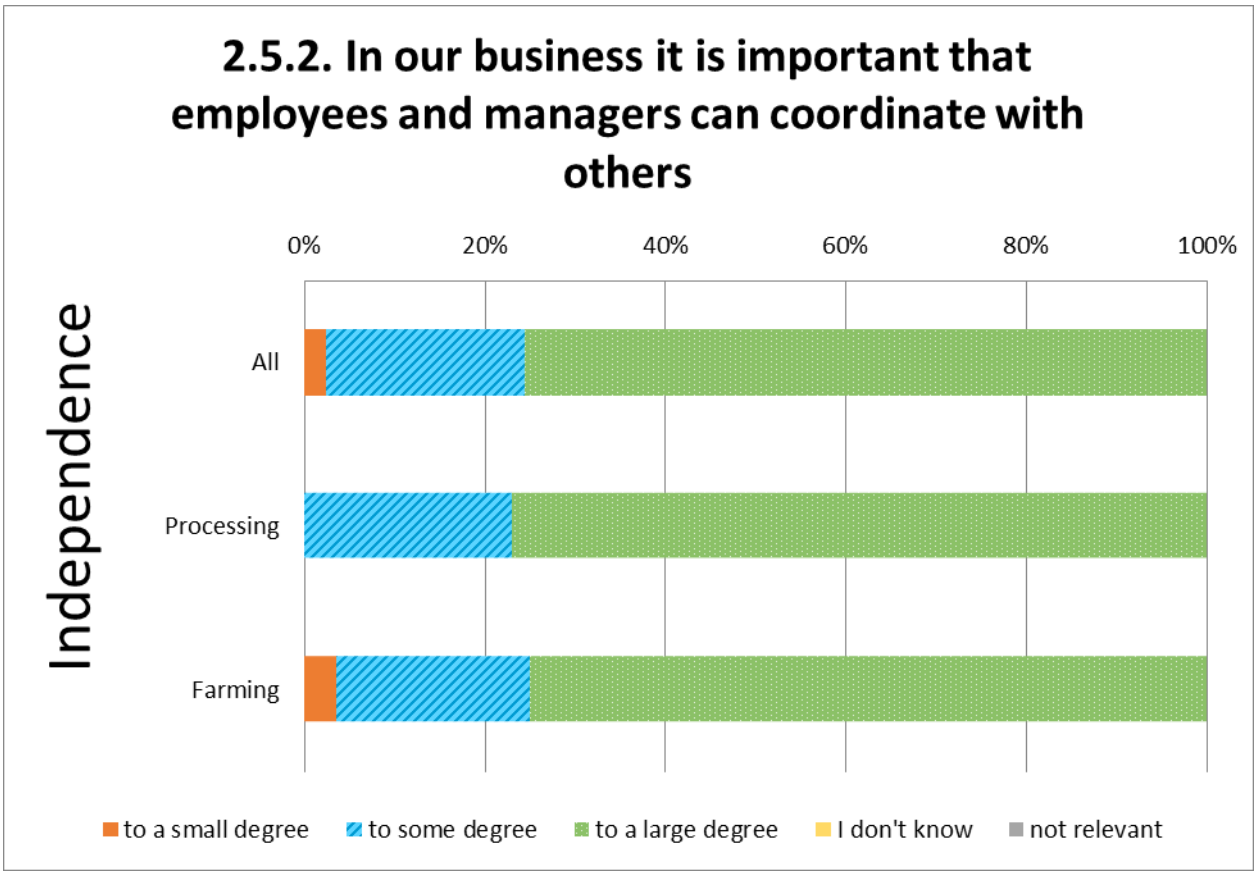


Figure 19: Skill 2.5.2. detailed comparison - processing vs farming

## 2.6. Learning

In the "learning" category the following statements were included:

2.6.1. have an interest for learning and self-development
2.6.2. have the ability to contribute to changes and innovation work
2.6.3. have interest to teach others
2.6.4. can read and understand advanced instructions and manuals

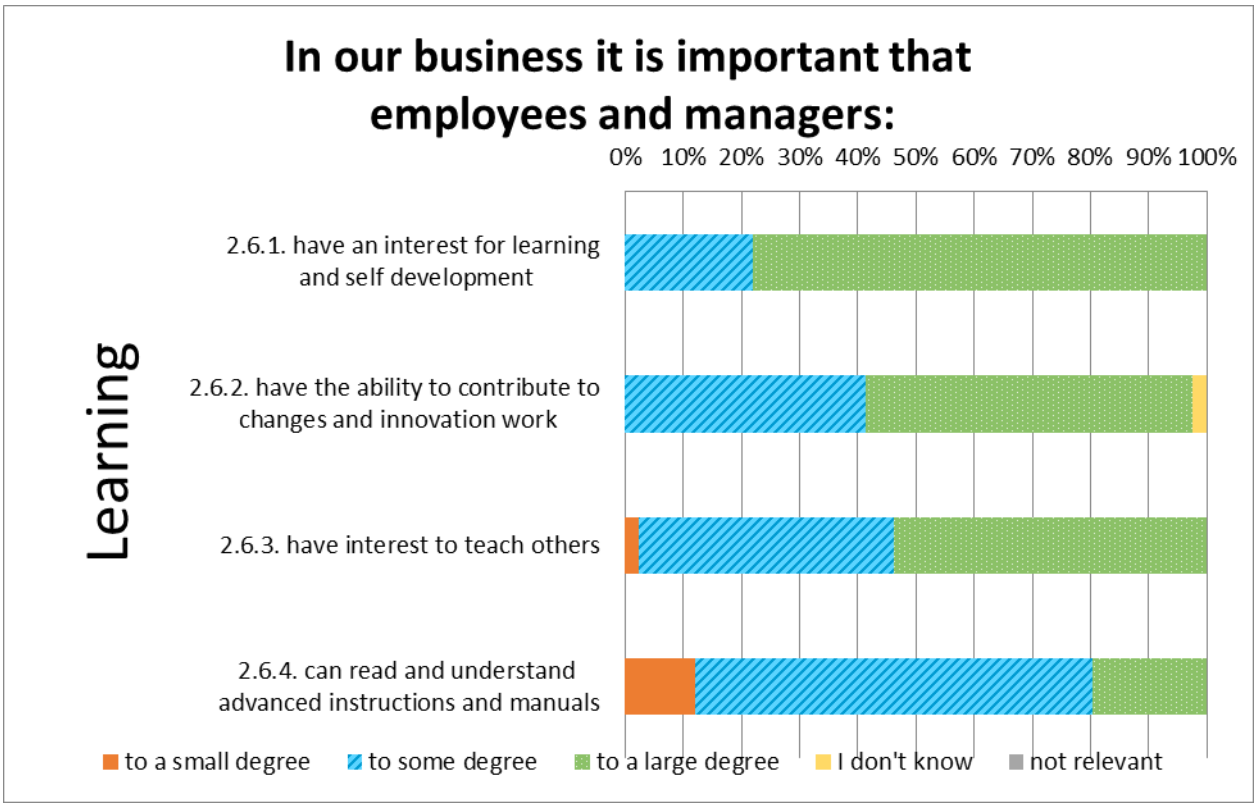


Figure 20: Learning skills category

The aquaculture industry is a fast developing due to technological innovations. Employees need to be motivated to continuous update their knowledge and skills. 78% of the managers consider as very important that employees have an interest for learning and self-development. Over half of them also consider very important that employees have an interest in supervision and teaching other staff.

The first bar (2.6.1.) shows that the staff must be able to follow up and specialize in various new working areas, for instance boat operations, ICT or treatment of cleaner fish etc. A modern VET system should be able to provide a wide aquaculture education, stimulating industry to afterwards offer specialist training through specialized VET courses thus supporting staffs self development and continuous learning of new skills.

The information in the bars (2.6.2 and 2.6.3) may affect the methods that are applied in a modern VET system. By including relevant tasks and activities, they may support and enhance application of work operations that are related to innovation process as well as group work related activities where experienced staff helps teaching the less experienced staff. Such training must be developed together with the companies involved.

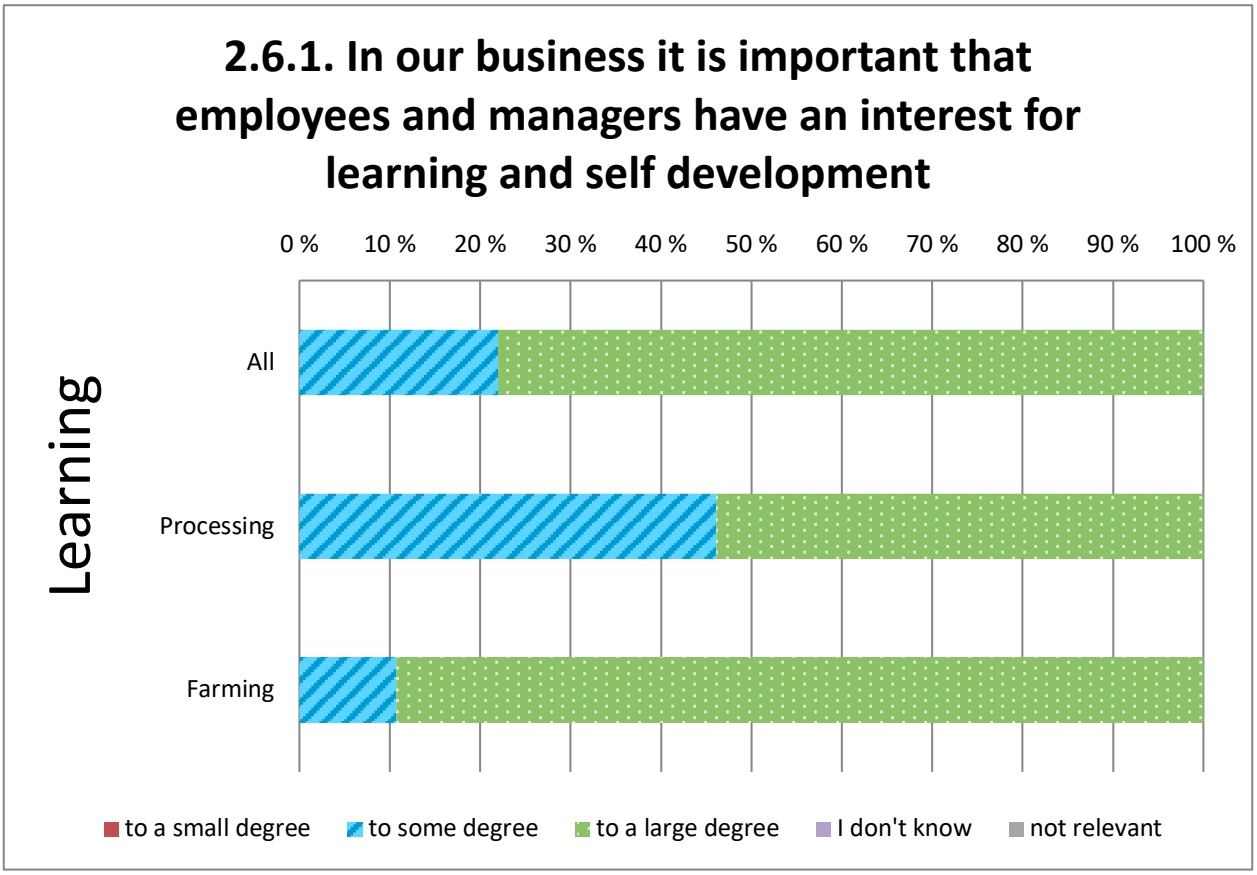


Figure 21: Skill 2.6.1. detailed comparison - processing vs farming

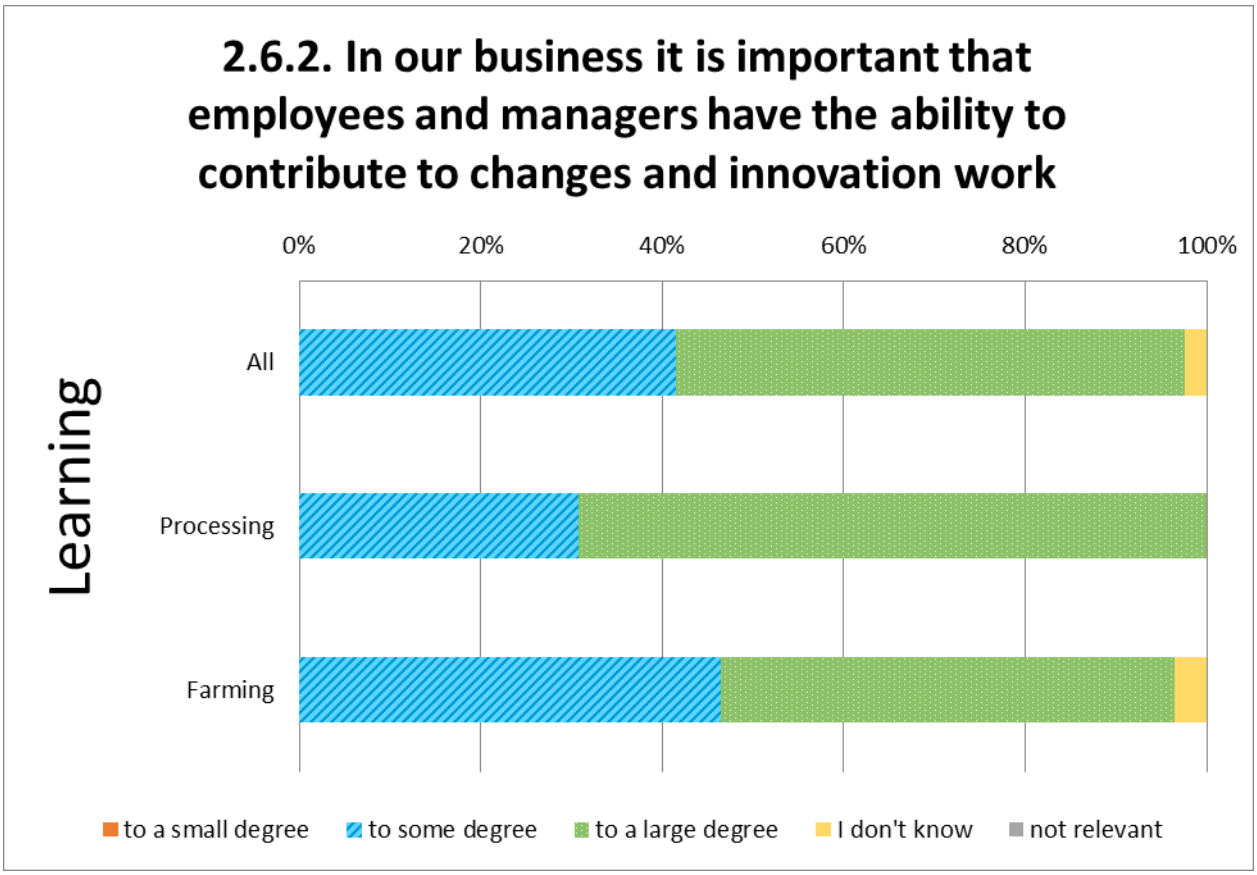


Figure 22: Skill 2.6.2. detailed comparison - processing vs farming

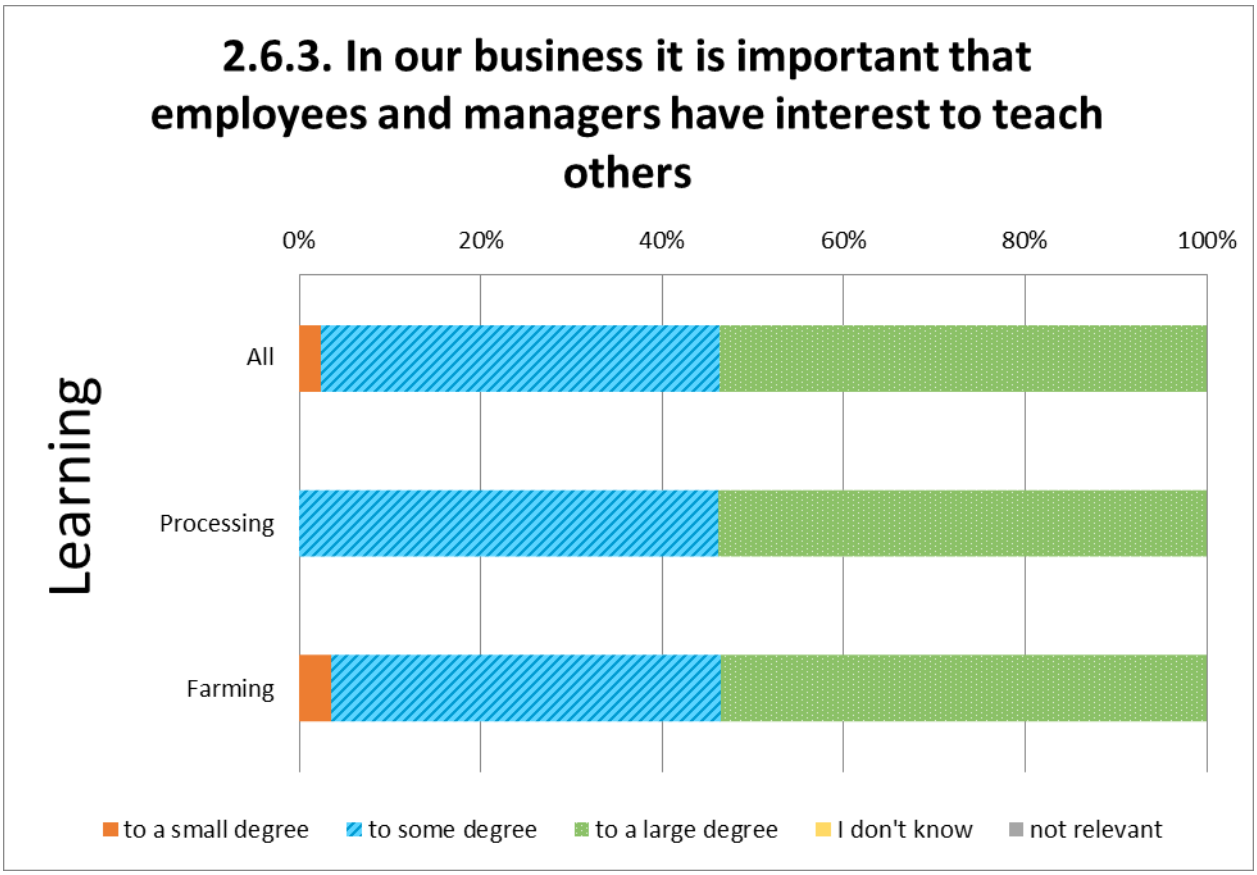


Figure 23: Skill 2.6.3. detailed comparison - processing vs farming

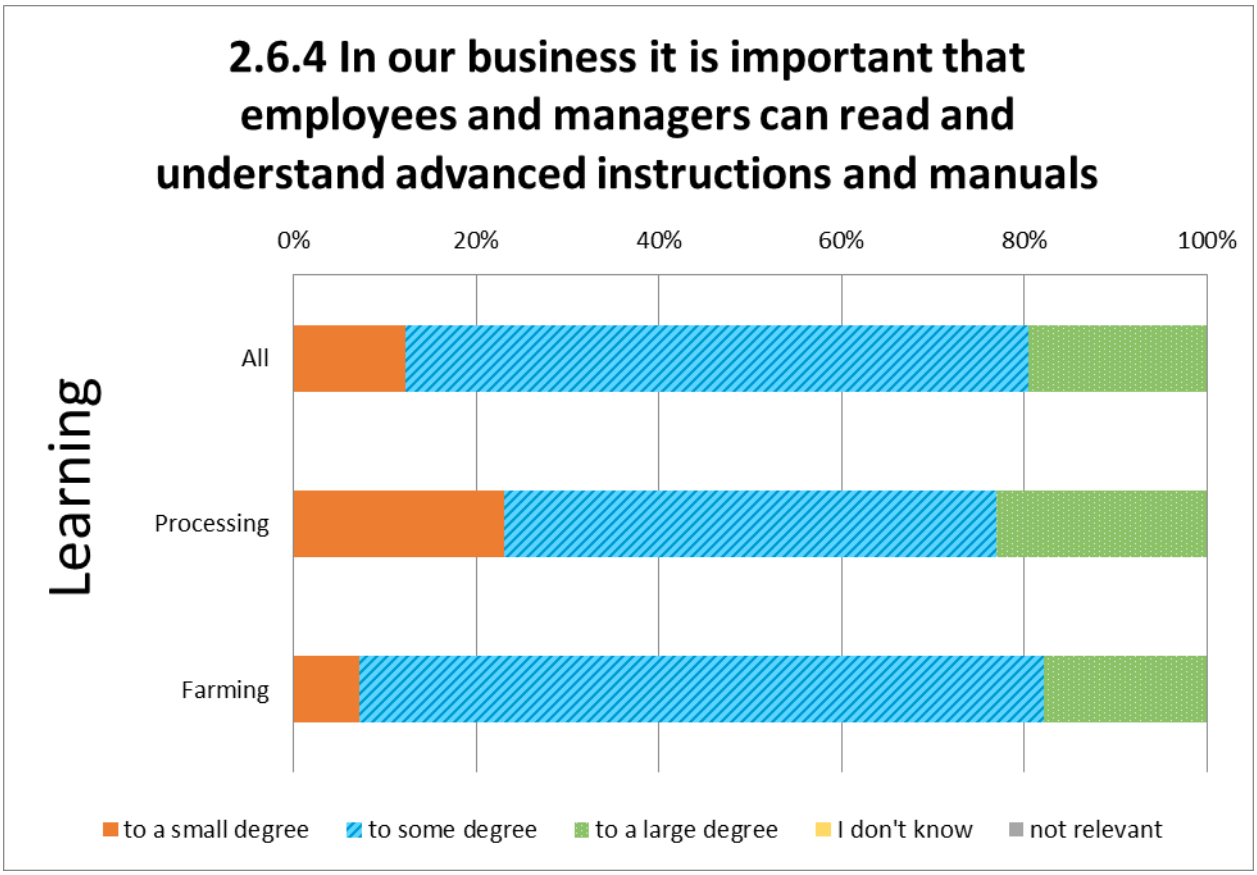


Figure 24: Skill 2.6.4. detailed comparison - processing vs farming

## 2.7. Digital Literacy

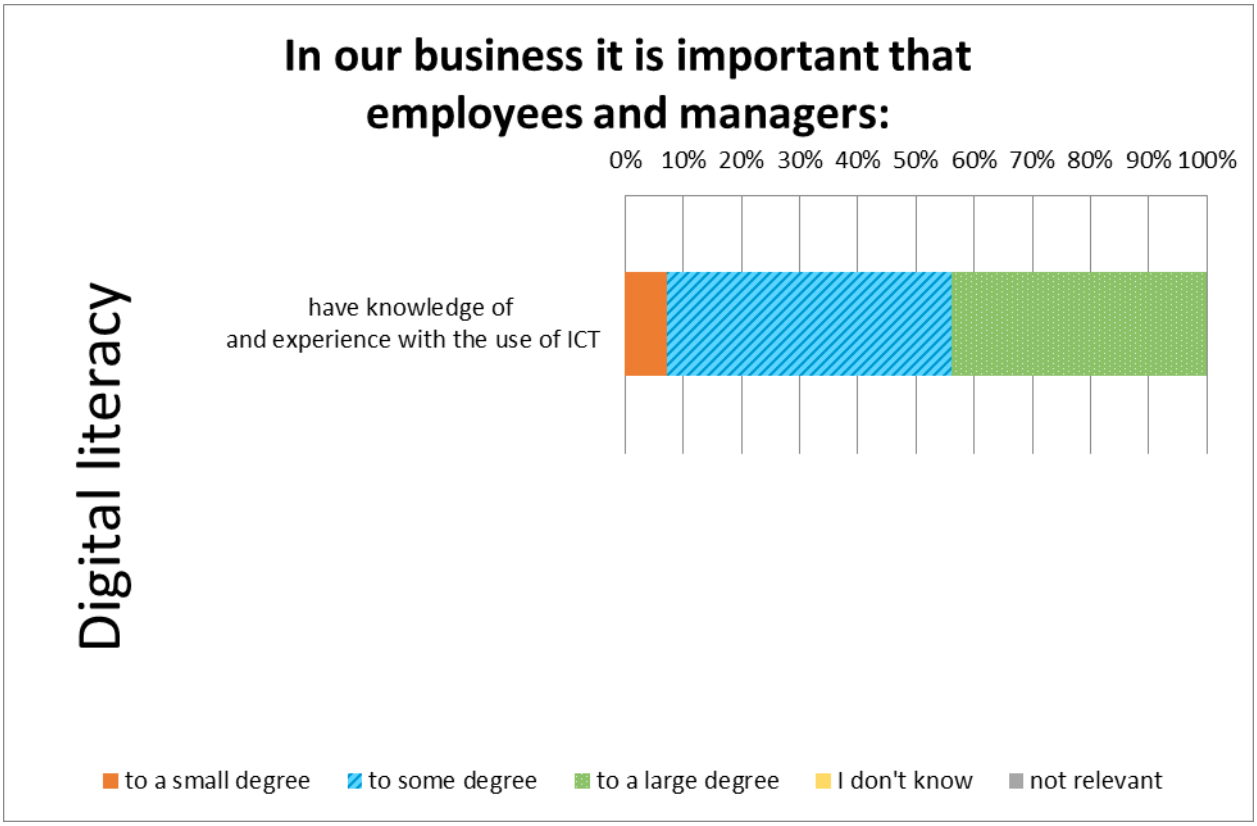


Figure 25: Digital literacy skills

44% of the managers consider as very important to have knowledge of and experience with the use of ICT. 49% of the managers consider this to be important to some degree.

These results shows that improved ICT skills are not among the highest priorities within the aquaculture industry. They shows that it is enough for the fish farming industry to have access to a limited number of staff that has the required ICT competences and skills. Such knowledge may probable be offered through specialist courses.

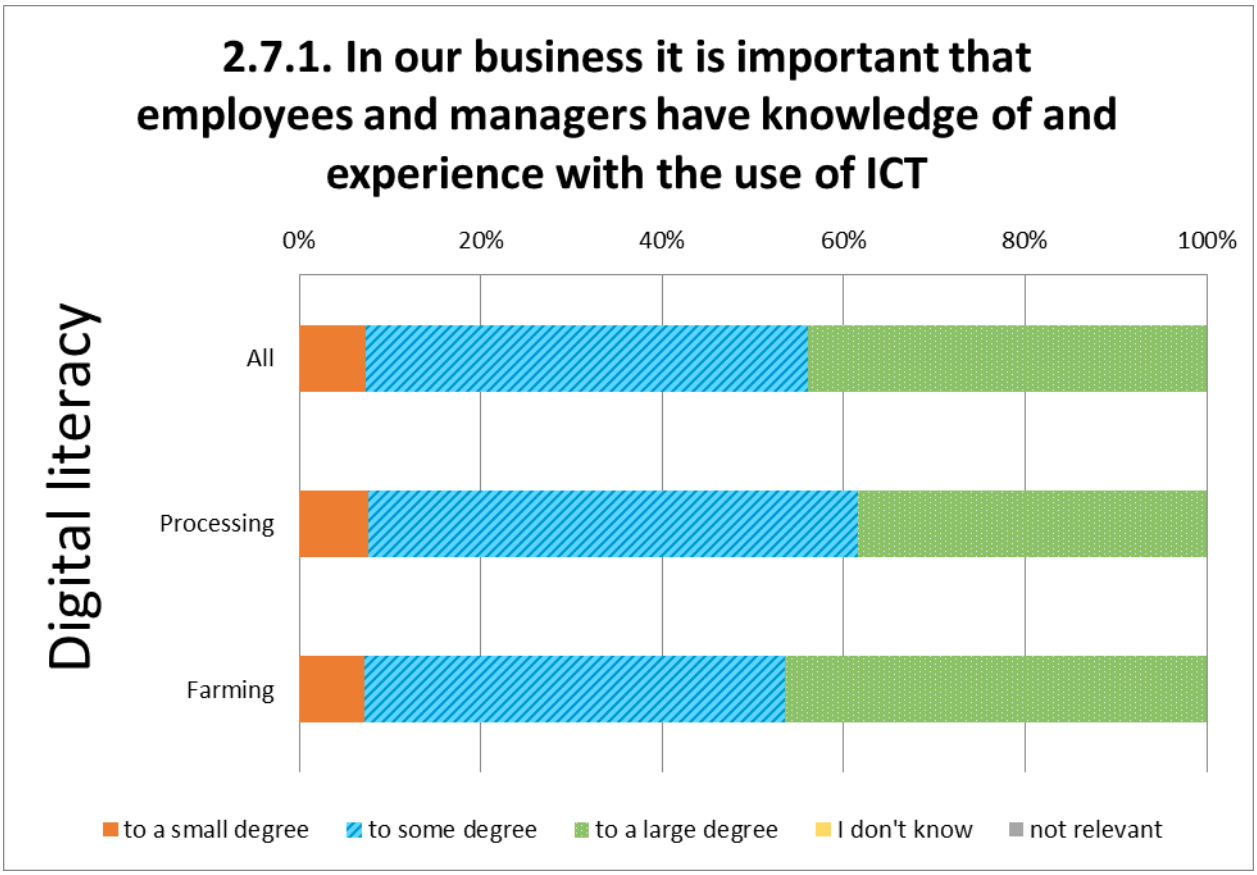


Figure 26: Skill 2.7.1. detailed comparison - processing vs farming

## 2.8. Communication

In the "learning" category were included the following statements:

2.8.1. takes frequent contact with their immediate leader
2.8.2. are good at communicating orally
2.8.3. are good at communicating in writing
2.8.4. can communicate in several languages

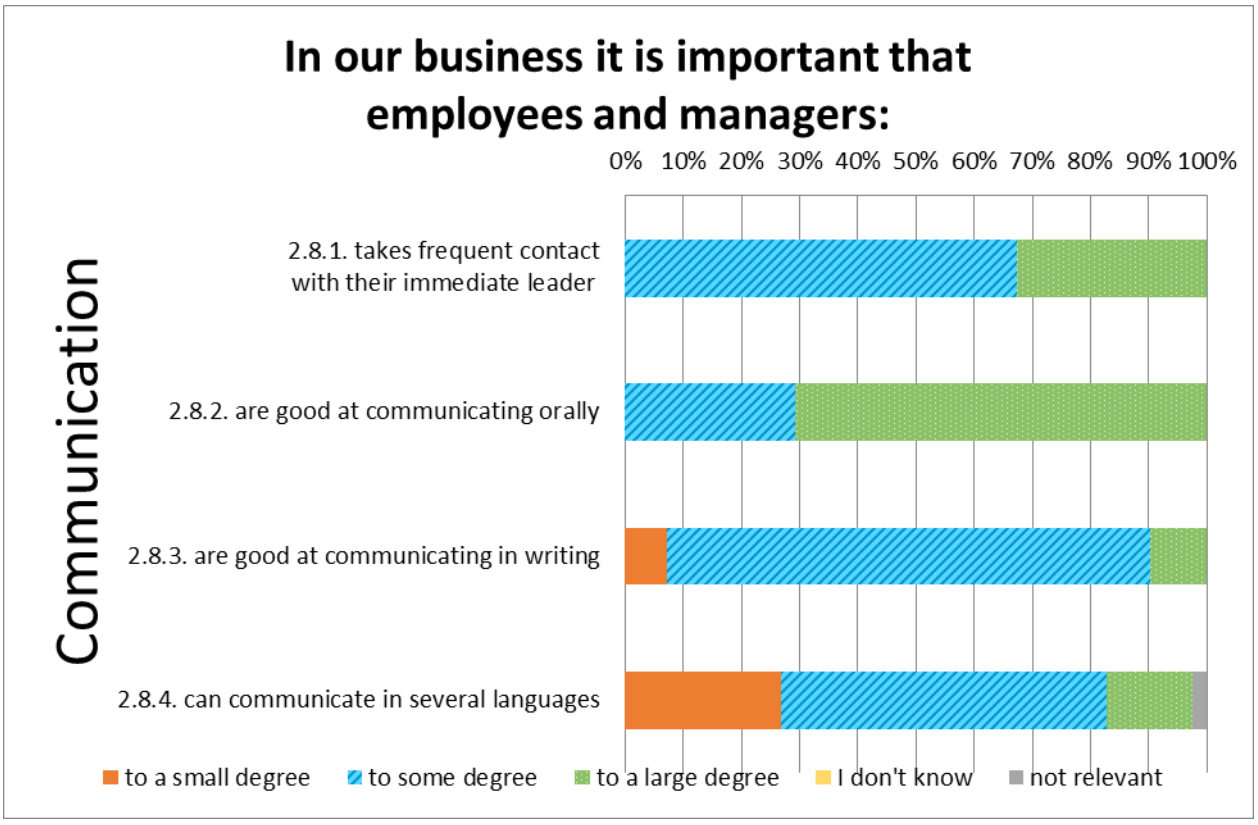


Figure 27: Communication skills category

The results show that oral communication is significantly more important than written communication. 70% of the managers consider oral communication to very important within the fish farming industry, while only 10% consider written communication as very important.

Frequent contact with their leader is considered to be very important by over 30% of the managers, a result that is also reflected in the accent put on the independence and proactivity.

The results indicate that the industry considers that the oral communication is more important than the written communication. However, in the VET school system in Norway writing is considered important. For instance, at the theoretical journeyman certificate exam, the students often need to develop a written production plan. Thus, this is an indication of a gap between what the VET school system considers to be important and what the fish farming industry highlights as important.

In the geographical area of Mid-Norway there are a lot of labor immigrants, which speak between 30-40 different languages. Despite of this the industry expects that the working language should be Norwegian, whereby they expect that it is not necessary to communicate in any other foreign

language. However, is this realistic to achieve within a modern VET course where many people might need to communicate in what for them is a foreign language?

In the current system it is required to complete the journeyman certificate exam in Norwegian. Therefore, in order to achieve this, the candidates must master the Norwegian language quite well at a working level.

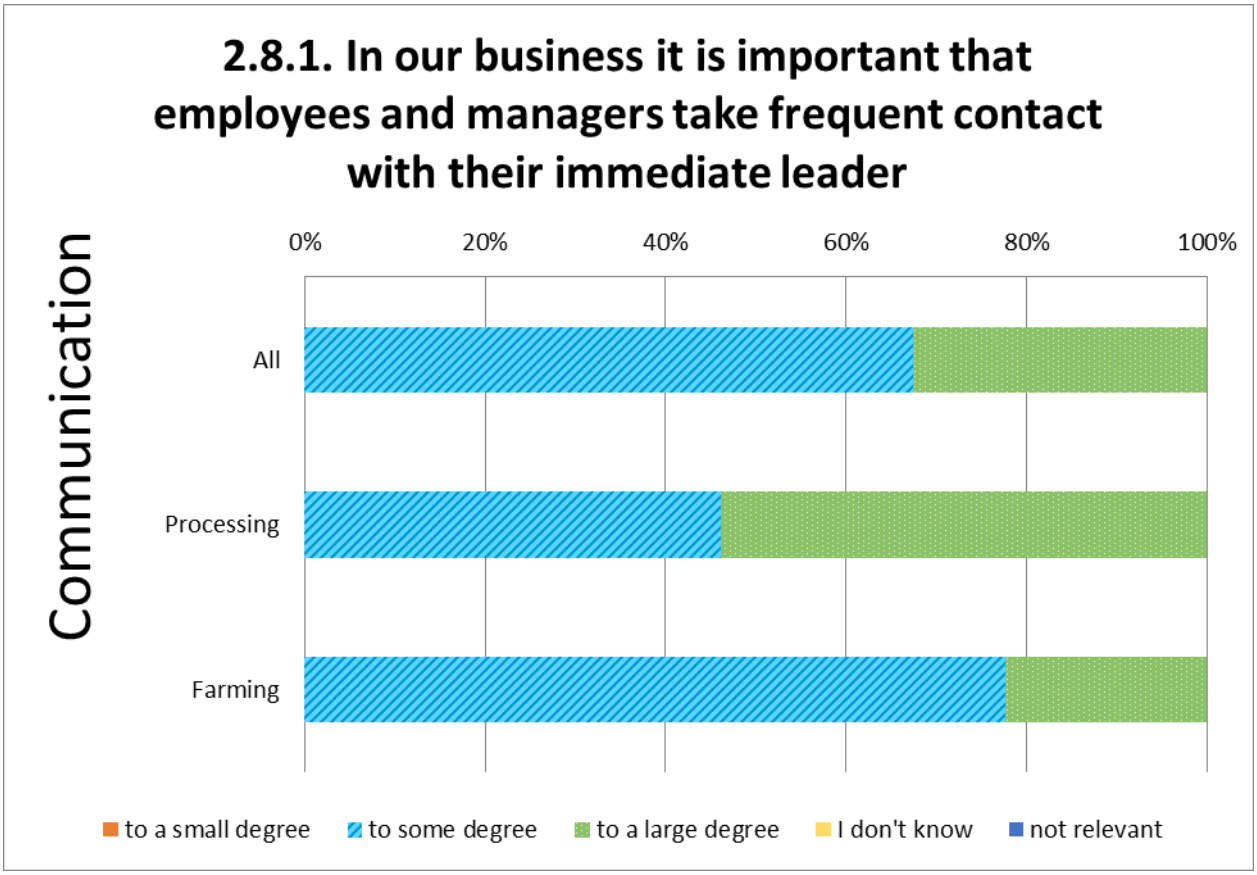


Figure 28: Skill 2.8.1. detailed comparison - processing vs farming

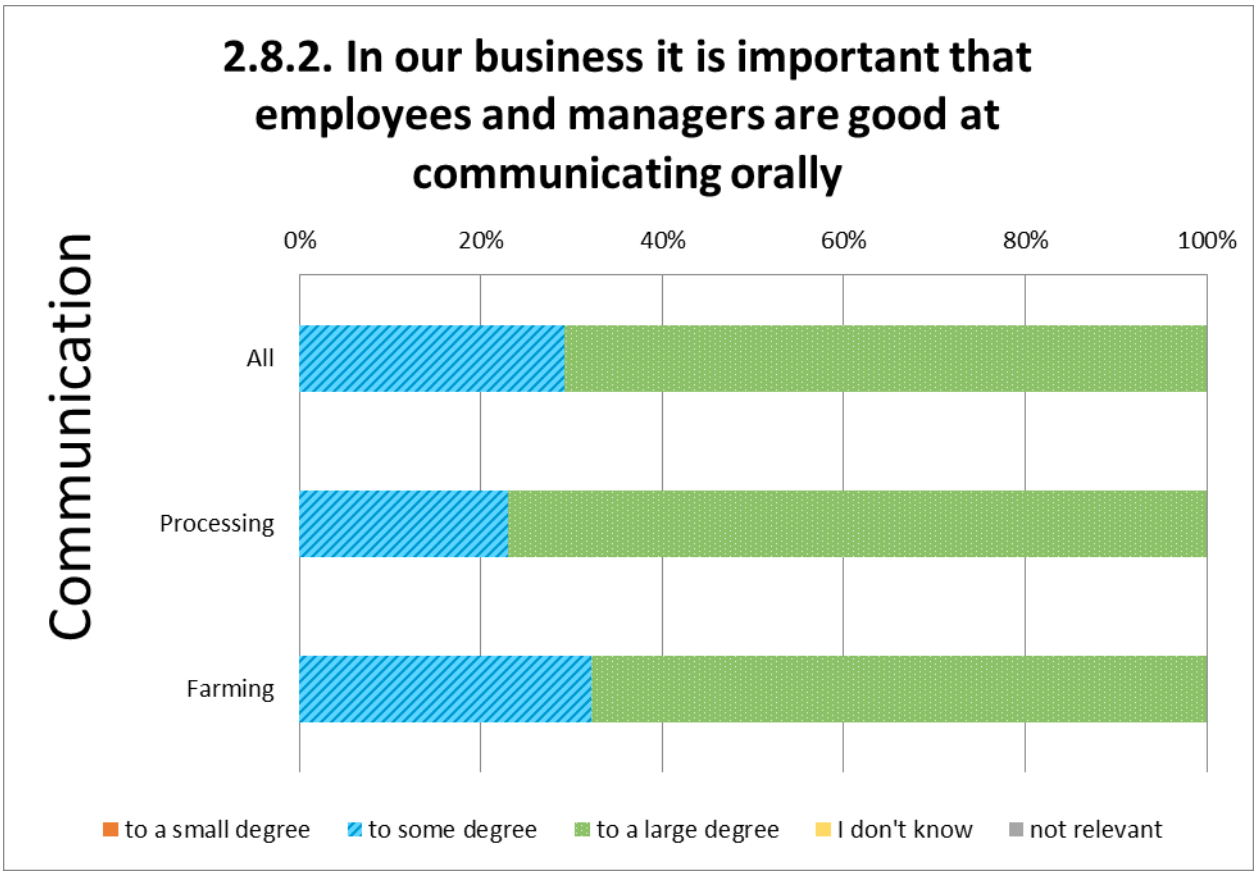


Figure 29: Skill 2.8.2. detailed comparison - processing vs farming

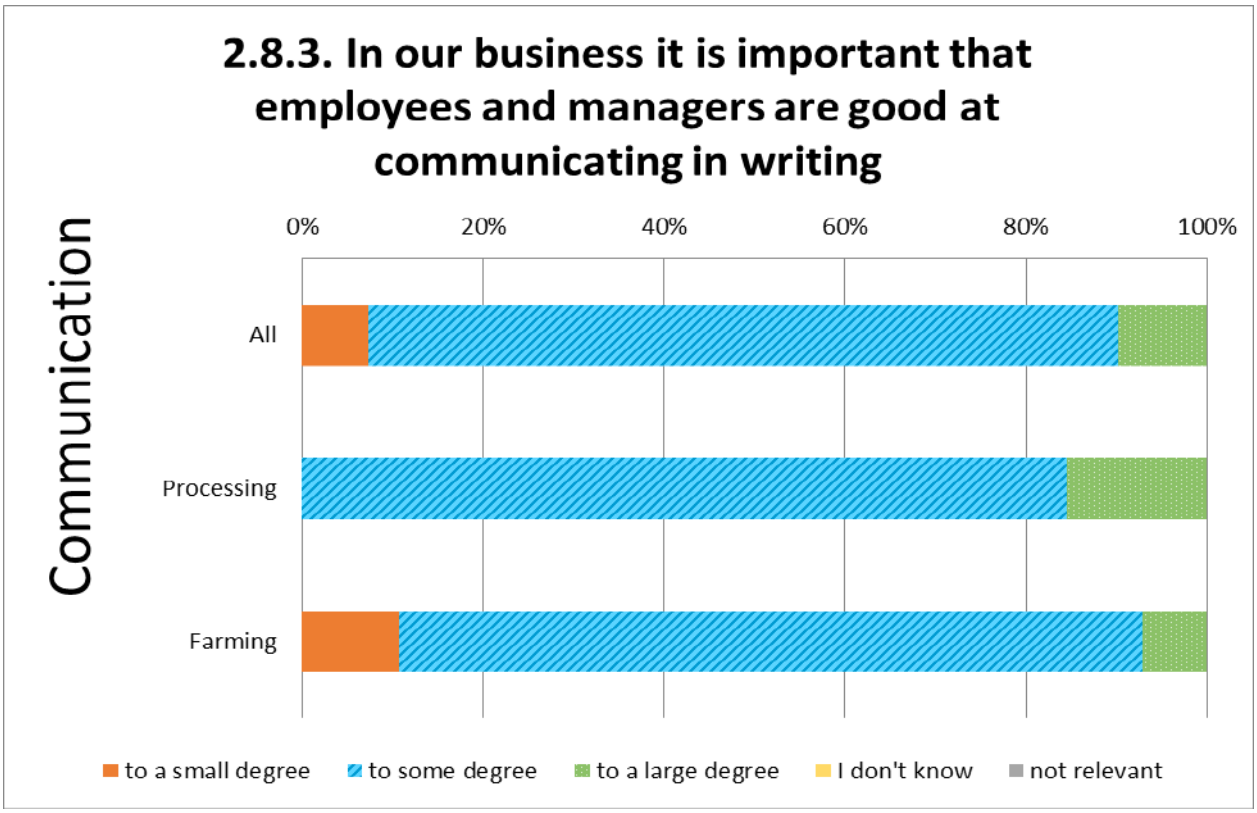


Figure 30: Skill 2.8.3. detailed comparison - processing vs farming

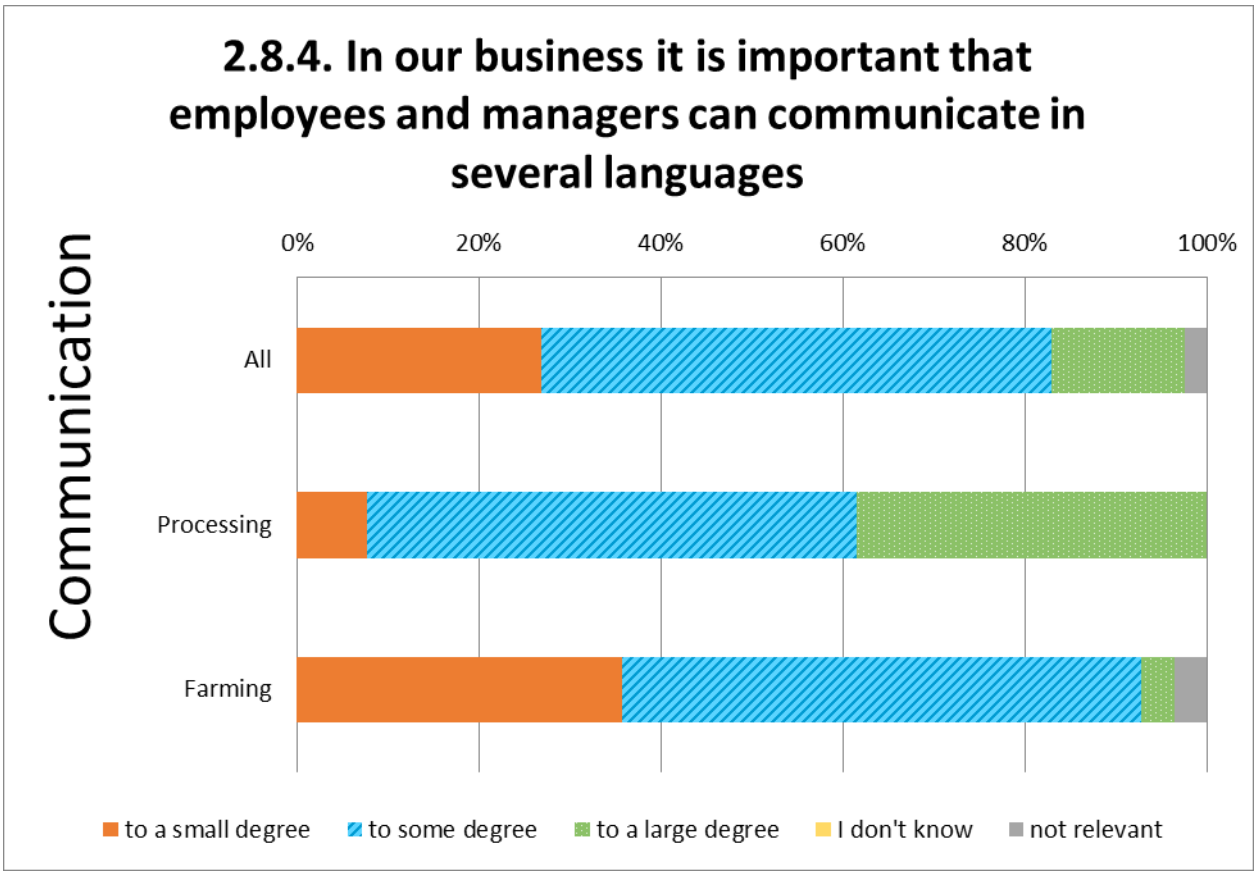


Figure 31: Skill 2.8.4. detailed comparison - processing vs farming

## Area 3: The company's recruitment needs

This chapter offers data related to the recruitment needs in the fish farming companies in Mid-Norway, and a number of factors in the society that are connected to the recruitment processes of new staff. These data help identifying key challenges for rural areas in the coastal zone. This type of data is not directly linked to how to organize aquaculture VET courses. They will, however, illustrate typical challenges, which costal rural areas face and help us to better understand why it is important to improve and deliver aquaculture VET courses to staff that are in full job in these areas.

Aquaculture companies' short-term recruitment needs and reasons for refusal of job offers are targeted in the first question:

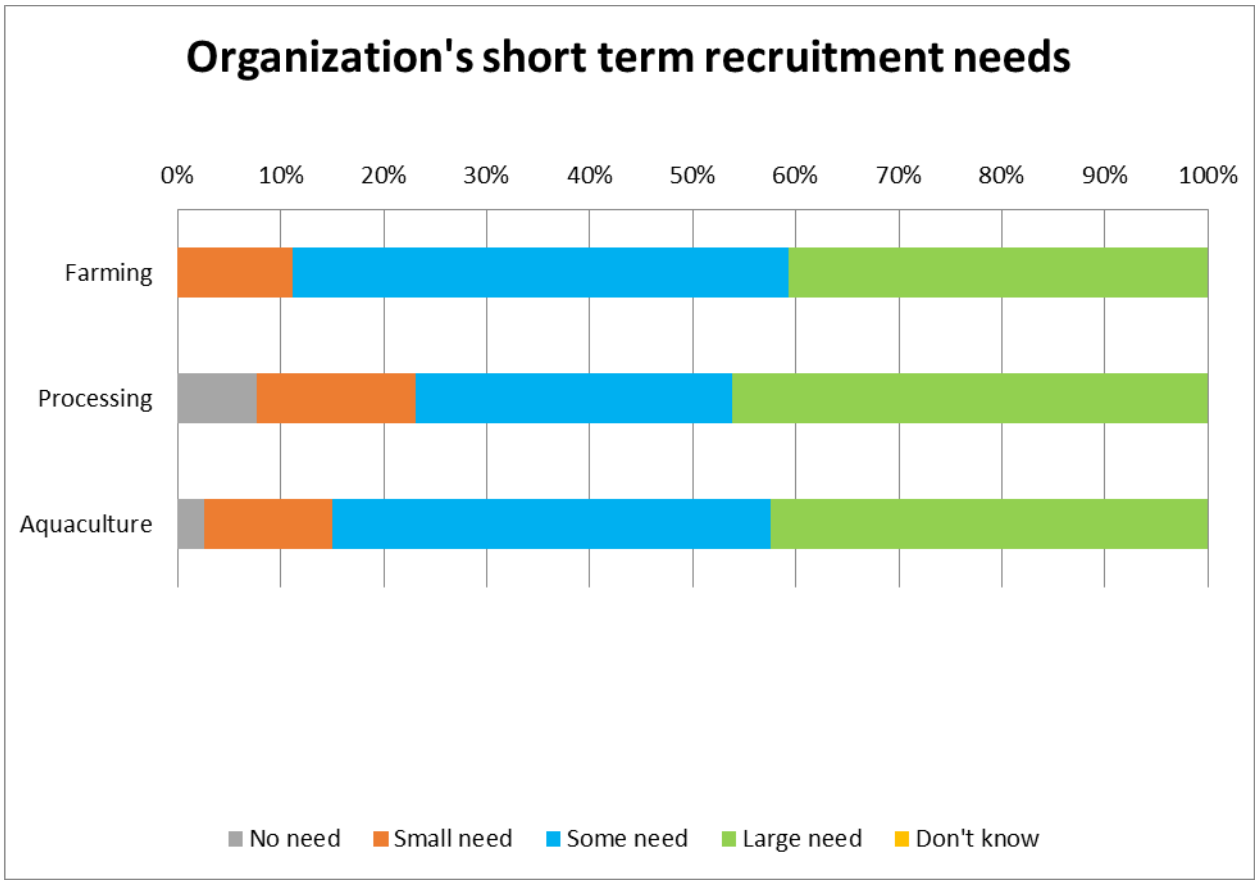


Figure 32: Short term recruitment needs

42.5% of the managers indicate that on short term their organization has a large need to recruit more people and another 42.5% have some need to recruit more people.

These results show that there is a significant shortage of workforce within the aquaculture industry today. This is a consequence of the fast expansion in the aquaculture industry during the recent years, whereby it has been necessary to recruit many more people to work in the fish-farming sector. Thus, VET activities as for example short specialist courses, must be offered more frequent compared to some years ago. Indeed, capacity building must support modern aquaculture VET programs in order to catch up and provide aquaculture qualifications to those who lack them.

## 3.1. Reasons to refuse job offers

The next statements aimed at investigating which are the reasons the companies' job offers are refused. The reasons have been categorized as follows:

3.1.1. Competition with other companies
3.1.2. Local job market
3.1.3. Education and training
3.1.4. Society related issues

### *3.1.1. Competition with other companies*

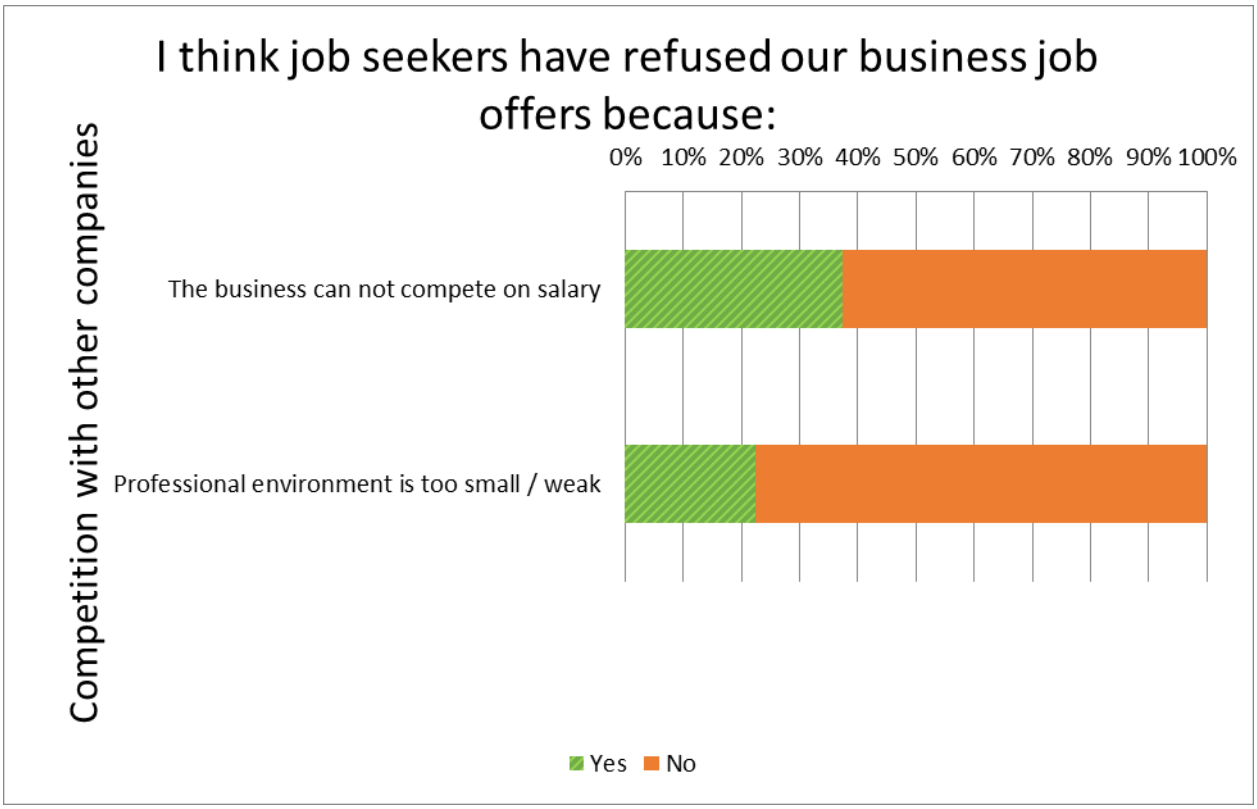


Figure 33: Job offer refusal – competition with other companies

A third of the managers have indicated lack of competitiveness with regards to salary as a reason to refuse job offers. One out of five indicate that the professional environment is too small or week as a reason.

Many of the managers work in the largest, global, fish farming companies established in Norway. The lack of competitiveness with regards to the level of salary needs to be further investigated, since the salaries for those working at the marine cages are high in these companies. For the processing part of the largest companies, the recruitment methods vary a lot. One of the companies recruits new staff by themselves, while the others use specialized recruitment companies.


Figure 34

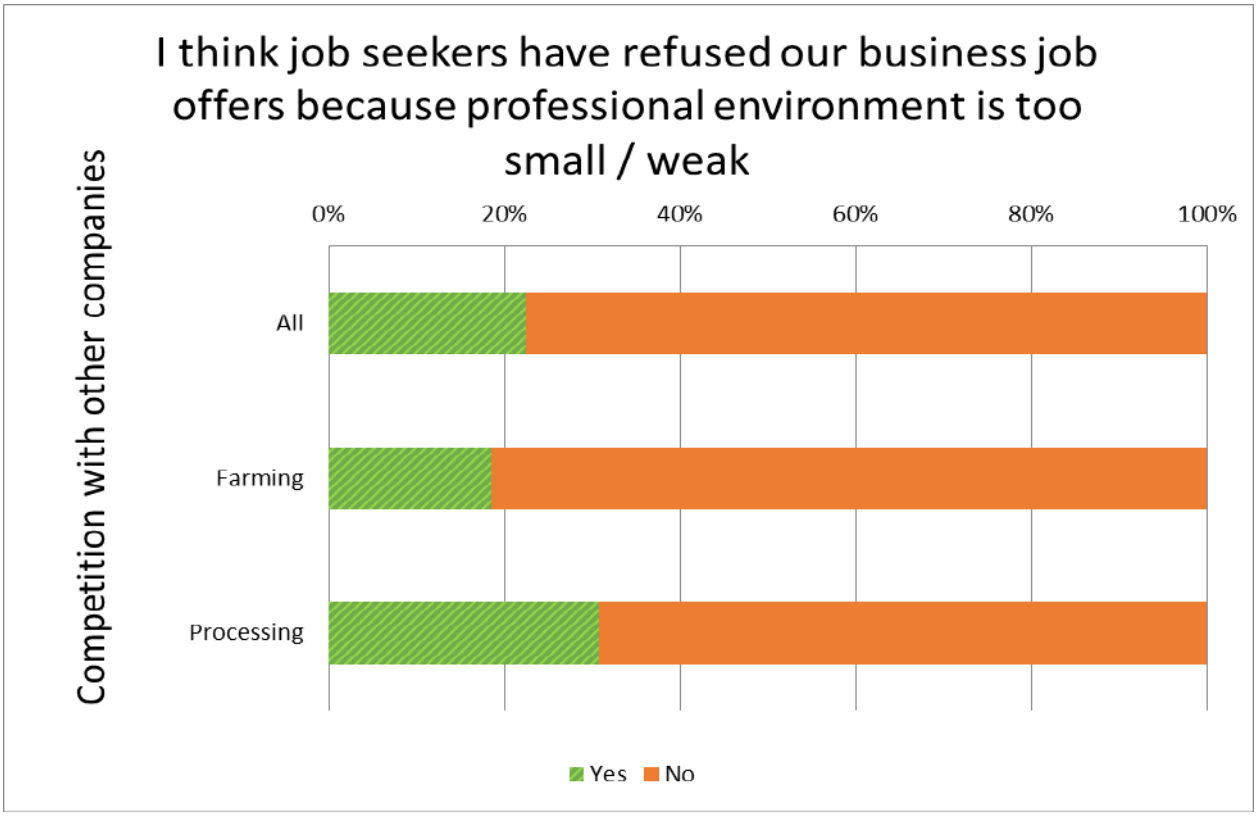


Figure 35

### *3.1.2. Local job market*

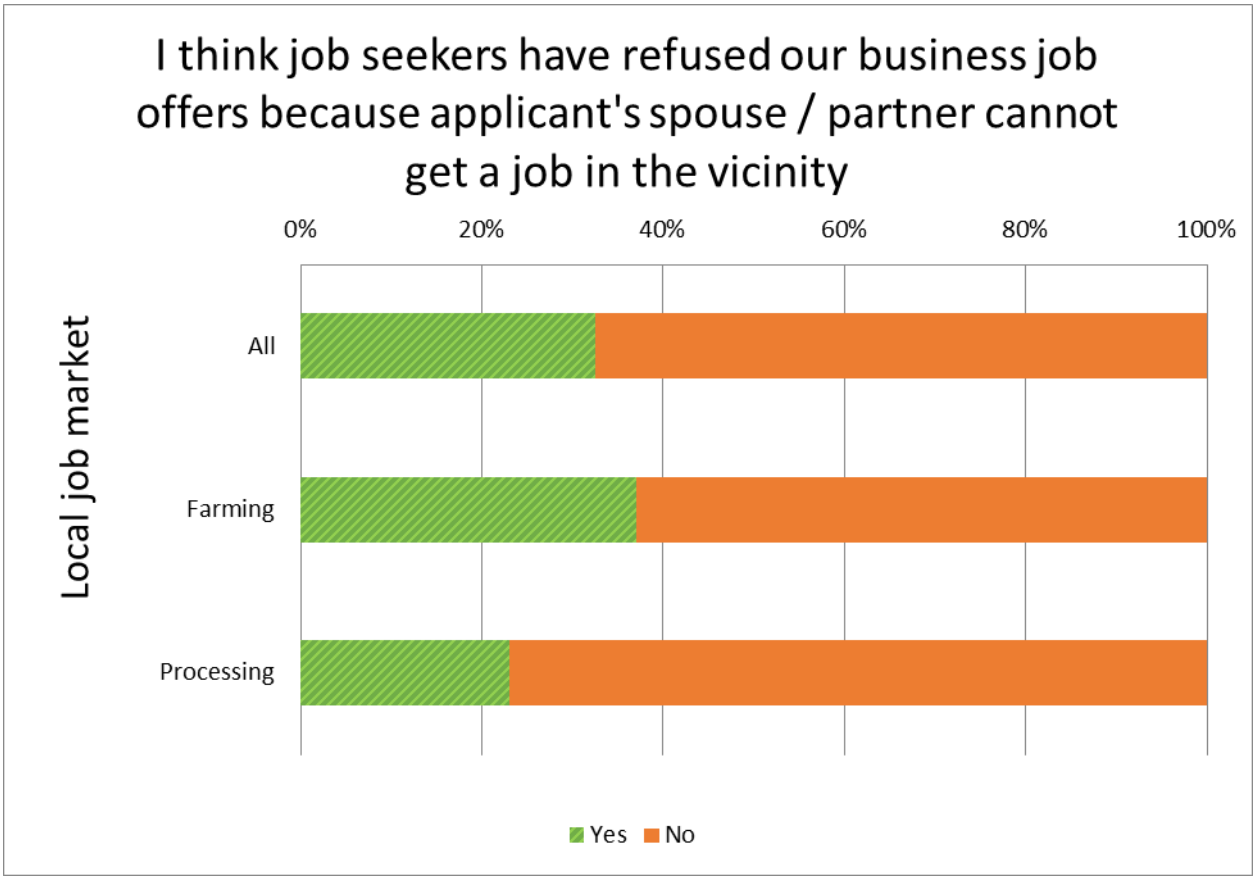


**Figure 36: Job offer refusal – local job market**

The aquaculture industry related production and processing operations take place in rural areas that are located in the coastal zone. A quarter of the managers mention the lack of job opportunities for spouse or partner as a reason to refuse the job offers in the aquaculture sector. The fish farming industry dominates in these rural areas and there are limited opportunities to get jobs in other sectors, e.g. the public administration in the municipalities.

Aquaculture VET courses cannot offer solutions to this challenge. It is, however, important to remember that aquaculture VET courses may strengthen the economy in the existing VET schools. Then these schools may get an opportunity to offer other types of VET programs in other areas. Thus, if the fish farming companies support the existing VET schools through aquaculture VET training, this may indirectly strengthen the capacity to offer VET training to other target groups that may want to work and live in the rural areas. Typical examples are education of health care workers, or people working with business administration.

### *3.1.3. Education and training*

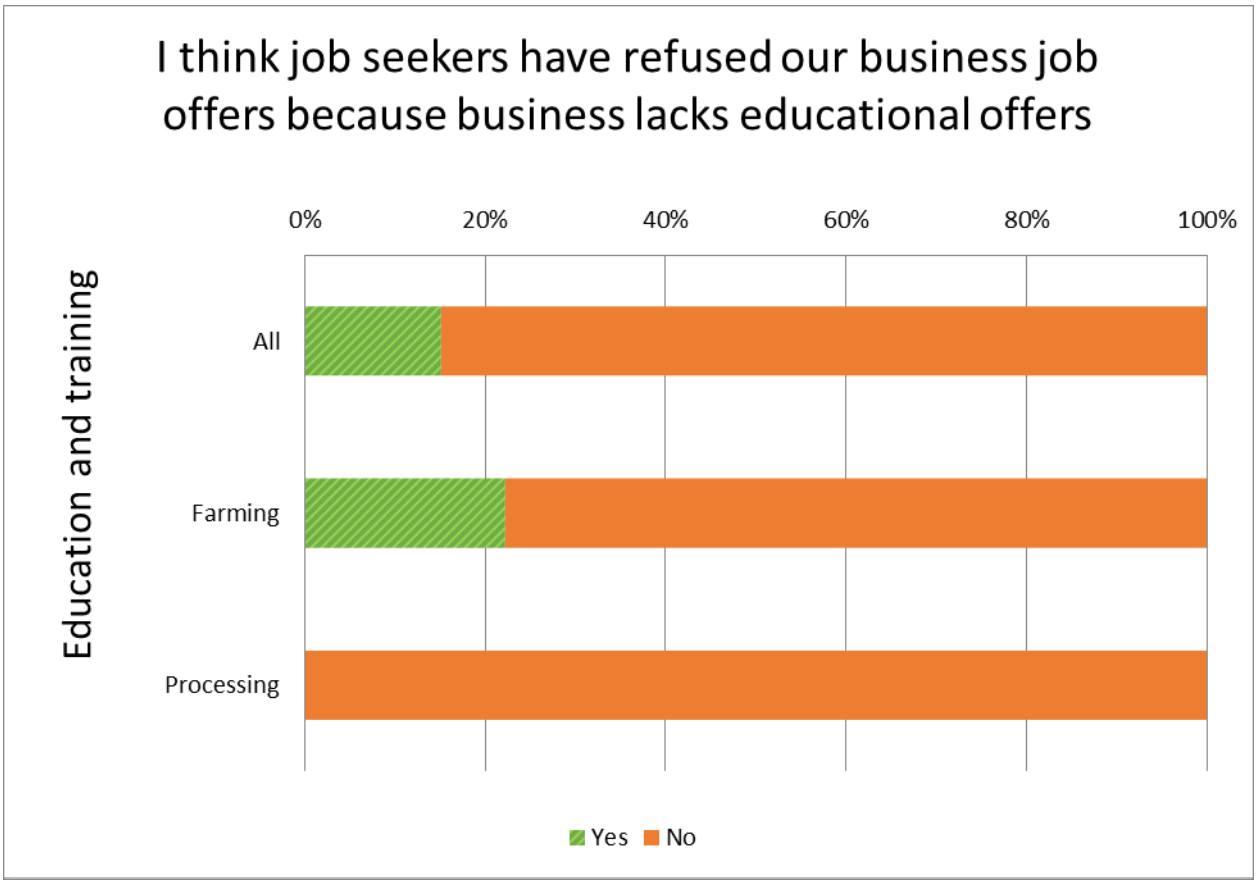


Figure 37: Job offer refusal due to lack of education and training

Approximately 15% of the managers report that lack of educational offers within the company as a potential reason for refusing a job offer.

Our data shows that lack of access to aquaculture VET courses is considered to be a relatively small challenge by the fish farming companies today. In 2014, a study made by SINTEF[5], showed that every second person in a Norwegian fish farming company lacked qualifications (Reference 1). In addition, SINTEF documented that skills based up on own work experiences were still supposed to be important during the next upcoming years in the fish farming industry. This attitude has not changed during the last three years.

[5] Stiftelsen for industriell og teknisk forskning (The Foundation for Scientific and Industrial Research) – is one of the largest independent research organizations in Europe and it has its main offices located in Trondheim, Norway.

### *3.1.4. Society related issues*


Figure 38: Job offer refusal – society related issues

36.6% of the managers consider the lack of housing as a reason for job offer refusal and 61% indicate as a reason the poor public transport services.

Fish farming industry cannot resolve these issues. These are complex problems that require involvement and cooperation between municipalities, county as well as private constructions companies.

It is still important to remember that current aquaculture VET practices in Mid-Norway often requires transportation of staff to the VET schools. This is an expensive solution for the companies. There are few or no alternative solutions regarding public transportation due to natural constrains like fjords, mountains, valleys, access to ferries and periods with bad weather. In the future, however, aquaculture VET courses may be more accessible and affordable if modern and flexible VET solutions included some e-learning.

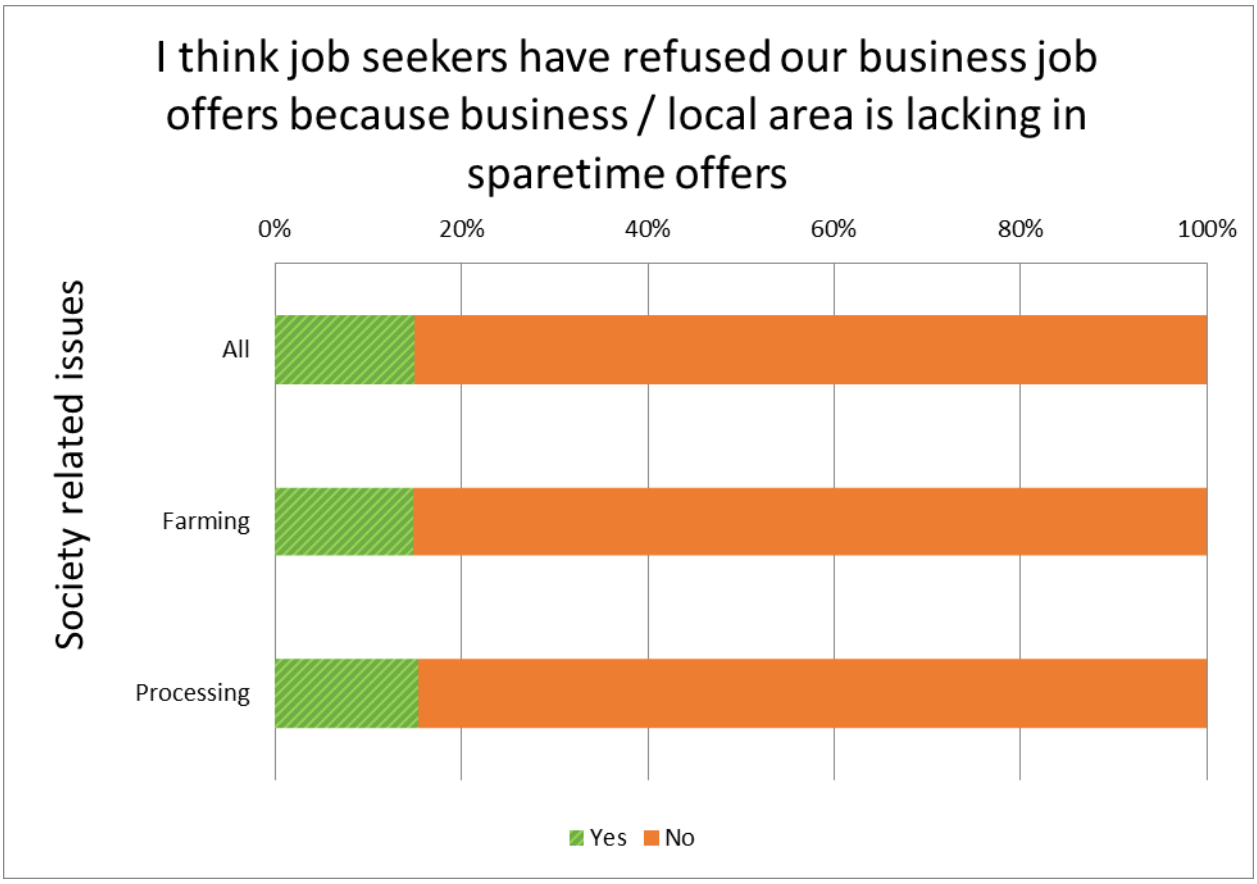
I think job seekers have refused our business job offers because business / local area is lacking in sparetime offers
0%
20%
40%
60%
80%
100%
Society related issues
All
Farming
Processing
Yes
No

Figure 39

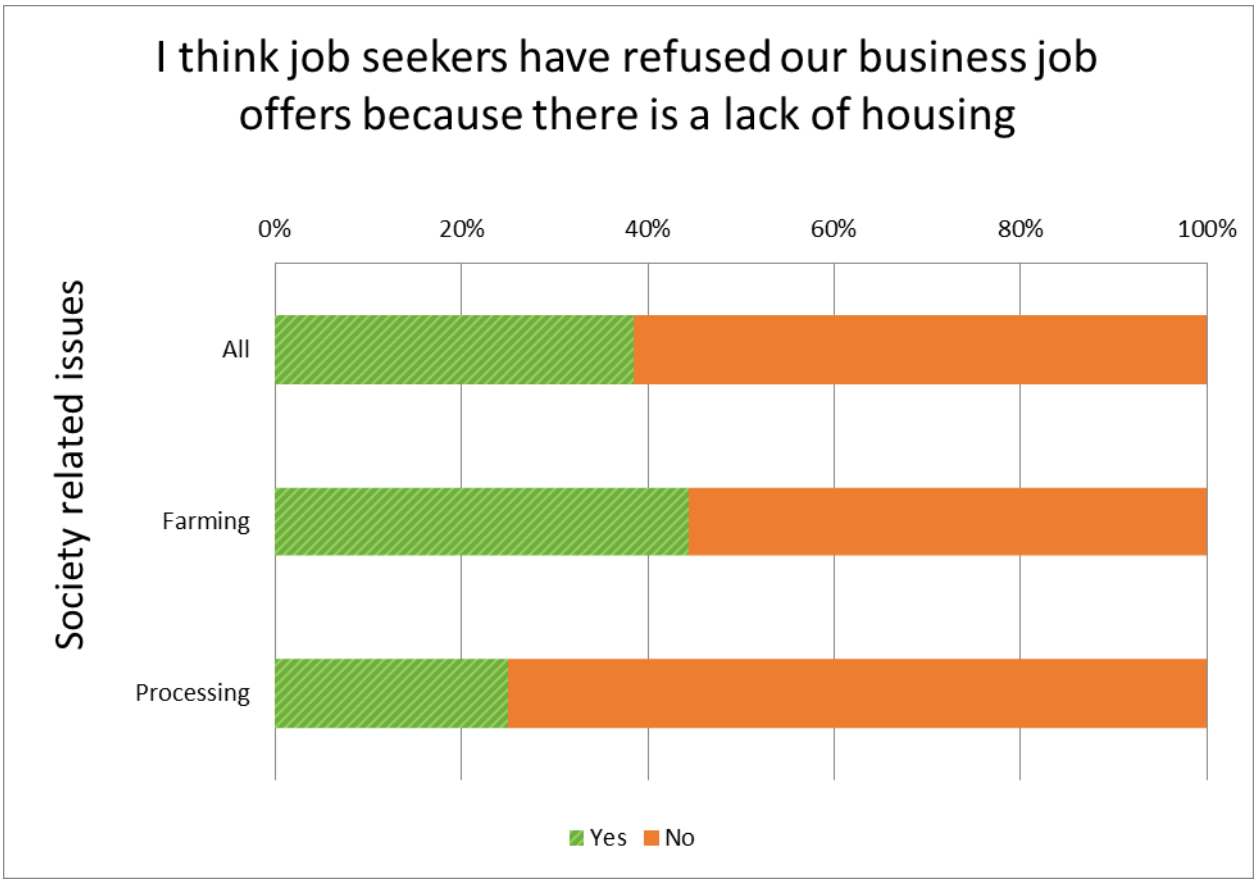
I think job seekers have refused our business job offers because there is a lack of housing
Society related issues
0%
20%
40%
60%
80%
100%
All
Farming
Processing
Yes
No

Figure 40

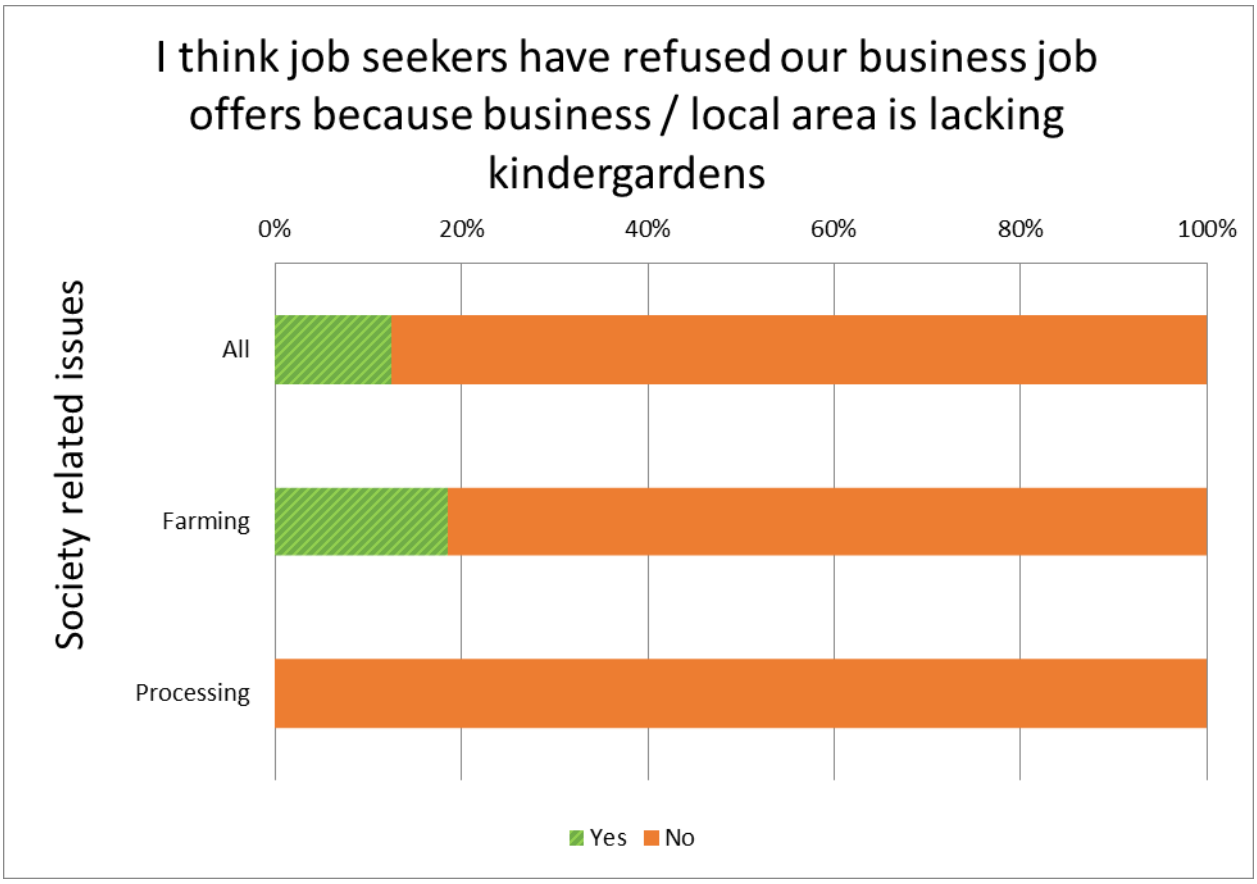
I think job seekers have refused our business job offers because business / local area is lacking kindergardens
0%
20%
40%
60%
80%
100%
Society related issues
All
Farming
Processing
Yes
No

Figure 41

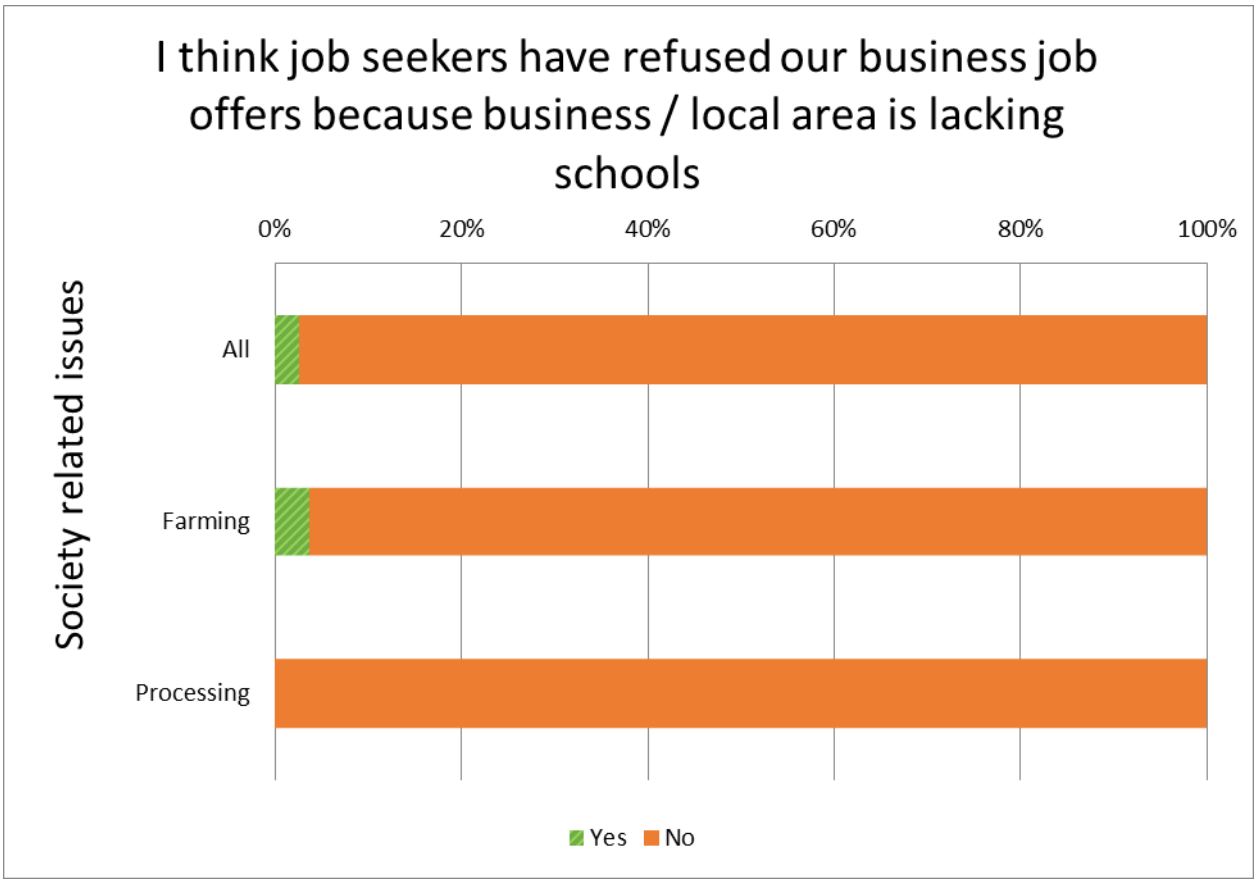


Figure 42

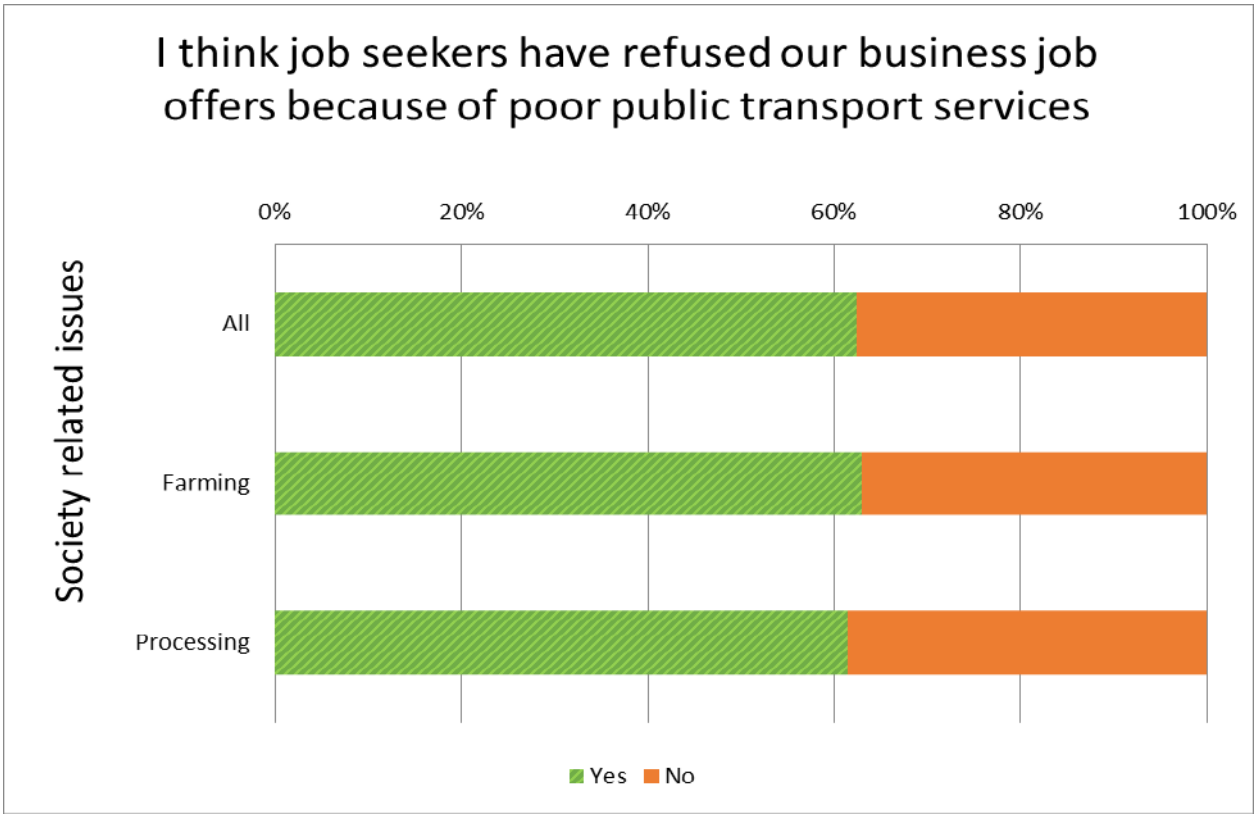


Figure 43

## 3.2. Retirement

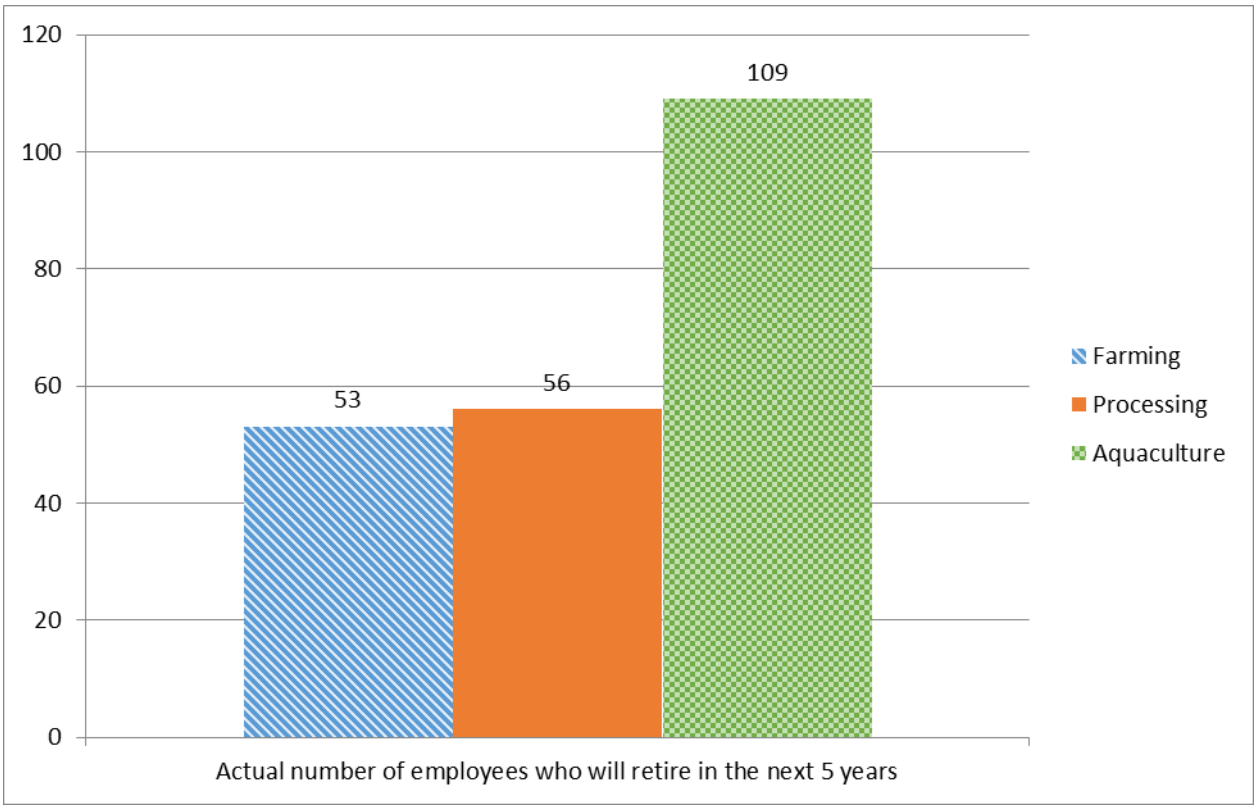


Figure 44: Number of personnel scheduled for retiring in the next 5 years

The Guri Kunna aquaculture VET school at Frøya, Mid-Norway, produces approximately 40 skilled workers per year. During the next 5 years they expect to educate approximately 200 persons with aquaculture qualifications. 27% of those students will be needed just to replace the farming staff that is going to retire (109 persons). The rest of the 144 students will be available on the working market to replace the people leaving due to various reasons (e.g. changing careers) and for the new recruitment positions if the industry is gong to keep on growing and expanding. Some of them may also be recruited by the processing industry, though the majority of the processing industry workers are recruited from abroad.

### 3.3. Shortage of skilled workforce and potential effects

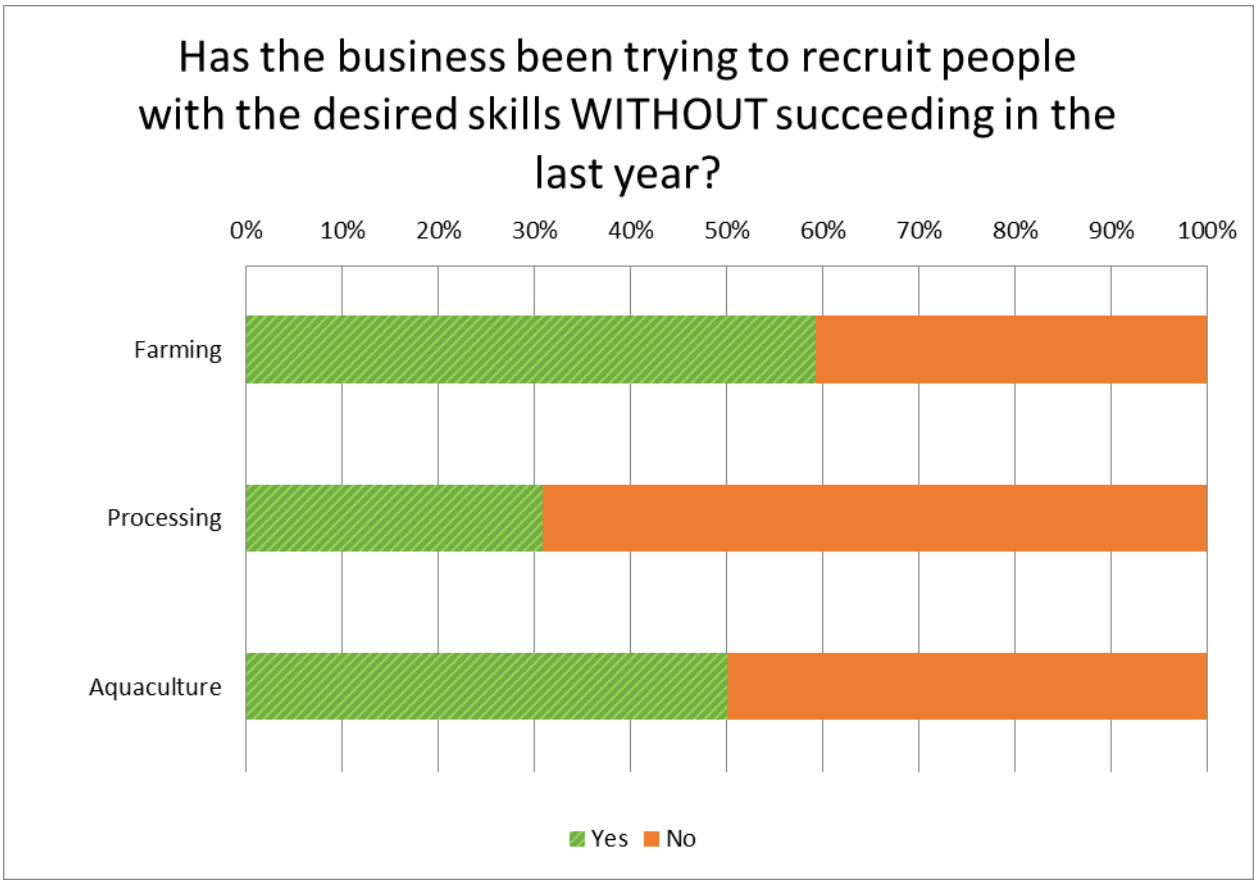


Figure 45: Failed recruitment of people with the desired skills

Half of the managers reported that their company tried without success to recruit people with aquaculture qualifications. The current aquaculture based VET school system is not able to produce the required amount of staff having the appropriate aquaculture qualifications, which today is required by the growing fish farming industry. It take 4 years to educate a person with appropriate aquaculture qualifications, whereby there will be lag in the public educational system when the industry grows fast. There are also other factors that might influence these, e.g. the number of personnel within industry that have got their aquaculture qualifications, whereby potentially further investigation is needed.

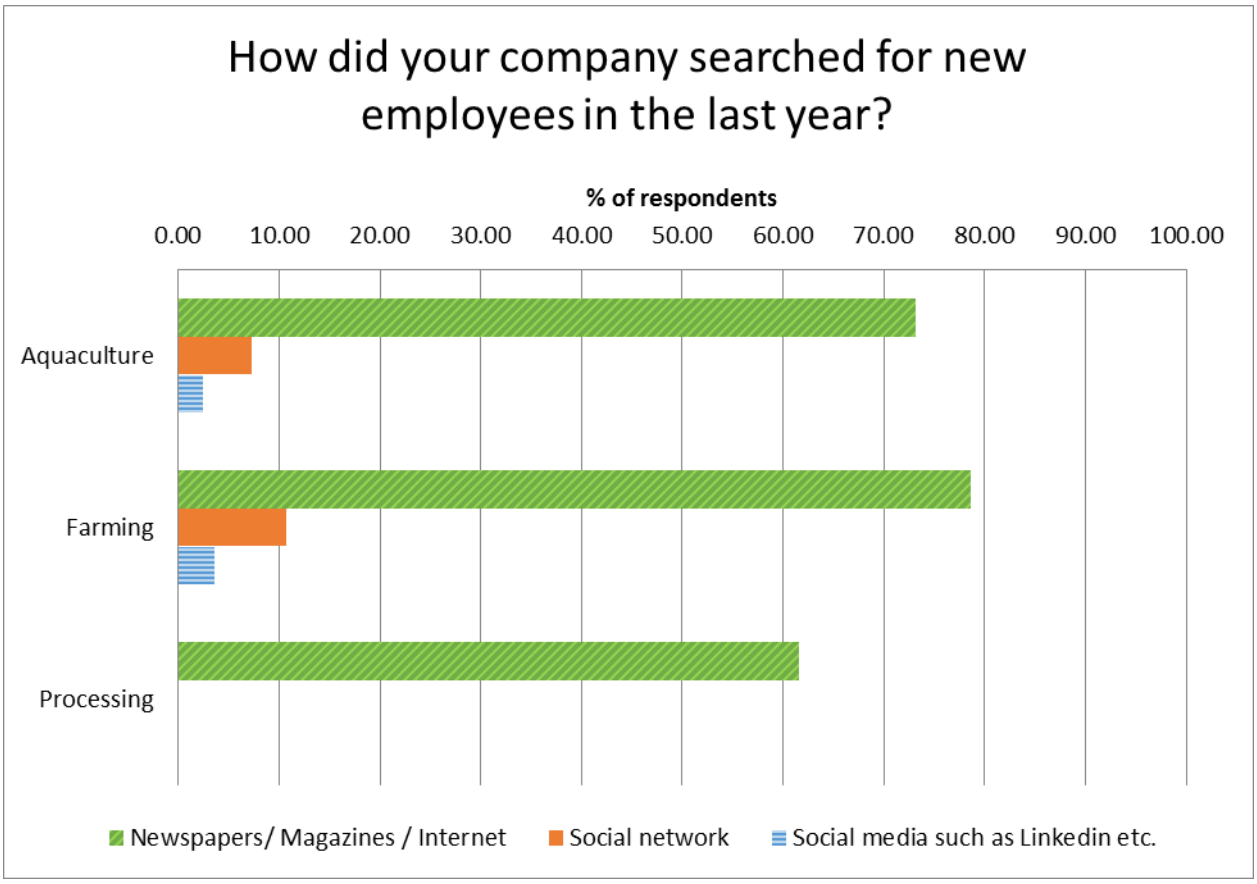


Figure 46: Methods to advertise new job positions

The aquaculture industry applies traditional channels when recruiting new personnel. They apply job advertisements in printed or online media. Only 2.5 % of the managers apply social media, while 7,4% tries to apply social networks.

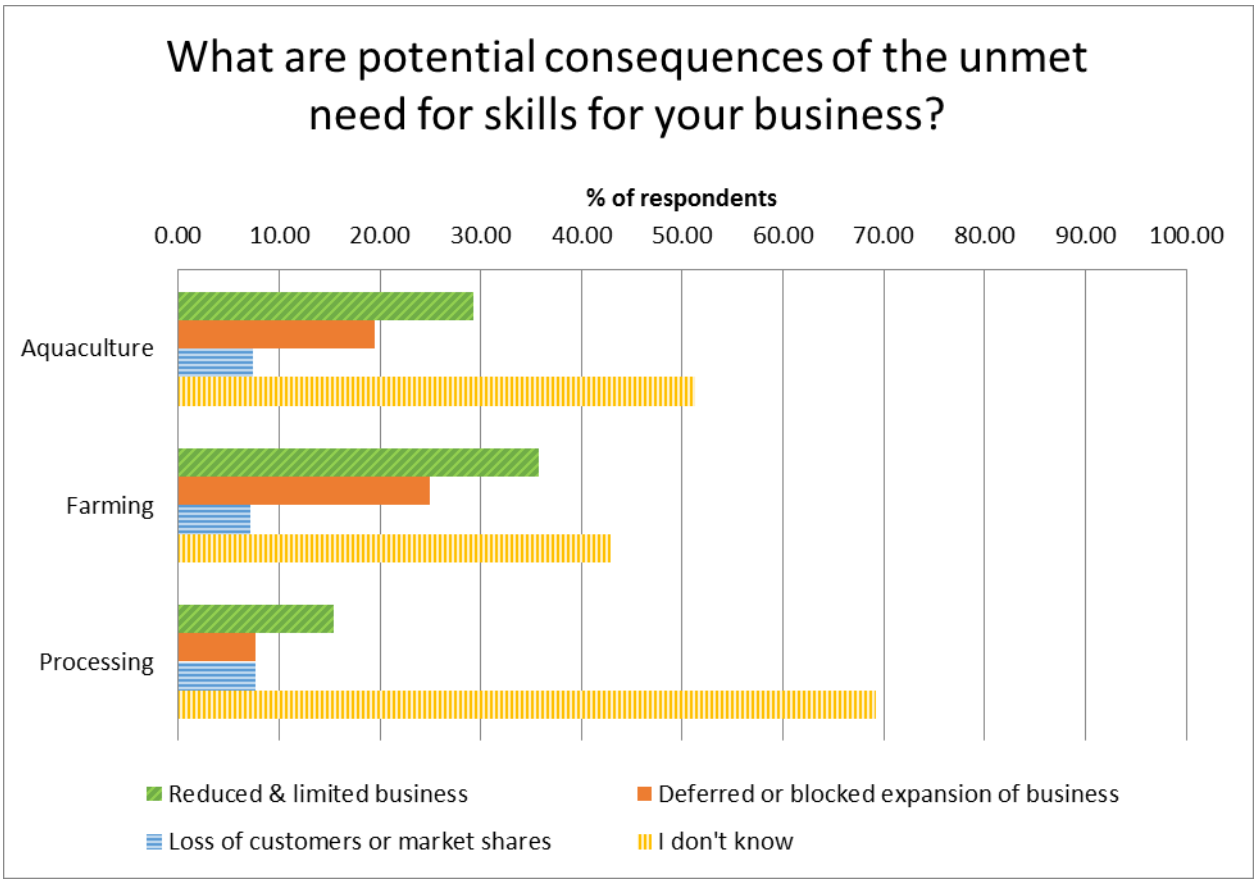


Figure 47: Effects of the shortage of skilled workforce

Over half of the managers abstain from indicating specific effects, as this is a quite complex issue. However about a third of them indicate that the consequences will be reduced and limited production and processing activities. 1 out of 5 managers replies that the shortage of employees with aquaculture qualifications will hinder or reduce the expansion of the production and processing capacities in their company. Only about 7% indicate that this can lead to loss of customers and/or market shares. Access to a modern aquaculture VET system that may educate personnel from industry, while they are in full job, is needed in order for the fish farming industry to keep growing. It is a key issue for 20% of the managers to get access to staff with appropriate aquaculture qualifications.

## Area 4: The company's future need for new competence

How does the fish farming companies' select their strategy for recruitment of staff that has got recognized aquaculture qualifications?

### 4.1. Recruitment strategy

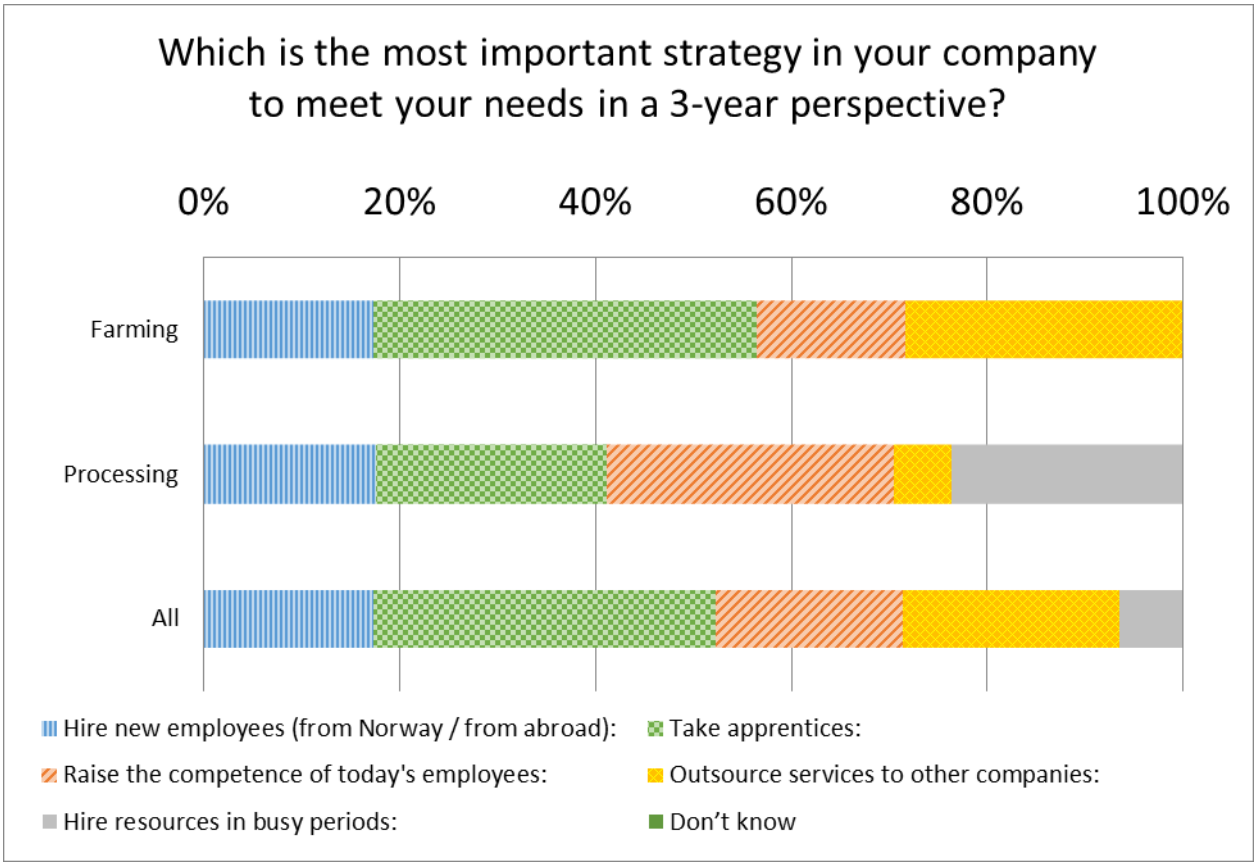


Figure 48: Aquaculture companies' recruitment strategies

Figure 20 displays the recruitment strategies that the fish farming companies apply. The managers report that 53% of the aquaculture industry applies the apprenticeship system as their most important strategy for recruitment of a workforce that has got their aquaculture qualifications. 1 out of 3 companies (34%) prefer to outsource work operations as their second most important strategy. This is even more important than raising the competence of their employees (29%) such that they get documented aquaculture qualifications, or hiring new employees (27%).

To recruit new staff through the apprenticeship system is an easy and safe operation. It often start by letting students during their first 2 years at the VET school, get some weeks with practice in the companies. If this works well, the students are offered a contract as apprentice for a period of 2 years. After passing the practical exam, they may start working as for instance husbandry staff.

Outsourcing is today a well-known strategy within the farming companies, which prefer to specialize on increasing their production of farmed salmon and trout. They apply it on many work operations,

whereby it seems to be applicable as their second most important ”recruitment strategy”, when they lack personnel with qualifications.

To raise the competence of their staff through aquaculture VET programs is the third most important strategy for recruitment of personnel with aquaculture qualifications. The importance of this strategy is at the same level as hiring new personnel.

By modernizing the aquaculture VET program there is a potential of raising the importance of the third most important recruitment strategy that is applied today.

## 4.2. Required Types of Vocational Education and Training

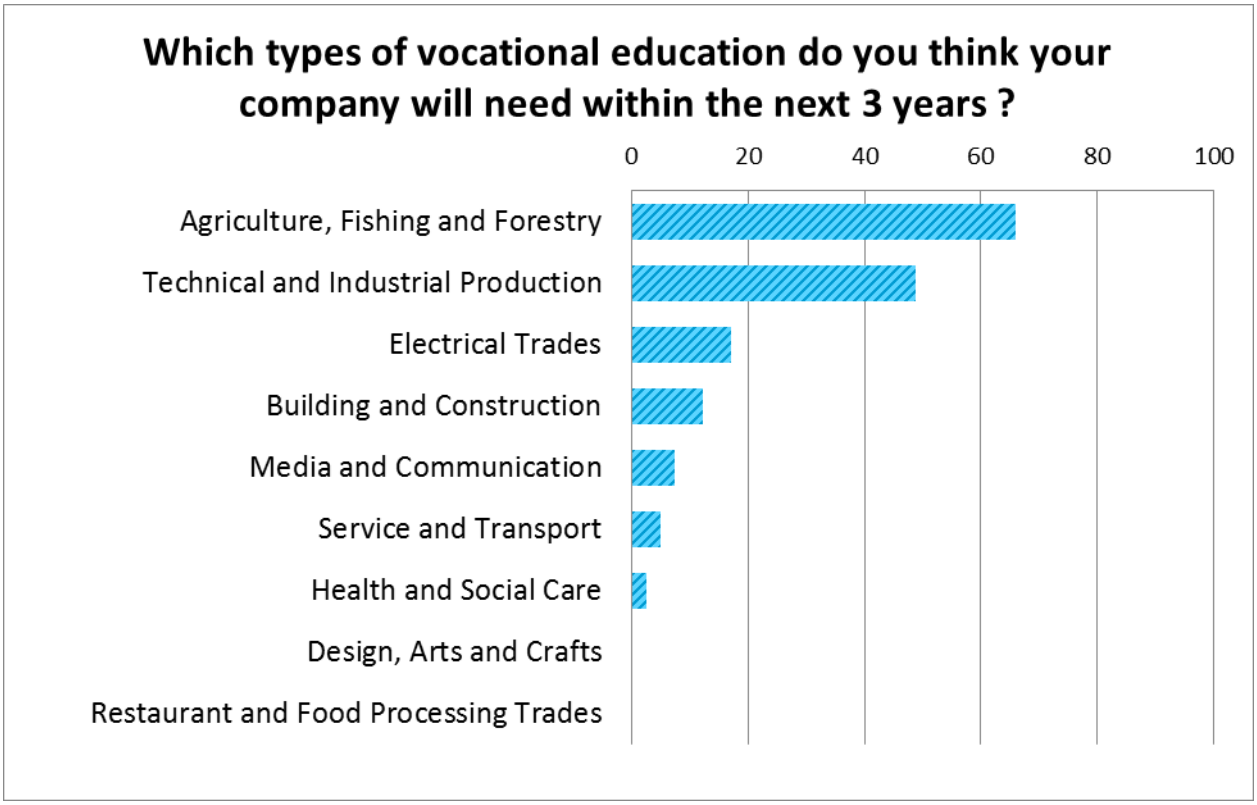


**Figure 49: There are 9 VET programs in Norway. The graph shows which competences that aquaculture companies need during the next 3 years measured in percentage.**

The two most important types of vocational education and training programs are aquaculture, which is part of the “agriculture, fishing and forestry” program (selected by 66% of the managers), and the “technical and industrial production” program selected by 49% of the managers.

To modernize the methods and tools applied within the aquaculture VET program, will help supporting these recruitment needs.

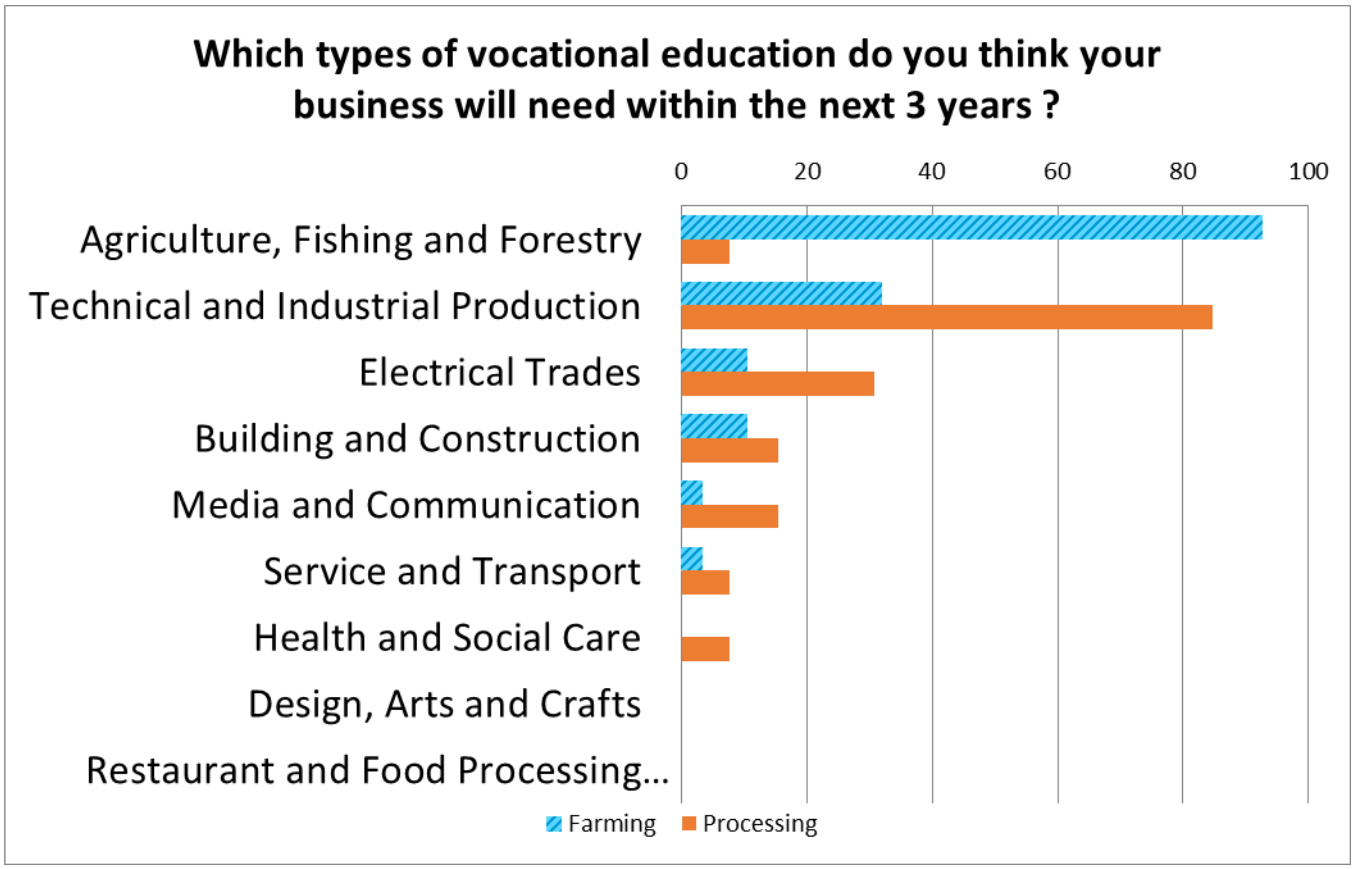
Which types of vocational education do you think your business will need within the next 3 years ?
0
20
40
60
80
100
Agriculture, Fishing and Forestry
Technical and Industrial Production
Electrical Trades
Building and Construction
Media and Communication
Service and Transport
Health and Social Care
Design, Arts and Crafts
Restaurant and Food Processing...
Farming
Processing

Figure 50

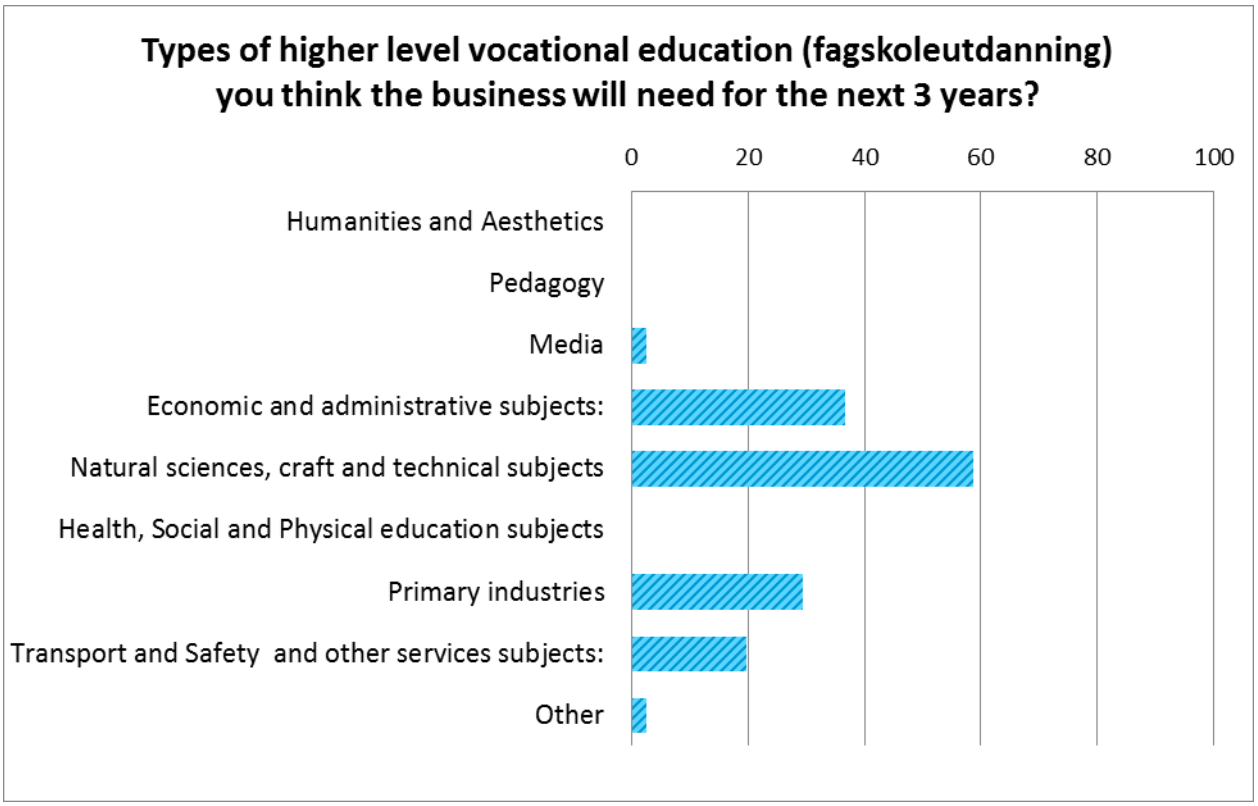


**Figure 51: The needed types of higher-level vocational education ("fagskoleutdanning" in Norwegian) measured in percentage**

"Fagskoleutdanning" is a level between the traditional VET programs and university education. Higher-level vocational education is requested by the aquaculture industry in 4 main areas: craft and technical knowledge, economy and administration, primary industries and transport and safety. These skills are not directly linked to aquaculture knowledge and skills. These types of personnel will typically offer supporting activities during the production and processing working activities.

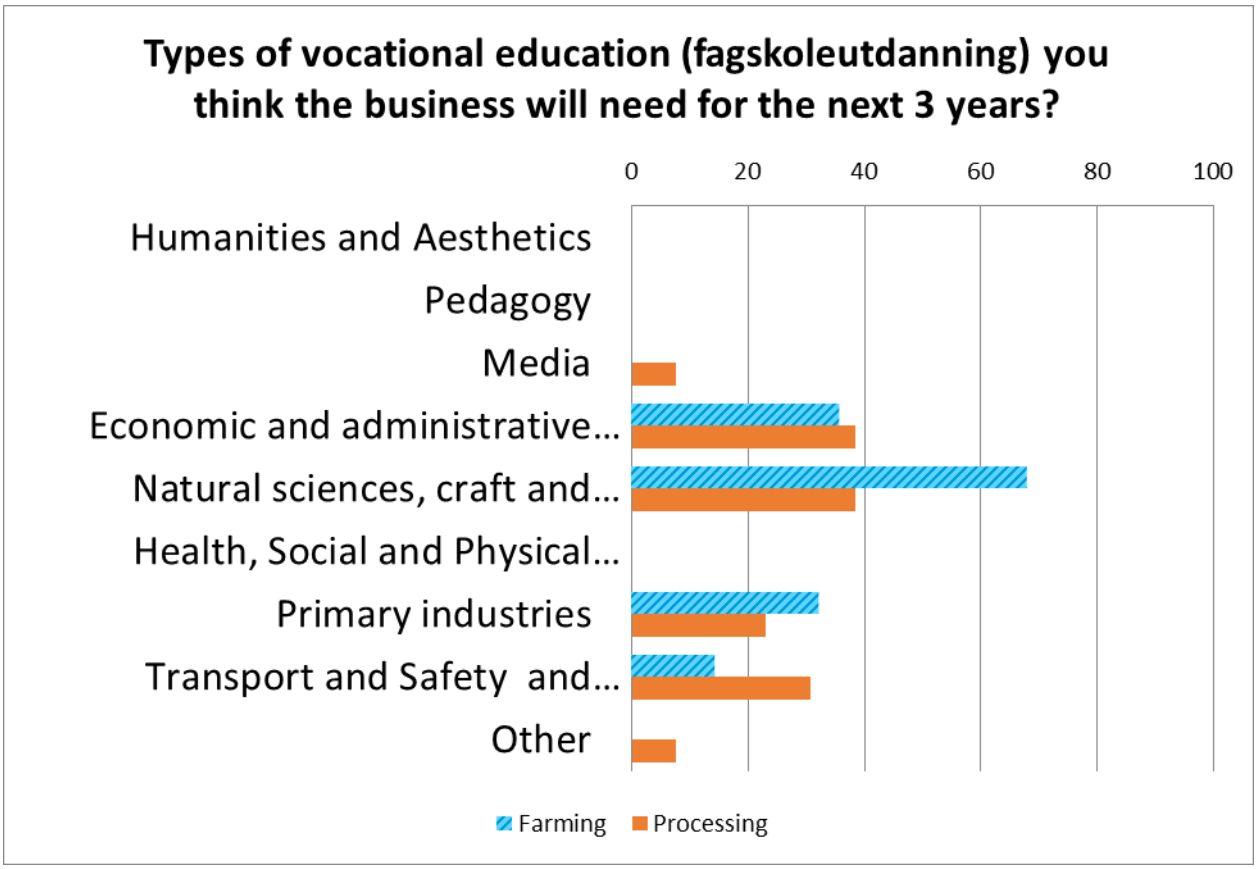
Types of vocational education (fagskoleutdanning) you think the business will need for the next 3 years?
0
20
40
60
80
100
Humanities and Aesthetics
Pedagogy
Media
Economic and administrative...
Natural sciences, craft and...
Health, Social and Physical...
Primary industries
Transport and Safety and...
Other
Farming
Processing

Figure 52

## 4.3. Types of training activities

### *4.3.1. Short Term Training*

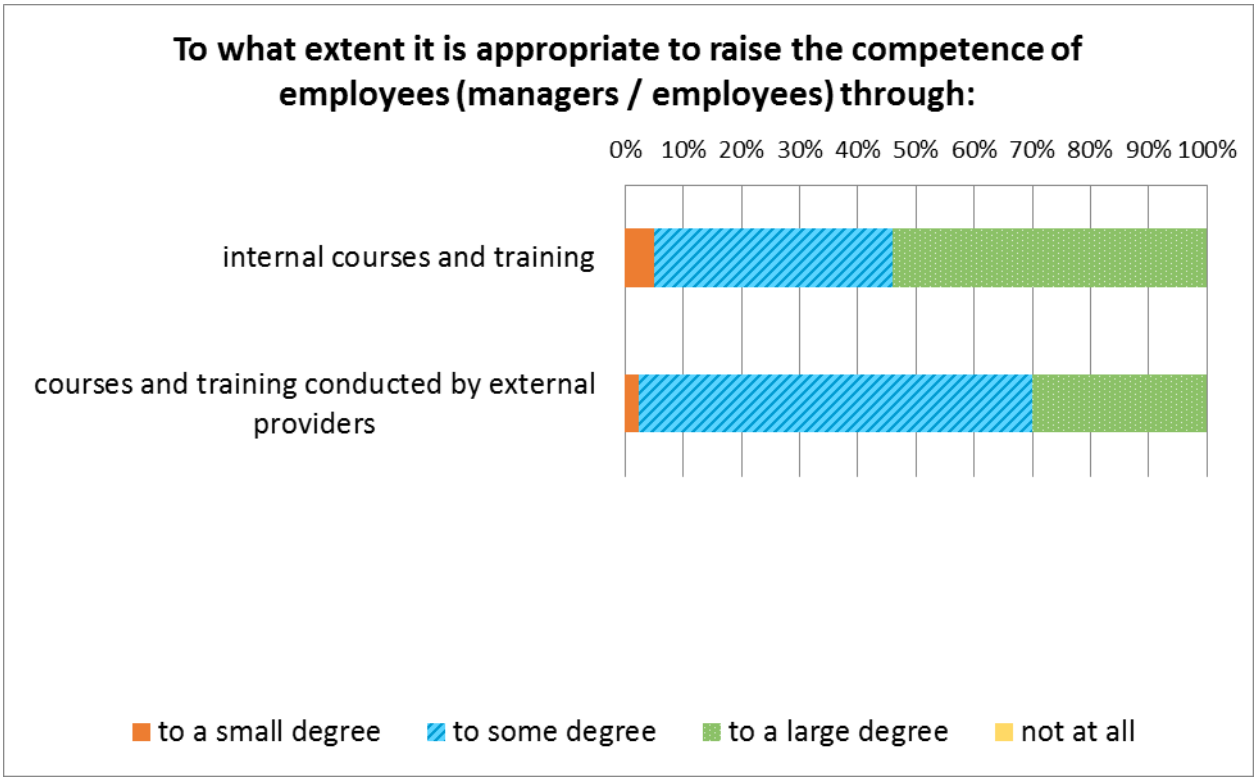


Figure 53: Needs for short term training activities

Short courses must often be provided based up on a legislation process. One or several of the 3 directorates that are regulating bodies in Norway, have regulated the fish farming industry market by making certain courses compulsory. Such courses could be from one to a few days long. Typical examples are driver licenses for boats, operating cranes, fish welfare courses etc.

For short time training activities, are internal courses and training an important mean of increasing the competence of the workforce as selected by over half of the managers. Experienced staff will support and train the staff that has less experience. 30% of the managers select external courses and training from external providers as the most important area, while 2 out of 3 prefer to engage external providers “now and then”.

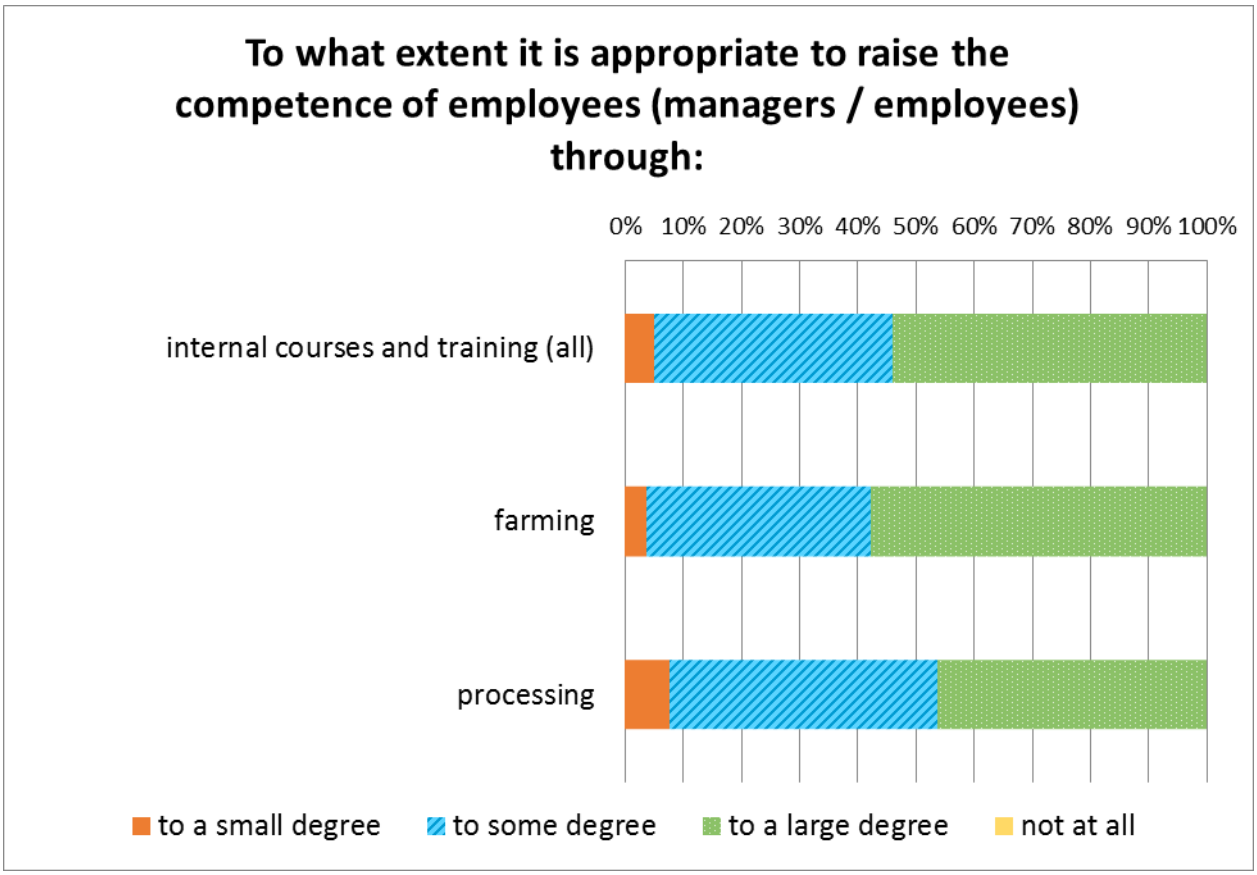
To what extent it is appropriate to raise the competence of employees (managers / employees) through:
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
internal courses and training (all)
farming
processing
to a small degree
to some degree
to a large degree
not at all

Figure 54

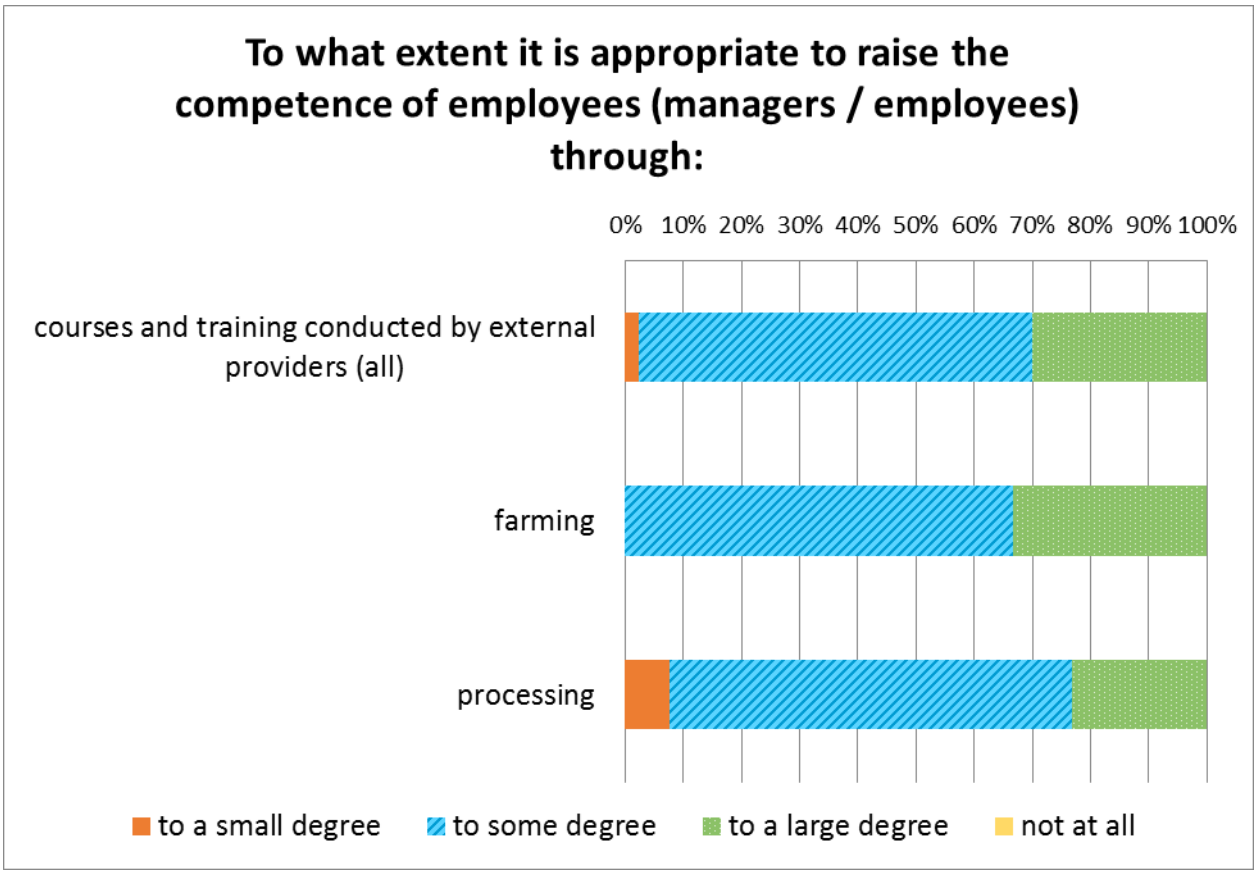
To what extent it is appropriate to raise the competence of employees (managers / employees) through:
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
courses and training conducted by external providers (all)
farming
processing
to a small degree
to some degree
to a large degree
not at all

Figure 55

### *4.3.2. Long Term Training*

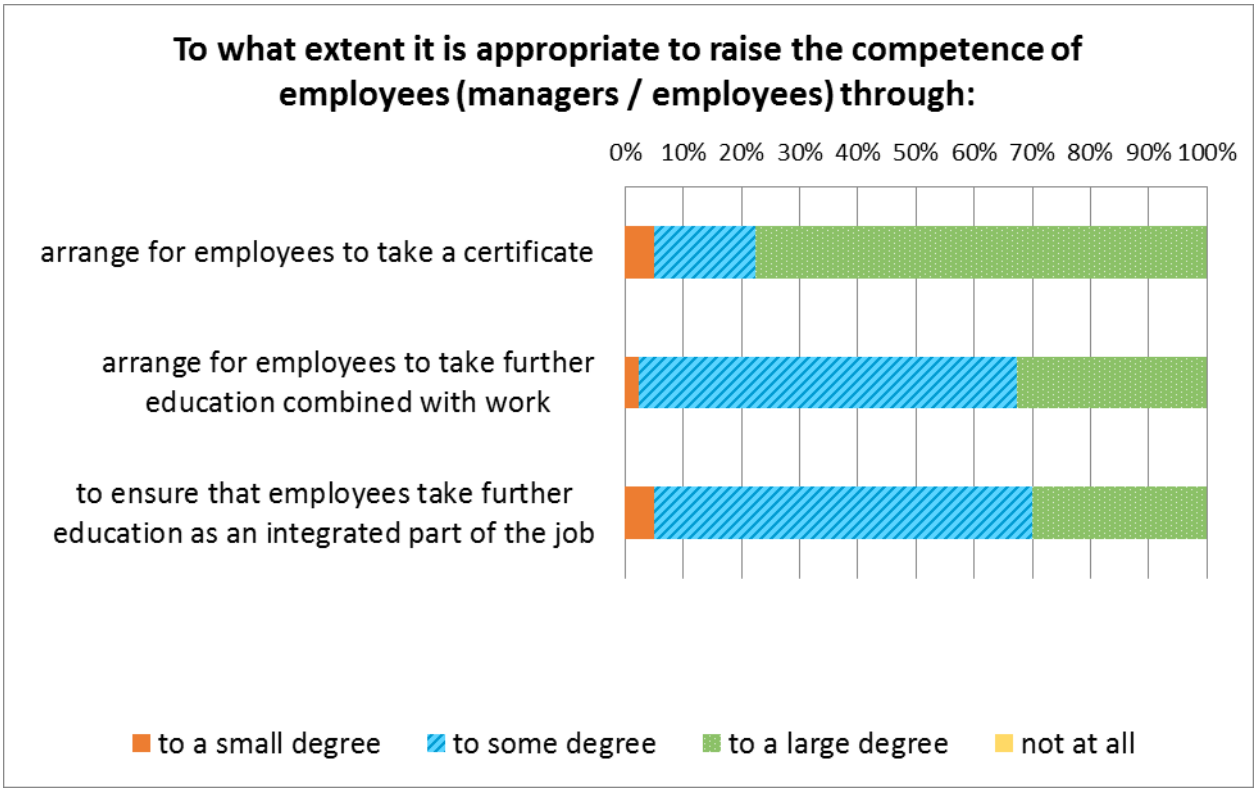


Figure 56: Needs for long term training activities

VET courses offered to industry that leads to national recognized qualifications, have a strong position in the industry market in Norway. More than 75% of the managers claim that their companies to a large degree support long-term training leading to a national recognized journeyman certificate. It provides a wide scope of basic set of skills on which companies can rely for a broad range of their working activities. Candidates that have got this journeyman aquaculture certificate may work in several types of work operations and activities within the fish farms, making them attractive for companies where the activities to some extent follow the season. The quietest time is the winter period from January to March.

1 out of 3 companies makes to a large degree arrangement at the company level such that their staff may take a journeyman certificate when they are in full job. The rest of the companies claim that they do it to some degree. The last graph shows that the companies want their staff to study to a journeyman certificate as an integrated part of their job.

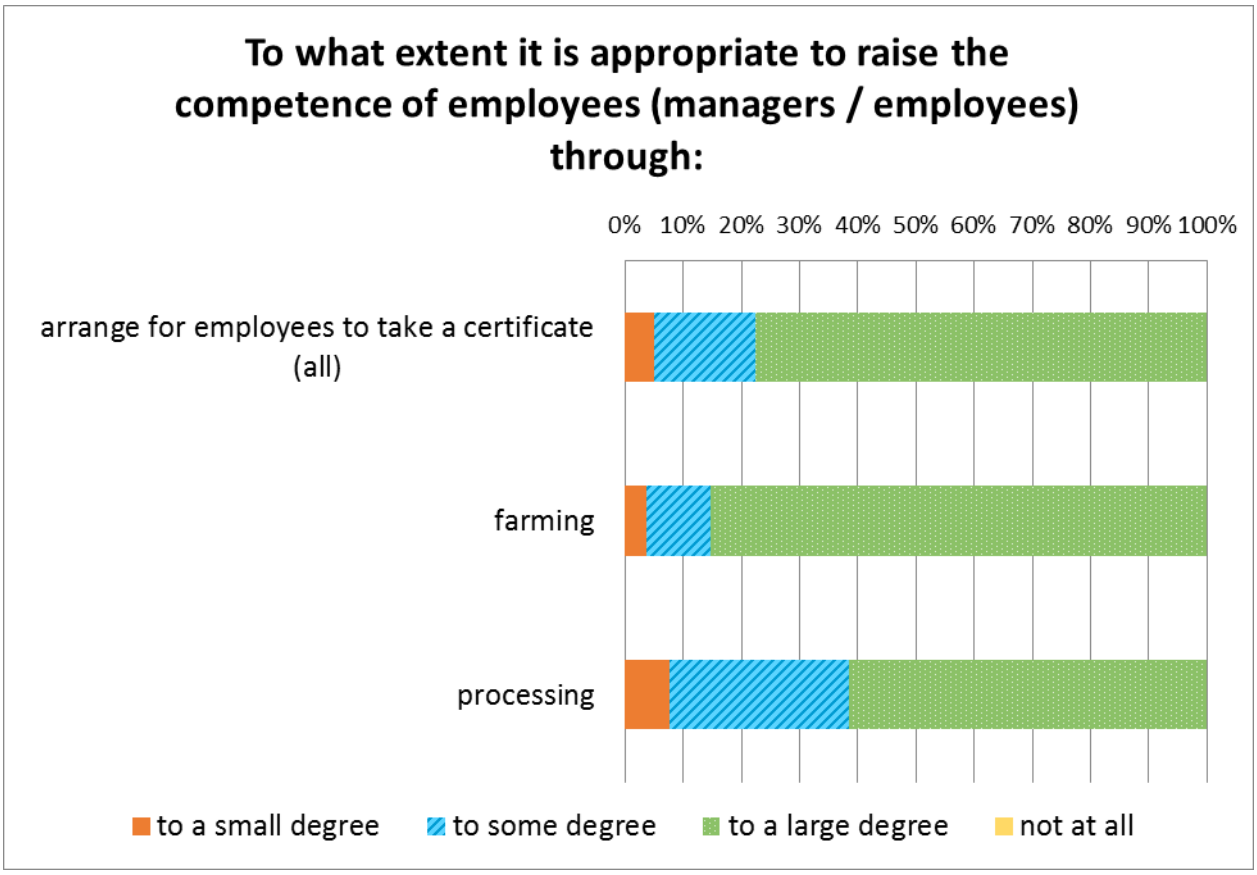
To what extent it is appropriate to raise the competence of employees (managers / employees) through:
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
arrange for employees to take a certificate (all)
farming
processing
to a small degree
to some degree
to a large degree
not at all

Figure 57

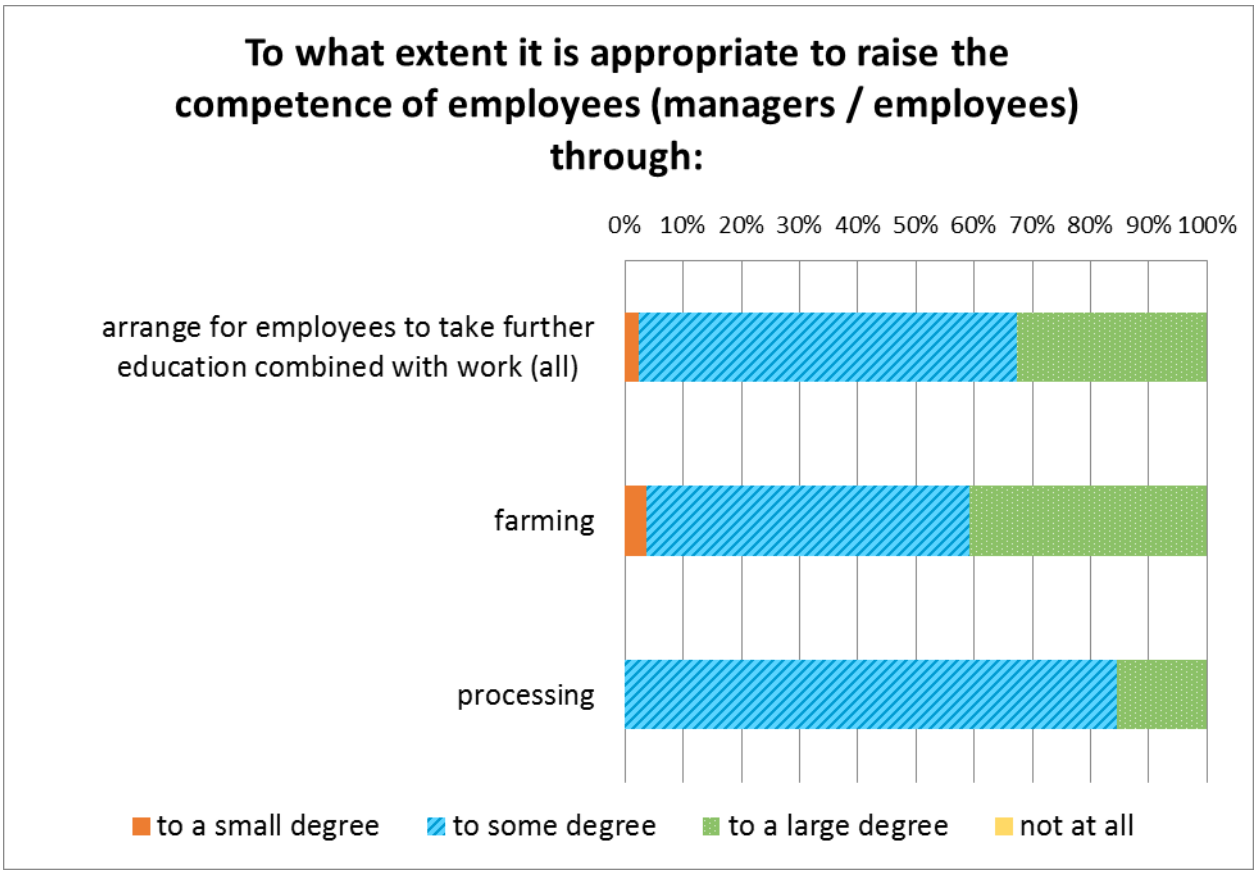
To what extent it is appropriate to raise the competence of employees (managers / employees) through:
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
arrange for employees to take further education combined with work (all)
farming
processing
to a small degree
to some degree
to a large degree
not at all

Figure 58

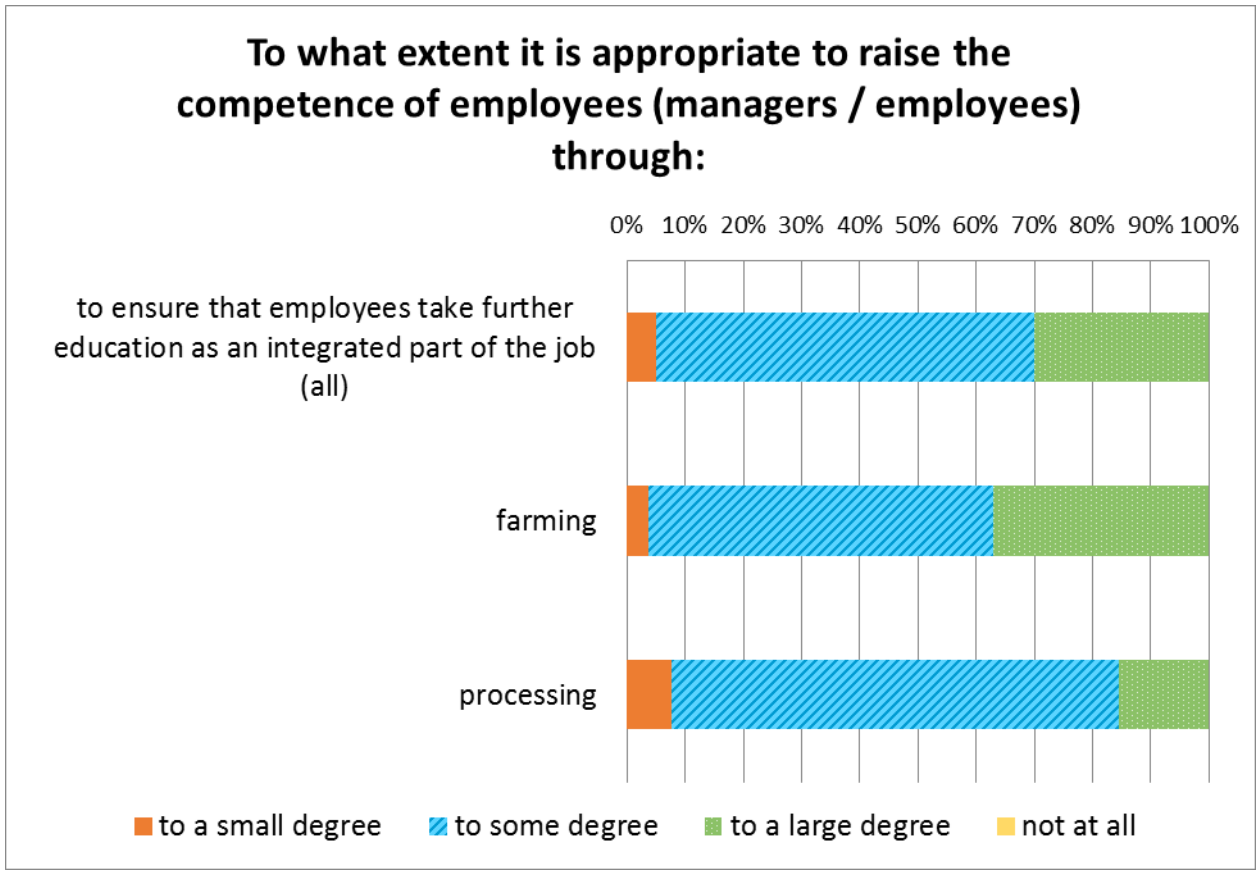


Figure 59

## 4.4. Areas Which Require Improvement of Skills

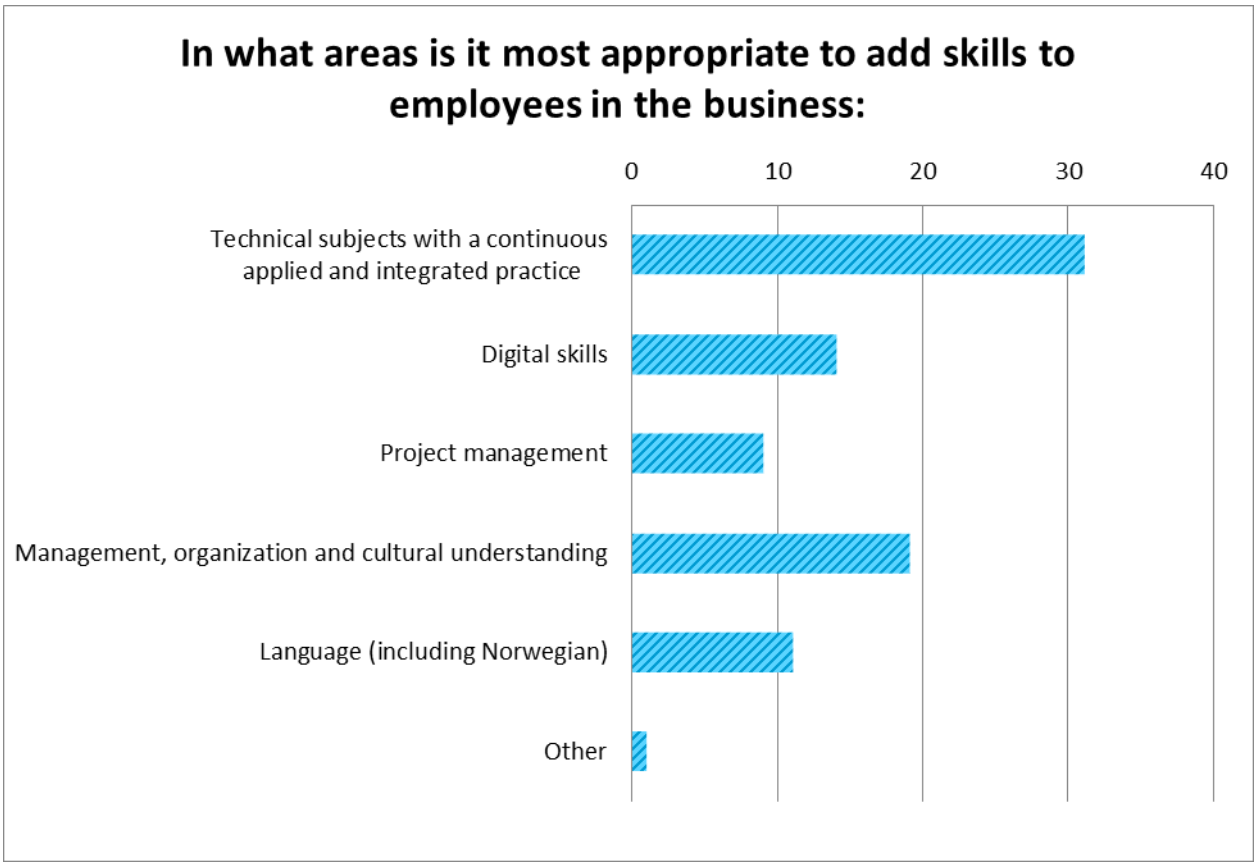


Figure 60: Areas which require improvement of skills of the employees

31 out of 41 managers (75%) report that courses addressing "Technical subjects with a continuous applied and integrated practice" are the most important ones. This reflects the needs in an industry characterized by fast technological developments. This is followed by courses leading to a "management, organization and cultural understanding" as the second most important area, selected by 19 out of 41 managers (46%), reflecting that the industry has become an international actor. For instance, on a daily basis the industry has to handle logistics involving a large number of lorries and staff from many different countries work together at the processing plants to produce the salmon or trout's. 14 of the 41 managers (34%) report that the digital skills of the employees should be enhanced, which is consistent with the number of managers indicating that digital skills are important (section 2.7.). The reason is that ICT is applied to control and operate a lot of the fish farming equipment and operations. 11 of the 41 managers (27%) mention that language training is important. The working language inside the companies is Norwegian, whereby the foreign staff needs to get trained to speak and read that language. 9 out of 41 managers (22%) mention that project management is an important area.

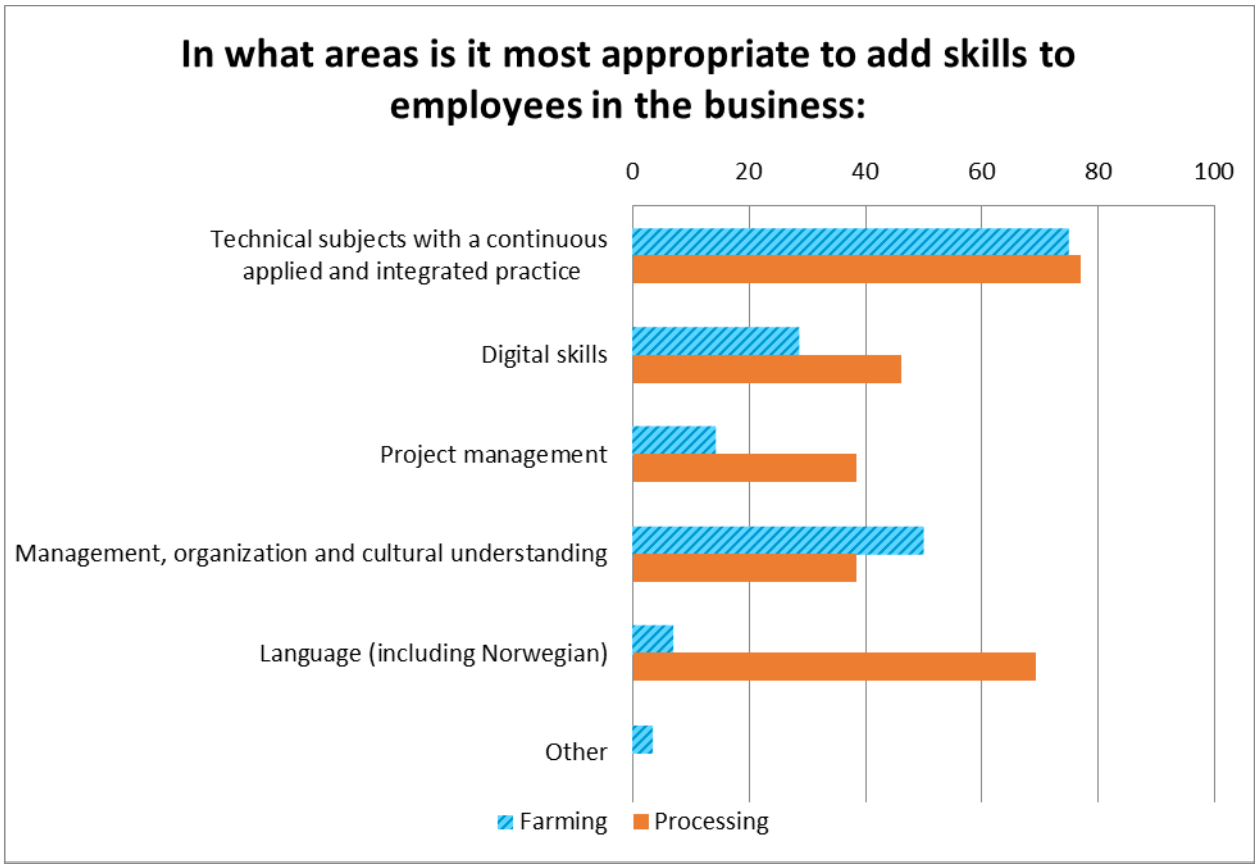


Figure 61

## 4.5. Types of Engineering Education Needed

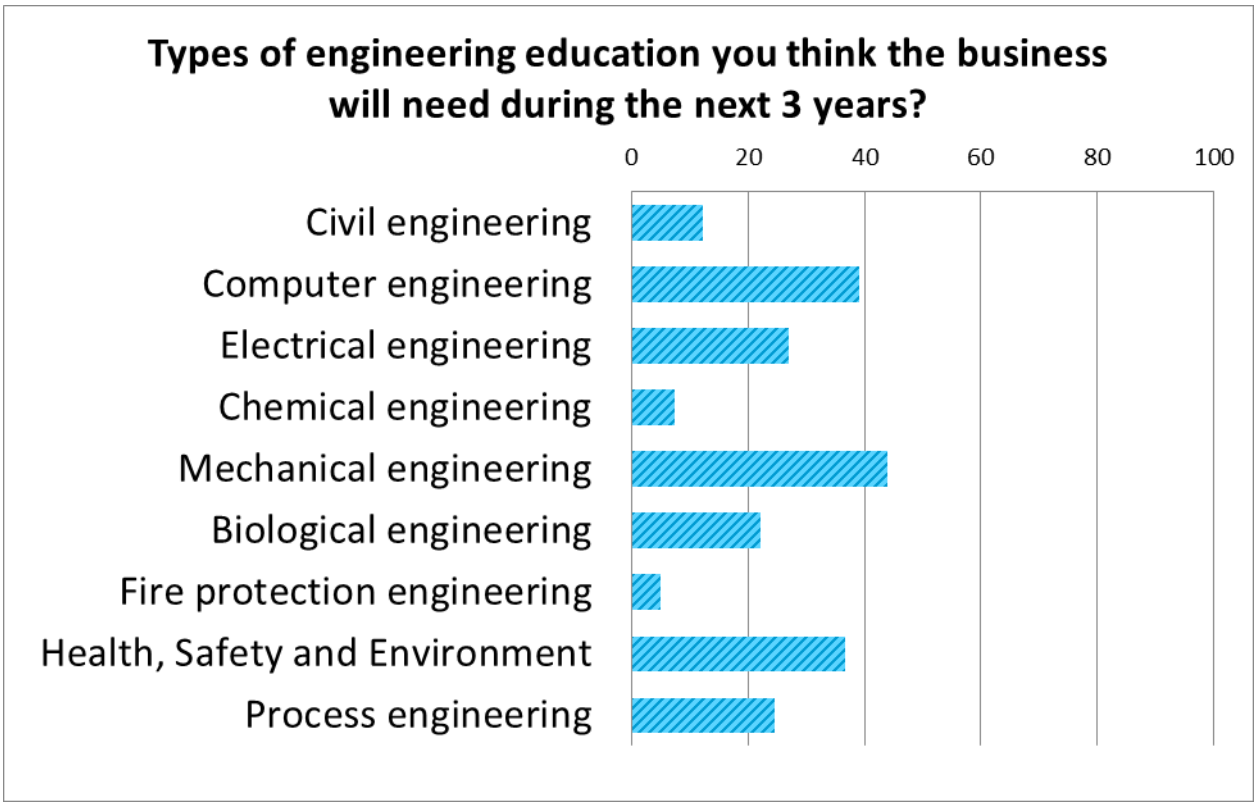


Figure 62: Types of engineering education needed during the next 3 years

The fish farming industry need a broad spectrum of engineers during the next 3 years. The three most important areas are mechanical and computer engineering, and Health, Safety and Environment. Computer engineering is considered to be important due to digitalization of production processes. Mechanical engineering is ranked on top, since new types of farms are going to be developed during the next years in order to handle the challenging sea lice problem.

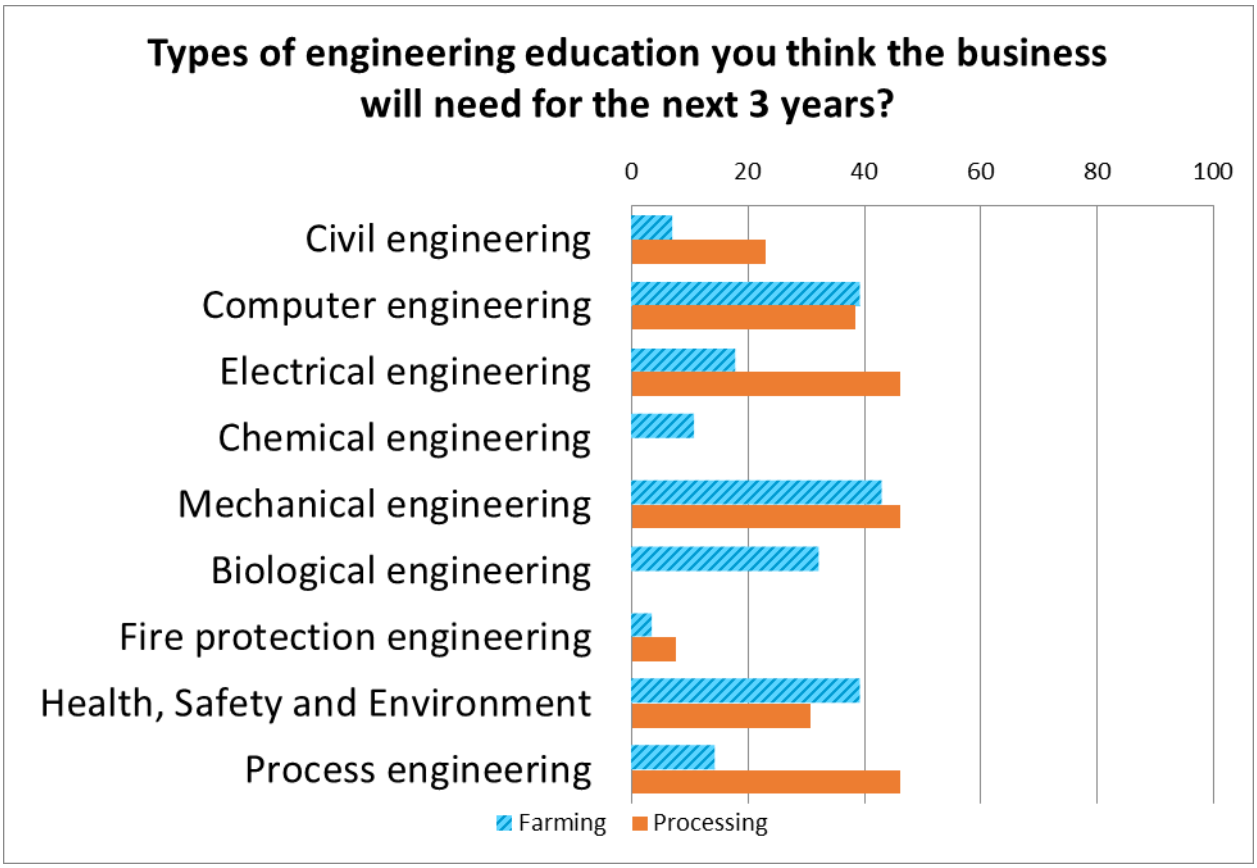


Figure 63

## 4.6. Collaboration With Other Relevant Actors

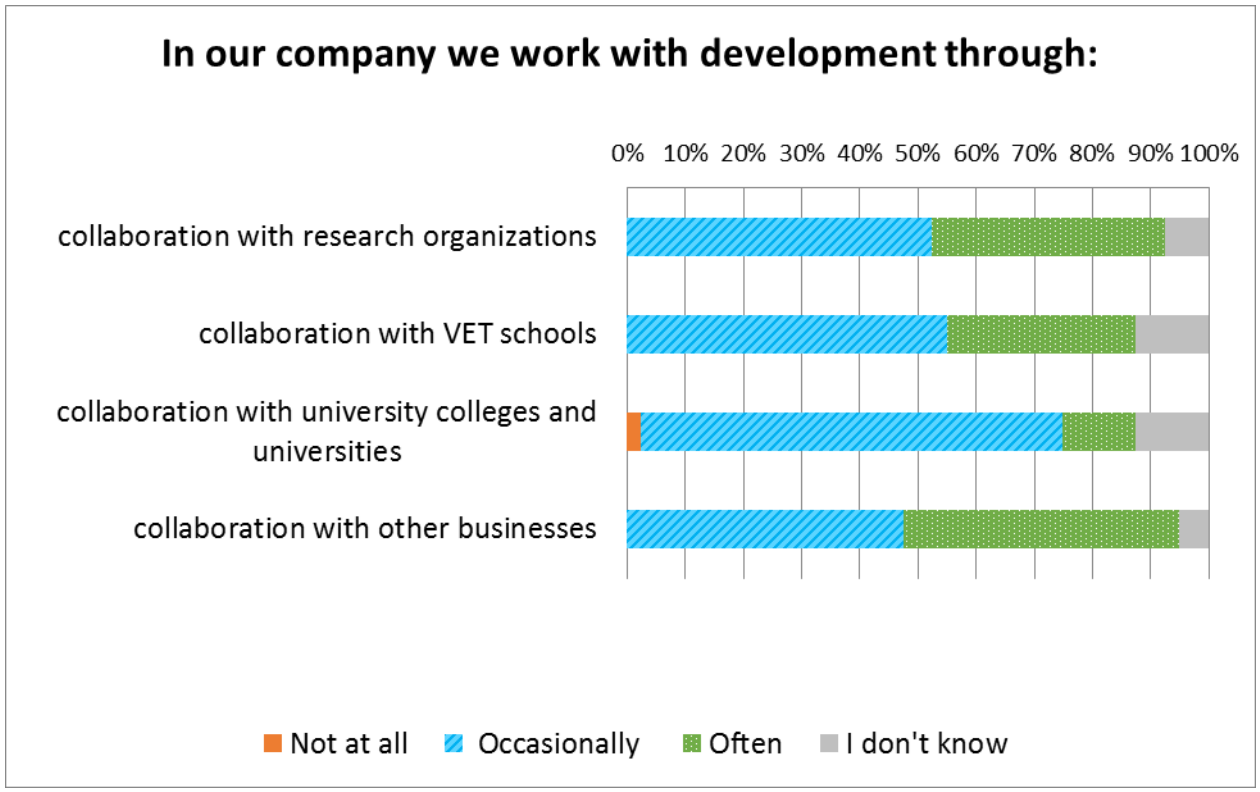


Figure 64: Development through collaboration with other relevant actors

Collaboration and cooperation has been an important factor for the development for fish farming industry in Norway. 40 % of the fish farming companies often cooperate with applied research organizations like for instance SINTEF, in order to pilot innovative solutions. 1 out of 3 companies often cooperate with high schools offering VET training within aquaculture. This includes offering practice for the aquaculture students. However, only 12,5 % often collaborates with universities in order to carry out basic research activities. This shows that the fish farming industry is much stronger on carrying out applied research tasks compared to setting up long term research programs involving PhD students from universities. 48% of the companies mention that they collaborate with other fish farming companies in order to carry out developments, despite that they are competitors on the same market when selling their fish.

Thus, the in company development in fish farming industry in Mid-Norway is driven by strong collaboration between companies and the research environment. The companies choose to collaborate with each other even though they are competing on the same market when selling their products. In addition they support the aquaculture VET schools by offering students access to practice and training involving modern equipment.

New aquaculture VET programs may support this by addressing the importance of development at several levels, including formal and informal meeting places where staff in the fish farming companies meets teachers and students as often as possible. This includes for instance offering practice to students and let students train on work operations they will meet when they start working in the companies.

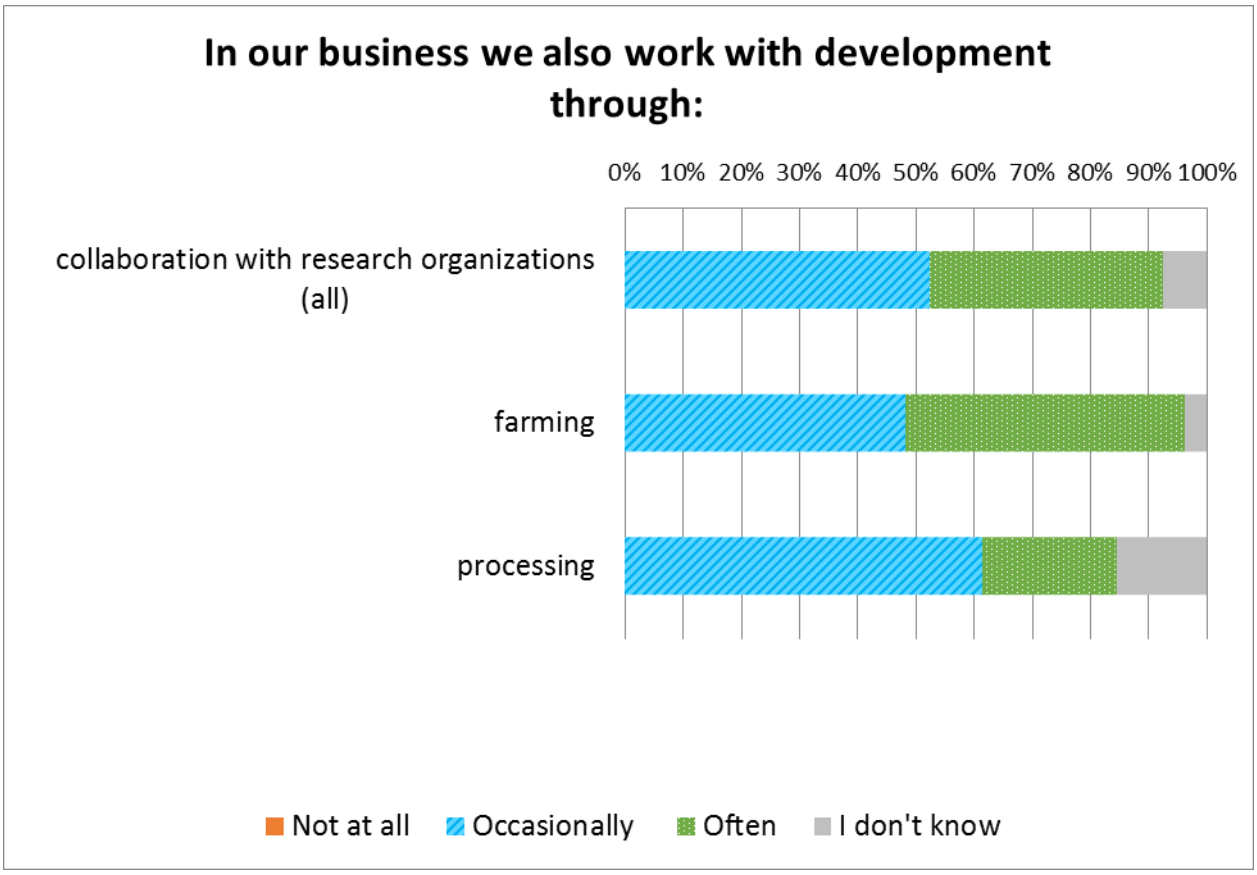
In our business we also work with development through:
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
collaboration with research organizations (all)
farming
processing
Not at all
Occasionally
Often
I don't know

Figure 65

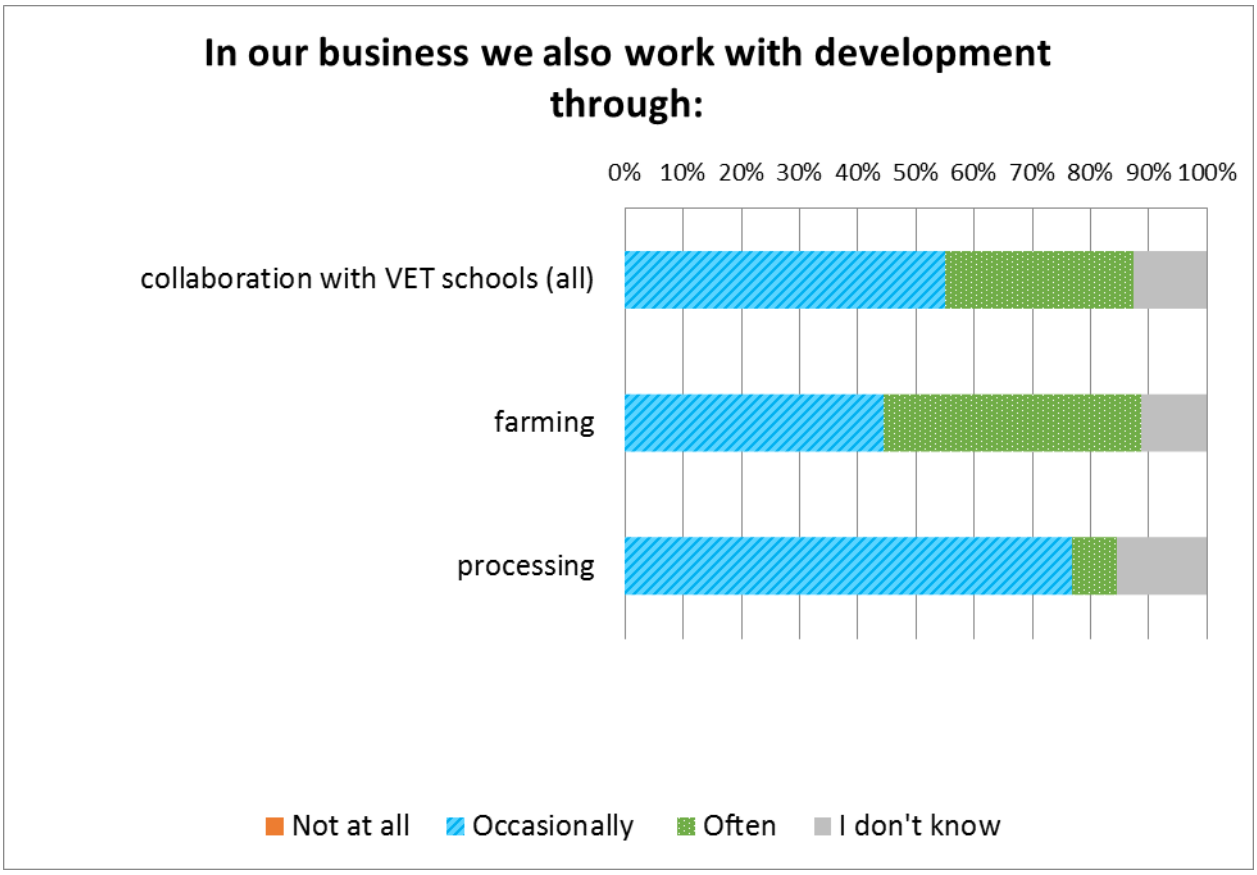
In our business we also work with development through:
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
collaboration with VET schools (all)
farming
processing
Not at all
Occasionally
Often
I don't know

Figure 66

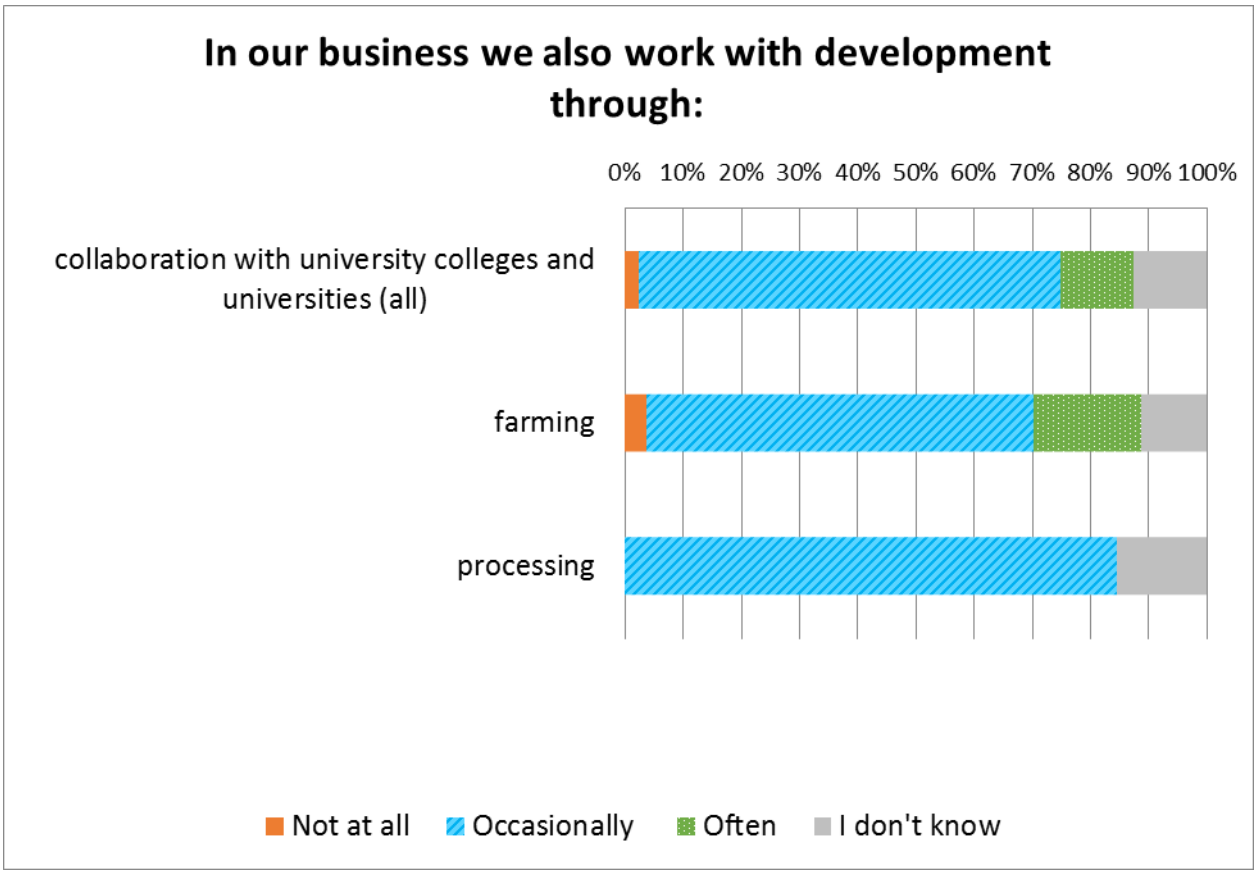
In our business we also work with development through:
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
collaboration with university colleges and universities (all)
farming
processing
Not at all
Occasionally
Often
I don't know

Figure 67

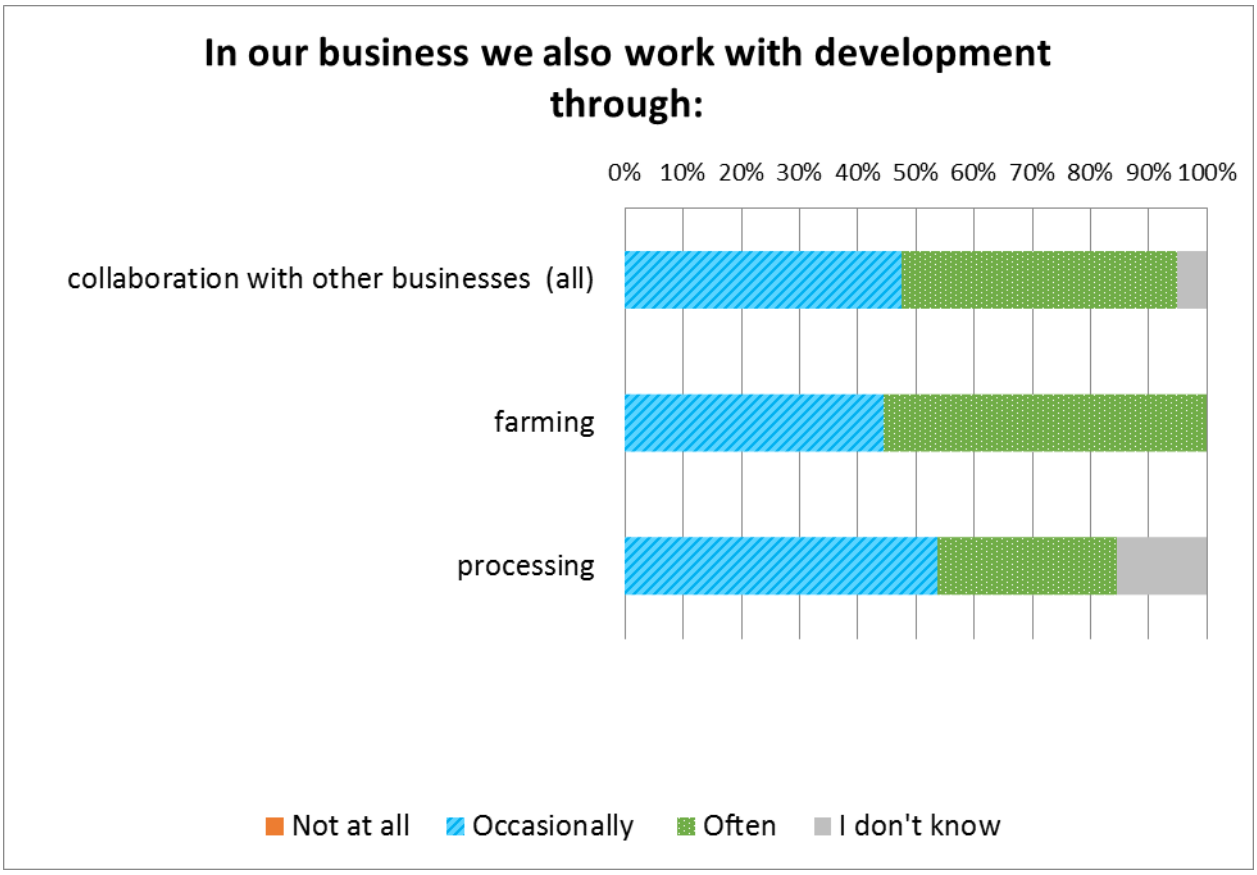
In our business we also work with development through:
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
collaboration with other businesses (all)
farming
processing
Not at all
Occasionally
Often
I don't know

Figure 68

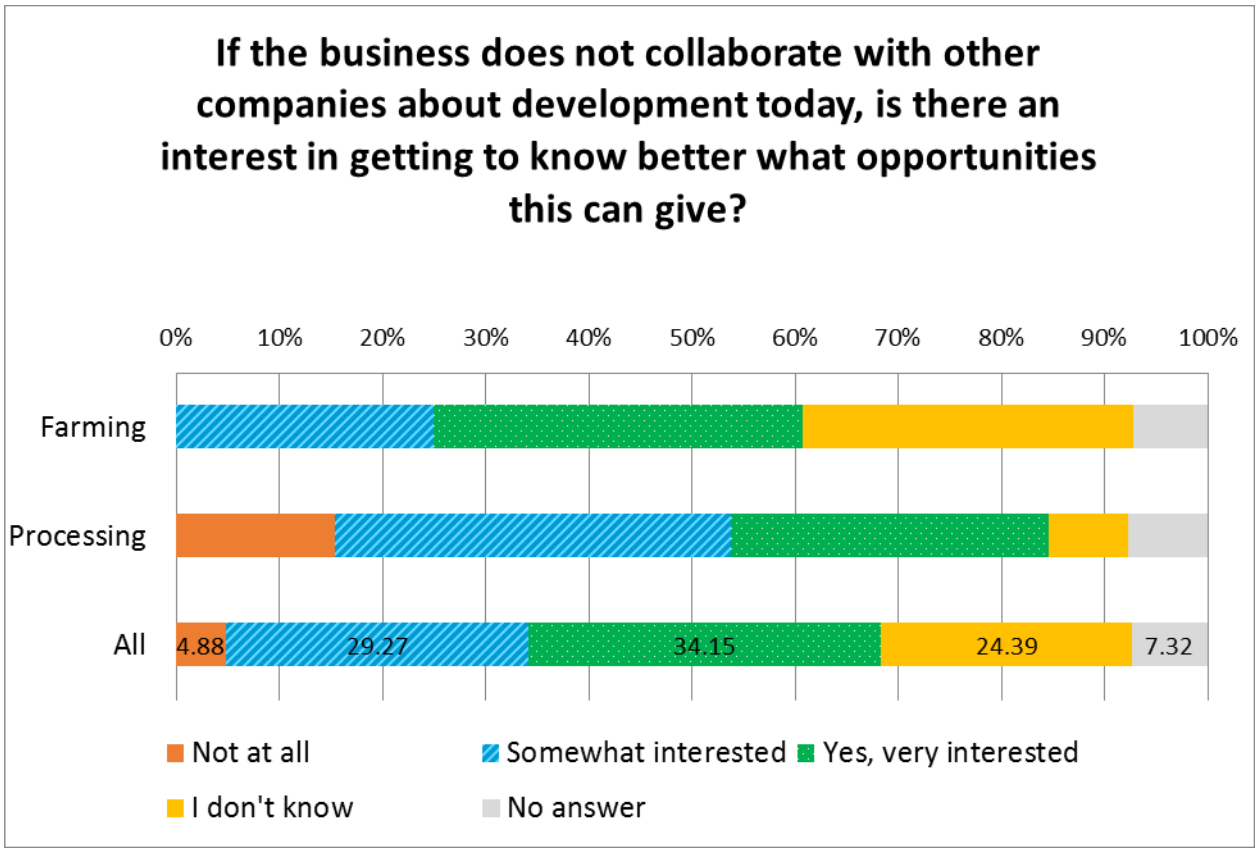


Figure 69: Interest in collaboration with companies

One out of three companies is very interested in collaboration with other companies, while almost the same share is somewhat interested. This shows that the managers still believe there is still a potential for improving the collaboration among the fish farming companies, despite Figure 27 shows that there is already an extensive collaboration ongoing.

A modernized aquaculture VET program could be designed to help facilitating new types of collaboration within the fish farming industry. The potential is large, when 63% reports that they are very interested or somewhat interested. A new aquaculture pilot could be designed to stimulate collaboration, by applying tasks and cases where people from different companies may work together in order to figure out the solutions to the problems or investigate common challenges for development.

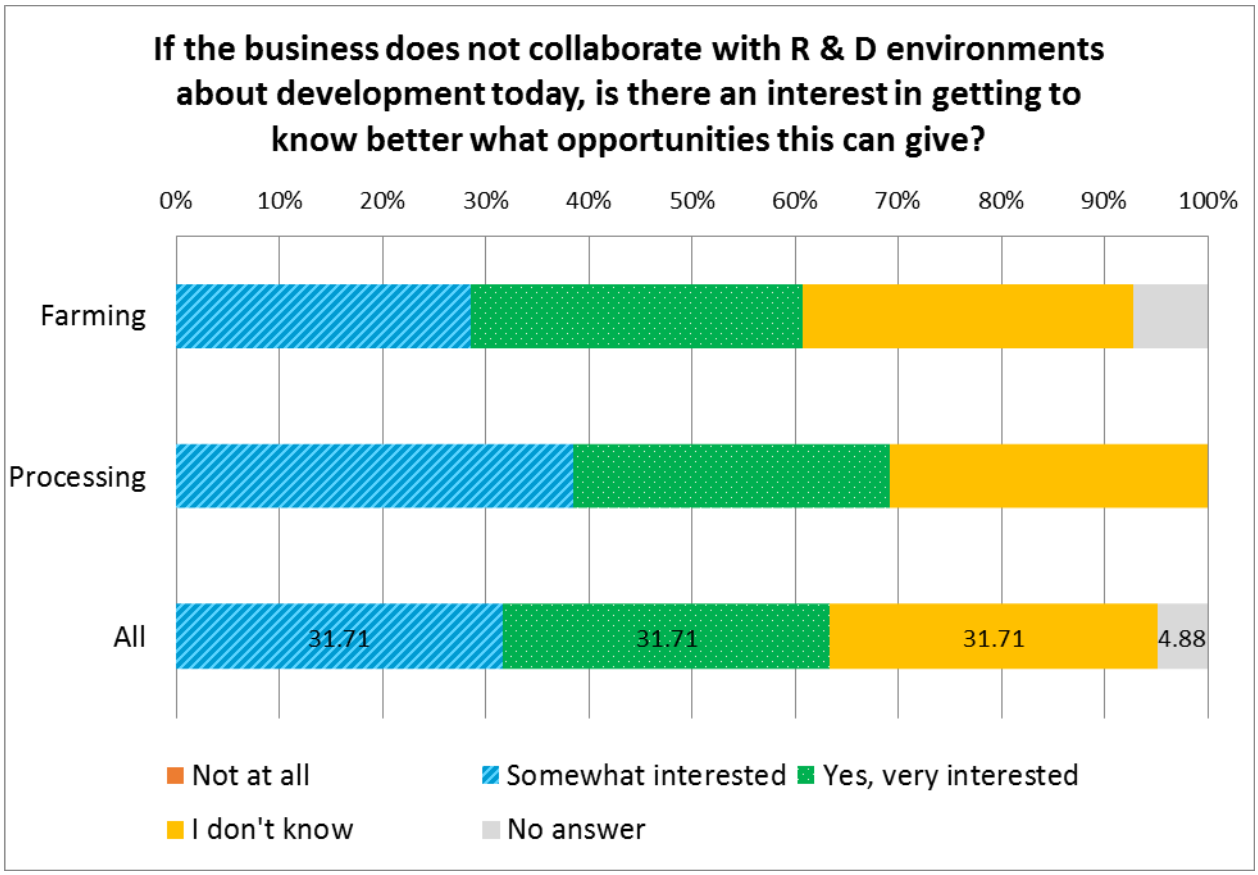


Figure 70: Interest in collaboration with research and development

The managers in the fish farming companies are very interested in getting information and new opportunities for establishing new collaboration with R&D institutions. 32% are very interested, while the same number of managers is somewhat interested. Figure 27 showed that 40% of the companies already had ongoing research collaboration with research organizations. However, those working at the manager level out on the farms or in the processing factories, mentioned that these processes could have been enhanced further. This indicates that there are many unresolved issues, task, problems at a regional and local level etc. within the aquaculture industry that needs to be solved by R&D.

Fish farming industry in Norway is still a young industry, starting approximately 40 years ago. Older and more mature industries in Norway invest a higher share of their turnover in research, compared to the fish farming industry. New aquaculture VET programs may try to address the importance of investing in R&D in order to get progress in research and development within the industry.

## Area 5: Conditions: locally - nationally – internationally

The last area of questioning refers to factors that might influence the company or the industry during a horizon of 3 to 5 years.

### 5.1. Conditions Influencing the Company

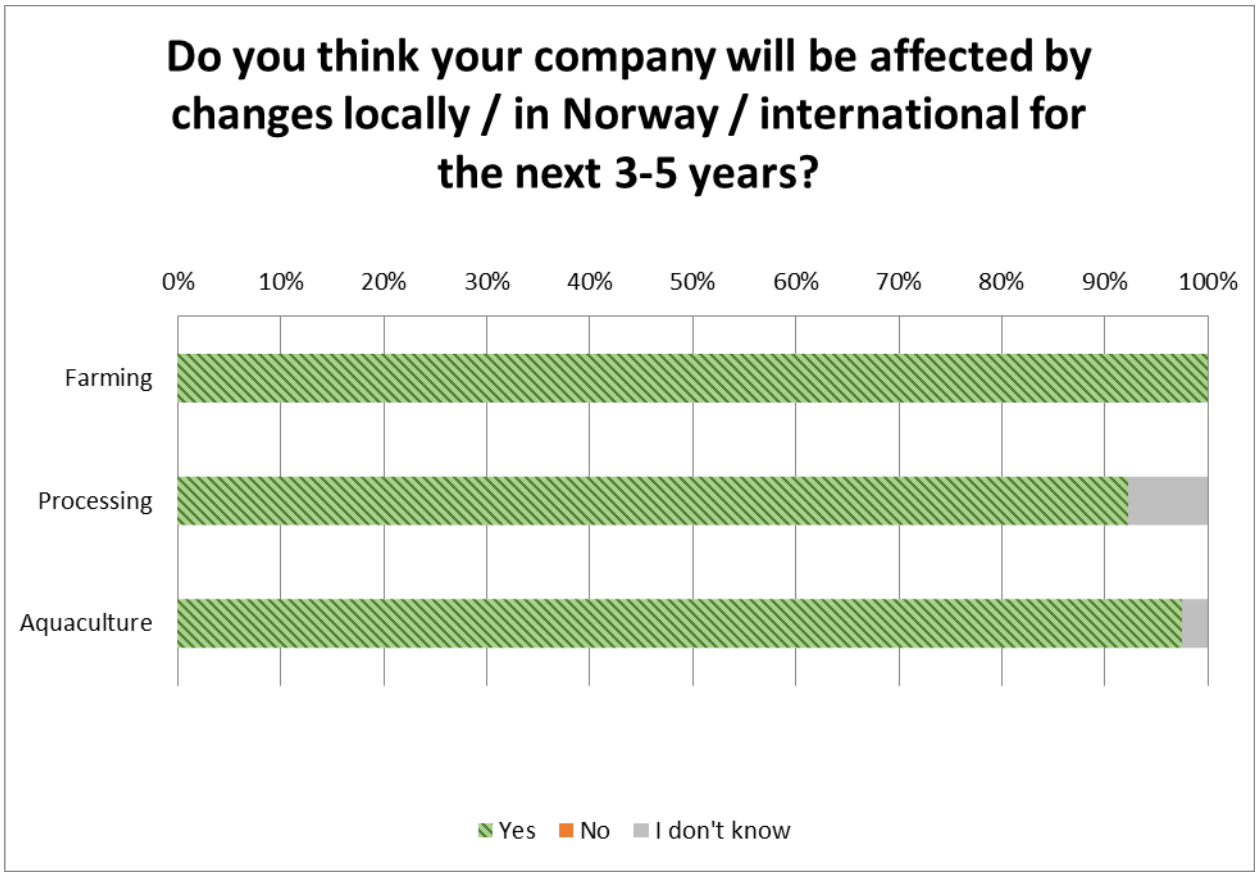


Figure 71: Perceived influence upon fish farming company

There is an overwhelming agreement that each company will be influenced by external changes during the next 3 to 5 years. The companies expect that the production and processing of farmed fish will change during this period due to technical development and legislations etc.

New aquaculture VET programs will be challenged by these changes. It will be necessary to update parts of such training programs frequently.

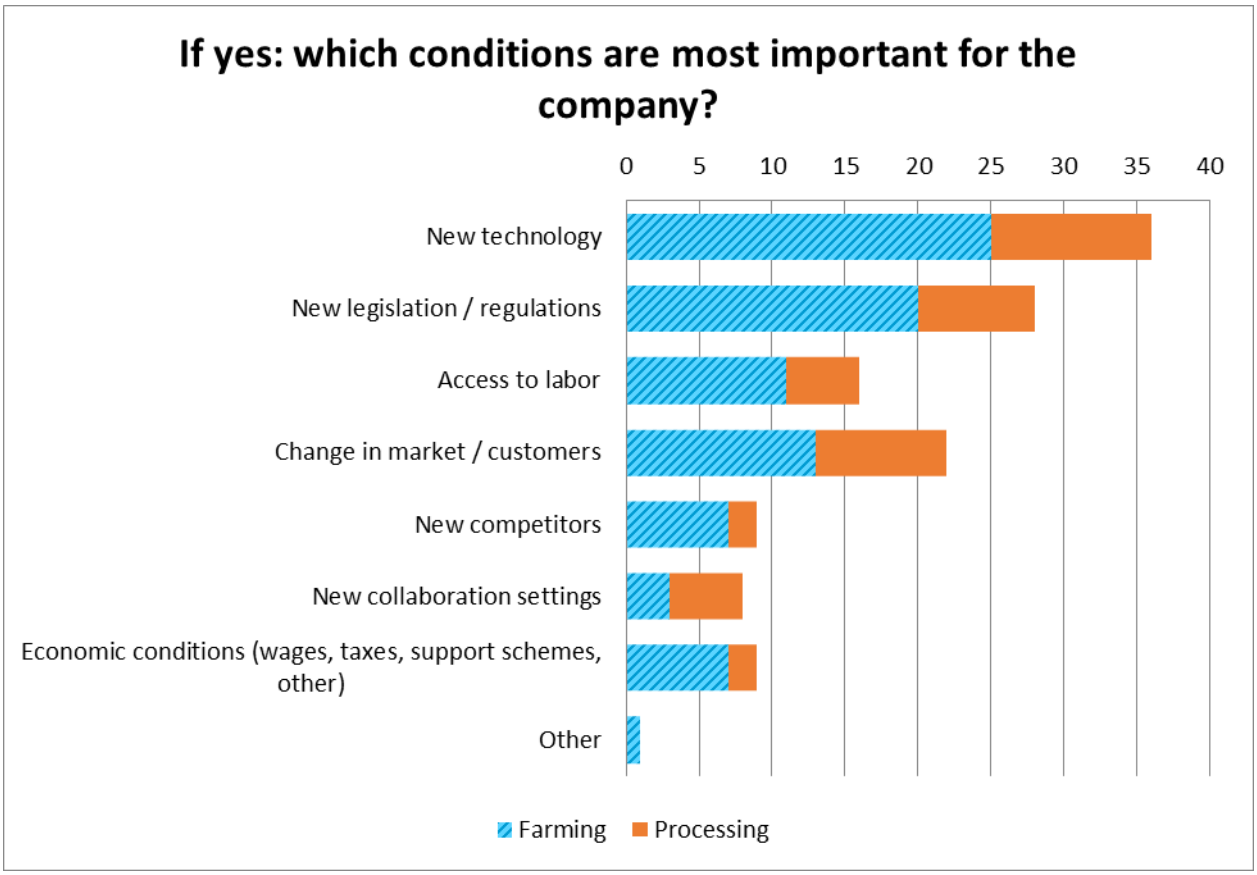


Figure 72: Factors influencing company on short term

The most important factors influencing a company, as pointed out by the managers, are access to new technology; changes including new legislations, changes in the external market and access to labor forces (88%, 68%, 54% and 39% respectively). One single manager mentioned as an additional new factor the “management authorities” and the regulations they may define.

For a modern aquaculture VET course program, the consequences are that it must continuously update the content such that it reflects the technology that the farming companies apply. Since production of digital content and learning material are expensive, one way could be to develop some material in each country and then share it between the countries cage farming salmon.

A modern aquaculture VET course program must include the latest updated national regulations. It may be tricky to share those between several countries, unless the European Commission harmonizes them. Such a program will, however, directly contribute to increasing the access to labor that has national recognized aquaculture qualifications.

## 5.2. Conditions Influencing the Industry

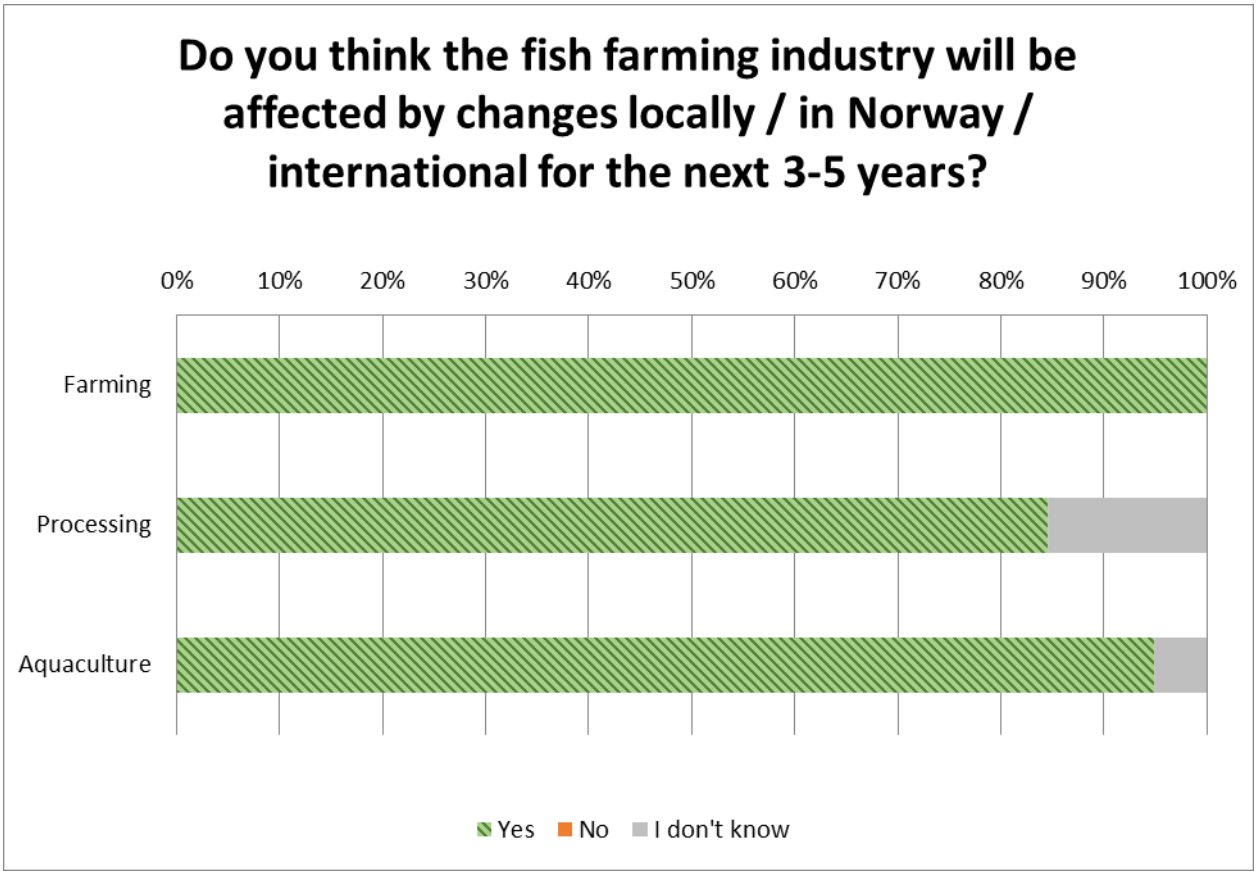


Figure 73: Perceived influence upon aquaculture industry

There is overwhelming agreement that the fish farming industry sector will be influenced by external changes during the next 3 to 5 years. The response rate is at the same level as it was for the fish farming companies in figure 30.

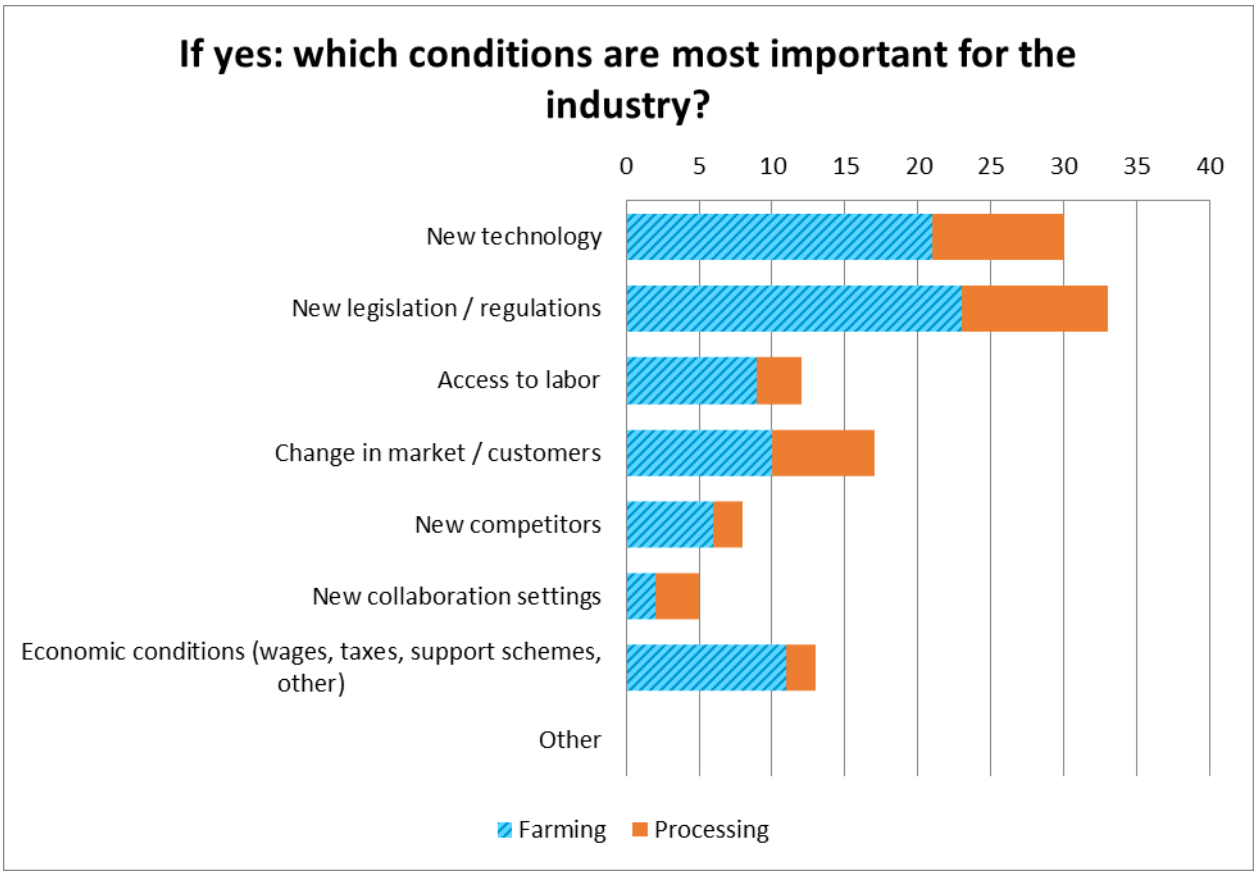


Figure 74: Factors influencing industry on short term

The factors, which can generate change in the aquaculture industry, are somewhat similar in the distribution to the ones regarding the companies in figure 31. The most important factor is now seen to be legislation followed by technology and then changes in market/customers and access to labor (80.5%, 73%, 41.5% and 30% respectively).

Since legislations and regulations is considered to be the most important point for the industry, modern aquaculture VET courses should provide in depth knowledge about these aspects.

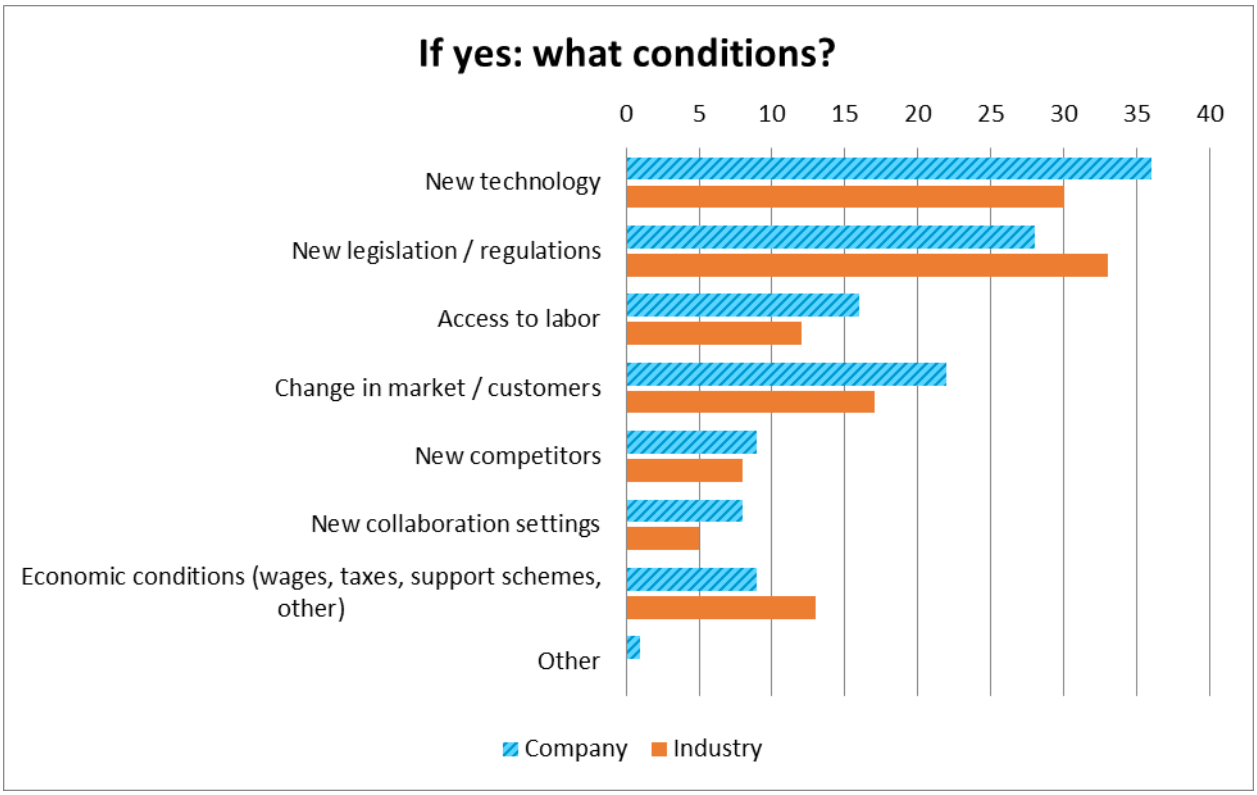


Figure 75: Factors influencing the company / industry side by side

If we compare the data in the same table, figure 34, we notice that the managers perceive that the company will be influenced by new technology to a larger extent than the fish farming industry itself. However, they perceive the opposite with respect to new legislation and regulations. That is, a smaller number of managers believe that legislation is a factor of change in company than the industry.

For a modern aquaculture VET program, the consequences may be that is necessary to offer adapted training to various types of stakeholders, e.g. fish husbandry or site managers. This training, however, may be delivered with eLearning.

## Quantitative data, interviews with staff from farming industry

Industry staff highlight that most north European farmed finfish 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

Staff mentions that workforce development will have significant marketing benefits for aquaculture. The industry is led by multinational companies who own farms in many countries. 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.

Industry highlight that it is difficult to recruit staff with National Qualifications (NQs) to farming. Easier for industrial food production (processing), though language is a challenge. The staff has to learn a lot through their practical work in the company. Most of the staff recruited to farming, keep staying in their job.

Apprentices are the most important recruitment channel. They are today focused on their career. They have good score from school and have nearly not been absent from school. Approximately 2 out of 3 apprentices have got their NQs within aquaculture.

The farming companies encourage their staff to start on the theoretical part of the NQ within aquaculture as early as possible and pass the final theoretical exam. This gives them additional competence towards the farming and production at the cages. They must, however, still wait until they have got 5 years of relevant experience to complete the practical exam and receive their NQs. This is a challenge as it may affect the motivation.

Farming companies have registered that the cost of attending the theoretical training in the NQ for staff from industry, varies from 650 euros and up to 1.800 euros. Several companies questioned why there are not an equal prize for the theoretical aquaculture VET course, assuming that courses from different providers had the same number of teaching hours. However, interestingly they did not question if there were different types of courses they were offered, which indeed turned out to be the case.

Information about new training courses leading to NQ are typically distributed the staff on the company's intranet. The distance to the classrooms and the date for start-up are important, since the staff often must cover the transportation costs them self. The farming companies only pays for the course. Farming company requires (2018) that the courses are held on evenings, Saturdays and/or Sundays, expecting the staff to stay 100% at work. In addition, courses should have some kind of flexibility such that they may be adapted to their work schedule at the farm. This is important in periods with a lot of work, especially from March until October.

The farming companies consider a combination of e-learning and on-site gatherings to give best effect. To increase and extend the staffs network is important and this is may be done by attending the classroom-based training. Furthermore, transfer of knowledge, competence and skills are important during their training. The staffs learn best when they may work together by turning the theory into practice, by learning from each other at the farm.

There is not much internal training in many farming companies, since they prioritize to keep the number of staff at a minimum level in order to reduce the costs. When needed they subcontract a supply service company to help them during the busy periods. Due to this, it is normal to subcontract and engage externals organizations to offer training. This may be the VET schools offering training to the apprentices or private training bodies. However, the farming industry often mention that large distances between the cages and the schools are a large challenge when engaging externals to offer the training.

The farming companies agree in that staff with NQ, seems to prefer staying in their job. In addition, they focus and encourage their new staff to increase their competence by studying and taking an national exam leading to NQ. The following increase in their salary, however, should not be the motivation for starting on a program leading to a NQ. Today there are usually challenges related to attending the on-site training based courses, mainly due to distances and the staffs work schedule.

During 2018 many companies started to receive many applicants to each new husbandry position at the farms. This includes all areas. In 2017-2018, as an example, one of the 3 biggest companies in Norway may receive between 1000 and 1200 applicants for new positions per year. Many of those lack NQ. Despite of this, all the farming companies highlight that the apprentices are the most important recruitment canal. A large farming company operating in the coastal zone of Mid-Norway may have up to 16-17 apprentices engaged within smolt and farming production. It is important for the farming companies that all their staff at the cages has got a NQ within aquaculture.

Until now each farm has applied their own methods for feeding the fish. The food is indeed the most expensive part of the production. When the fish is almost ready to be slaughtered, the husbandry operative feeding the fish may during one day (8 hours) feed the fish with 100 toon with food. As a result of this, the biomass in one farm with 7-8 cages may increase with nearly 100 ton during one working day. This food will cost typically 100.000 euro/day, whereby even a small improvement in the fish feeding systems may lead to large increases in the income for the company due to reduced food costs.

Due to this In Mid-Norway and in Troms (Northern Norway), the farming companies start establishing central centres for feeding of all the fish in many farms at a distance. In Trøndelag, this started from August 2018. This will reduce the needs for control at each farm/cage and there will not be any feeders left at the farms. These centres may be co-located with the processing factories and the husbandry operators specialize in just feeding the fish. These persons are the most important ones inside the farming companies and should have very good skills. The number of such operators that have taken a master degree is increasing.

The farming companies highlight that the theoretical exam, which is one out of 2 in the NQ, is a challenge for many of their staff. Many of their staff has been and is till recruited based up on their ability to solve practical problems on a day-to-day basis, whereby they have avoided to start on

training involving a lot of theory and in particular learning activities involving reading and writing. However, the 5 hours theoretical exam is a written exam only, whereby this challenge a lot of their staff. The language it self becomes the challenge. The aquaculture VET schools spend time during the courses just on preparing the students for spending 5 hours on writing for instance a full production plan based up on a set of predefined start-up criteria when the farm receives the smolt. Despite of this, until now many husbandry operatives (up to 90% of those that have started) has manged to pass both the theoretical and practical exams, leading to a NQ. Several companies mention that this may not be the case in the future, indicating that many of the several hundred husbandry operatives lacking a NQ, struggle with learning and training disabilities.

There are indeed gaps between the ambitions of the industry and the current training methods which do not take into account how many staff that are champions in problem solving, while they at the same time avoid and fears the required theoretical training.

Farming industry leaders mentions that they want to promote collaboration between farm sites within each company, as well as improving collaboration 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', will support future learner mobility, consistent with the sector's vison for a collaborative culture based on knowledge exchange and continuous learning.

## Harmonization of industry endorsed national qualifications

Farming companies highlight that a harmonization of aquaculture VET in Norway, Scotland and Iceland would have been useful. With the term "harmonization", the industry would like to have automatic approval of national qualifications within aquaculture, thus securing free flow of personnel between farms when necessary.

However, inside the companies most staff don't know many details about the production in other countries. The top leader group have often been visiting farms in Scotland and Iceland, while leaders at regional level seldom have any own experience about farming in Scotland and Iceland. Thus, an industry provider partnership across national borders would have been useful in order to support the development and quality assurance of shared resources for learning and assessment, and for help developing occupational standards for cage farming for the husbandry operative and site manager level. This would also help and support a framework for improved understanding of each other's aquaculture VET systems, and the subsequent need for developing shared learning outcomes.

Farming industry in Norway including those who start working as leaders in the companies in Iceland that have been bought by Norwegian companies, highlight that practice and work-based learning and training is a key issue within aquaculture VET. The require minimum 6 months of practice in order for students to actually learn how the production is done. The farming industry in Norway is open for receiving students from Iceland and Scotland that may stay for 6 months in order to get work-based practice. An an industry provider partnership would help organizing this too. It is worth noticing that the staff in the Norwegian companies would like that the modern apprenticeship system in Scotland should include teaching of the same theoretical subjects as in Norway. That would require that students in Scotland receive practice bot in smolt production and farming out at the cages. Staff in industry in Norway are not aware of the differences between the aquaculture VET systems in Norway

and Scotland and Iceland. An industry provider partnership across national borders would help displaying the details in each system and open up for improving all systems within a possible "harmonized model" for north European aquaculture VET in the future.

Farming companies mention that one production cycle could last up to 14-15 months and that it involves many different production phases. Due to this it is convenient to let the staff get several years of experience, such that they may take part and get trained in the same phases several times, before they are allowed to take the final practical exam in the national qualification pathway. For instance, during one production cycle the fish is sorted a few times in order to pick out the largest fishes and send those to the processing factory. This process is only done a few times, whereby it could be challenging for staff that work in a shift-based system to get enough training by attending just one production cycle. Thus, it is important to understand that staff has to work some years in order to get trained in all operations and obtain the detailed production knowledge about all the steps and details in the production process. Several farming companies mention that 5 years with practice is a realistic and necessary approach in order to get sufficient trained and understand all the details in the production, before they take the final practical exam and receive their national qualification ("fagbrev").

Farming industry mentions that a new aquaculture VET model should be flexible and if possible be applied in several countries at the same time. That would require several components, such as developing

- a common framework of learning outcome descriptions for north European cage farming that includes systems for defining knowledge and competence-based learning outcomes in a form that is compatible with each partner countries national VET system and the needs industry have with respect to further specialization due to the technical developments. This should include defining learning outcomes descriptions at husbandry operative level for cage farming to ensure the transferability of learning resources and assessment consistency between partner countries.

- joint work-based learning and assessment delivery systems and resources that include systems for the recognition and accreditation of staffs prior learning with respect to knowledge and competence. Industry expect thus is of particular interest for staff that has been recruited on their capacity to solve practical problems on a day-to-day basis. It will includes establishing new and joint e-learning resource quality standards and a distribution system for learning materials that is compatible with all VET schools learning management systems. Industry representatives mention that this is something that the VET schools should organize and set up, as the industry from a practical point of view outsource the aquaculture training leading to a national qualification to the VET schools. Farming industry is aware of the lack of updated learning materials within aquaculture VET, a challenge arising partly due to rapid technical developments. Thus, it is necessary to investigate how to source, evaluate and inventory existing e-learning materials and content, and how to map them into a common framework of learning outcomes that can be utilized or repurposed. Through the apprenticeship system the industry is used to take part in evaluation and assessment of young students' knowledge. It could be desirable to consider start applying a similar system solution in training of personnel inside the companies, by developing a new continuous assessment

processes to support work-based-assessment of technical knowledge and competence and transversal skills. Industry mentions that this should include team work and improved communication between companies and between farms, thus down pining the final exams as the only tool used to assess student's knowledge. The digital e-portfolio system applied by industry in the apprenticeship system could serve as a basis for a new model for managing the quality assured assessment of practical competence obtained in work-based learning out in the companies.

- improved collaborative experiences within VET. Farming companies staff mentions they have had good effect of collaboration when they during the last 2-3 years and due to governmental regulations, had to start up collaborative partnerships between farms and between companies in order to combat sea lice. These new and emerging partnerships models could be extended at regional and maybe even at national level. Such national work-based learning delivery partnerships and teams for support, could include company work-based mentors providing learning and development support to work-based learners during both the theoretical as well as the practical training. Some of the companies mentions that they already have started with such mentoring support at an informal level, usually initiated by eager aquaculture VET teachers that would like to test out such solutions with their classes. Some teachers have started to test out such training solutions in order to manage to offer practical work-based training to groups of 4-5 students at the m ore. Due to limited instructional area, often rough weather conditions and security issues, there is not possible to offer effective workplace-based training to more that 4 or at maximum 5 students at the same time. Industry mentions that work-based training today is not standardized across the whole country, since each VET schools is supposed to serve the needs in a particular region inside Norway. In order to better achieve a possible "harmonized" system targeting farming in cold water, industry staff may need to qualify in order to take part in the development of work-based witness testimony providers to ensure consistency and standardization of the assessment of practical competence. Learners' portfolio building skills must also be developed, enabling them to better and more effectively support a work-based assessment evidence gathering process.

## Specialization in farming and supply service industry

Norwegian farming companies highlight the needs for specializing of the workforce in the forthcoming years due to larger, heavier and much more advanced equipment's, boats and services. The training needed includes all kind of training related to the biological aspect within the production. In addition, training is needed within operations of service boats, fish health and fish welfare. Industry staff mentions that industry may contribute into this field by applying their competence in partnership with the VET schools in projects.

Industry highlight that the total costs for training staff such that they get their national qualifications, are important for every company. Today the industry doesn't pay their staff salary when they study and prepare for their national qualifications. Each staff must be motivated to start on the training. This is however, challenging for many of their experienced staff with excellent practical skills. They are not used to study theory and consider this to be risky. Indeed, this is strengthened by the internal policy in some of the companies. If their staff fail in passing the exams leading to a national

qualification, each staff must pay the course fee them self. In addition, the cost related to buying learning materials are important, whereby the VET schools should investigate if development of aquaculture open educational resources could be an alternative.

Farming industry companies mentions that a revision of the aquaculture curriculum and training methods are needed. Due to very fast technical developments and innovations leading to a change in the production, the curriculum needs to be adjusted to current production methods. Several companies have mentioned that aquaculture VET schools should start learning from the oil industry and how they have organized the training. Smaller modules with unitized learning materials would be considered as positive for their staff. This would help preparing for a bit more application of e-learning and flexible training solutions. VET schools must also remember that their staff learn in different ways, and that improved collaboration is important for the companies. It would have been more useful if the training could consist of a blended mixture of e-learning, on-site training and networking where the students "play together on the same team". The companies believe that this would have strengthened and lead to improved cooperation and collaboration between the companies and between the farms, especially if the VET schools could have applied cases within the training that could challenge staff from different companies and farms.

Indeed, farming industry consider collaboration and sharing of information and knowledge related to the production as an essential key feature. Indeed, staff highlights that those companies that are not willing to share information and knowledge, will in the long run start losing money due to all the failures they will do during the various production phases. Staff from industry points out that the production costs will be too high, whereby they at the end are going to lose the battle in the hard competition on the international market.

## Staffs skills

Farming companies wish that their staff shall have a joint understanding of the biology of the farmed fish, for instance fish welfare, and they want that their staff has got national qualifications based up on a vide aquaculture VET model. The staff should know all the key subject areas within aquaculture, whereby they may - based up on the needs in the production - work in different positions inside the companies. This gives the companies an appropriate flexibility.

Farming companies recruit people in such a way that they mix people with different background and education, setting up interdisciplinary teams that together manage to solve as many as possible of the day-to-day task and challenges that arrive. Even when the access to an increased number of personnel with national qualifications within aquaculture start increasing, many companies will still keep on recruiting 1-2 persons that are very good practical problem solvers out at a farm. This is still considered to be more important than that every person has got a national coalification.

Recruitment of staff to specialization should be based up on the staffs interests and their own responsibility for getting a national qualification that set up the pathway for attending further education courses. A teem working at a farm should have different background and experiences. It is important for the companies that

- as many as possible of the staff has got a wide overview off the whole production process

- they prepare for transfer of competence between various types of staff through inhouse training programs inside the company
- subgroups of the personnel try to specialize in some aquaculture areas, e.g. fish health, fish welfare, etc.
- each team at a farm are responsible for their decisions and involvements over staff into the decision processes, thus leading to better responsibility for targeting the goals for the production.
- Meetings at the fleets are an arena where every staff are encouraged to provide information, take part in discussions, thus securing staffs confidence. The meetings should not be controlled by one operator only.

Farming company's general opinion is that reading, writing and learning disabilities are higher in the aquaculture sector compared to the society in general. This challenge is however, not considered to be serious problem in the work at the cages. The challenge arise when this type of staff start preparing to receive a national qualification within aquaculture. That requires traditional training as at school, and that is challenging for personnel that struggle with learning disabilities. It is important for industry to be open about this challenge during training courses, since the staff may have very good practical skills even though they for instance have writing disabilities.

However, the companies give different measures for how many at the marine cages that struggle with for instance with dyslexia. Further research is needed in order to document this and provide numbers. School dropouts, however, are not a serious considered to be a serious problem in the aquaculture industry. The reason seems to be that there is not many people that get engaged as school dropouts.

During the period 2011/12 until 2018/19 there has been a massive growth in the production in Norway. Since it takes 4 years to receive a national qualification, farming industry have for a longer period been forced to recruit unqualified husbandry staff. The number of personnel inside the farming companies that are lacking a national qualification in aquaculture is still around 40-45% of the staff at the marine cages, though in medium sized farming companies up to 60% of the staff is still lacking national qualifications ("fagbrev") in aquaculture. However, due to large growth during the last recent period with expansion, 2 out of 3 persons has been recruited as unqualified. The number of unqualified works with limited practical experience has indeed grown during the recent years, though the total number of personnel lacking national qualifications has dropped a bit compared to the SINTEF lead study published in. 2014. In just one of the big farming companies in Norway, approximately 200 persons were lacking national qualifications in aquaculture (2018 data).

Farming companies operate with a general training plan for their personnel. This includes all the competences that the staff should have according the internal regulations in the company and is including both internal and external courses. Some of the internal courses lead to a in company certificate, e.g. how to count the sea lice. The national qualification in aquaculture is part of this education plan. The fish farming companies are an attractive employer in the coastal zone and receive many requests from unskilled staff. In 2018 approximately 10-15% of those who applied for positions as husbandry operatives had got a national qualification in aquaculture. This was just enough for the companies in order to manage to employ skilled husbandry operatives.

Farming companies highlights that it is the new young staff that enter the farming industry through the apprenticeship system that will be the most important factor that will contribute in a fast increase

the number of persons in the farming industry that have got a national qualification ("fagbrev"). Within a period of next 5 years, this may contribute in lifting the number of persons that have a national qualification up to approximately 70%. This is a very important aspect, since the companies expects that more staff will need to specialize. Such a specialization is easier to organize if more the staff has obtained a wide basic education leading to a national qualification. The companies expect that it is indeed the biology of the fish will be one of the important components in the specialization that would be needed in the future.

It is difficult for farming companies to send one person on a course during their staff time, since it is difficult to replace that person in a rural area. There aren't any persons available that may come and do their work. This is one of the most important restrictions and in offering training leading to national qualifications. The direct costs related to paying a course fee is small compared to the indirect effect of losing one person in a number of days in the production. Due to this challenge farming companies start requesting more flexible training solutions that would make it easier to combine a full job with VET leading to a national qualification of their staff. In addition, they mention that it is easier to get this flexibility if the courses are organized at a local level inside their own region, whereby travel distances become short and transportation to the classroom-based training doesn't take too much time.

## Quality assurance of the production

The husbandry operative positions at a farm have to do 4 different types of work. This includes

- driving the supply boats and wessel's
- technical maintenance of the farms
- feeding the fish, and
- managing the cleaner fishes.

However, due to fast technical developments the industry start discussing if each of those categories should be specialized and operated by dedicated personnel with appropriate training. Especially the feeding of the fish is considered to be the most important work that requires high skills, including skills for monitoring data from many different types of sensors that are displayed at a range of screens. In the same way the work with the cleaner fishes requires a lot of indebt knowledge and skills.

The farming companies want to increase the competence and specialize their staff in each of these 4 areas. Each of the husbandry operatives are today responsible for certain areas within the production and the companies prepare specialized internal training plans for their staff that reflects this specialization. The specialized training is organized as either internal in-company courses or the companies engage specialist to offer this training. The farming companies cooperate about the specialist courses, e.g. by engaging the company Åkerblå to train personnel from different farms in the same group. It is worth noticing that companies still prefer to engage new husbandry operatives that have taken a wide national qualification. The specialization process is afterwards organized internally along the 4 tracks above. However, even a person that is feeding the fish and spend most of his working time on that, must still be able to drive and operate the supply boat in order to for instance check equipment at each cage if errors occur.

Most of the farming companies report that there is a low turnover in the positions inside the company. This is considered to be an important feature in the production, demonstrating that their staff are both motivated and interested in their job.

## Learners needs and drop outs

Farming companies mentions that a number of young persons don't seem to manage to understand why it is important to study and get a national qualification when they are young. Previously young boys dropped out of secondary school, while the now drop out of upper secondary school. Farming industry has been and is still a good option for those young persons that have very good problem-solving skills. The companies highlight that some of their best staff indeed has dropped out of upper secondary school. In the farming industry they have got motivation, interest, got encouraged and learned how to carry out the work. This has according to the companies nothing to do with their skills to do but is related to how the secondary school is organized. Despite of this, many of these persons indeed understand how the production is done and how machines and tools work together in an interplay, whereby they become very interesting for the farming companies. The practical and technical skills which the companies need, cannot be replaced with training at a school. The farming companies indicates that 35-40% of their staff have been drop outs. Despite of this, they have an understanding of operations at the cages that is attractive for the companies. The start getting improved biological knowledge when they are in work, and thus getting improved motivation for learning more theory. The companies need to have staff that know how the machine work in a supply boat, how they maintain the equipment on the boat, how they drive the boat, how they moor the boat to the cage without destroying it, etc. Many of these persons collect 5 years of experience during their work, get motivated and take the theory education afterwards before they pass the two exams and get their national qualification.

## How to specialize the husbandry operatives?

In the near future the industry would need to specialize their husbandry operatives to target the 2 areas mentioned above. Aquaculture VET schools should try to start developing a VET system consisting of modules that may be studied individually and adjusted to the in-company workflow. The companies mention that fish biology is very important in all these 4 tracks. It is so important that it may be necessary to develop a 5$^{th}$ module to target just the biology and add it to the list above.

The farming companies have different options about how the aquaculture VET courses should be organized. Some wants to make up a system where their staff get partly of their job when studying, while others struggle so much with replacing personnel that are at school, that they want the VET providers to offer the training during afternoons and weekends. This requires that the courses cannot be to intensive. It is better both for the staff and the teachers which need tom offer this training in their spear time, to spend some additional time.

The industry mentions that e-learning seems to work for some of their staff, but not for everybody. e-learning cannot be the only solution in an aquaculture VET system, but may be a component in a blended approach mixing several delivery channels. Industry companies suggest that VET schools

could try to apply the periods (2-4 months) where the farms are not in usage, just after the fish has been slaughtered, to train their staff.

Companies would like VET schools to offer more training that strengthen collaboration between farms and between companies. To learn from each other is very important in order to transfer production process knowledge. Some farming companies has started to send personnel from one farm to another farm when for instance counting sea lice. This helps establishing networking and make it easier to solve complex problems that occur during the production. It could be further strengthened by introducing collaborative methods during the training activities, thus increasing the transfer of knowledge and skills between farms and between companies.

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## Scotland Summary

The surveys of VET demand in Scotland have been derived from a series of structured interviews with key industry stakeholders, including the three largest salmon producing companies and the largest trout producer. The survey work was carefully coordinated so as to complement, as opposed to disrupt, the national Skills Survey undertaken on behalf of the Aquaculture Industry Leadership Group (AILG 2030) and published in May 2018.

Consequently, the BlueEDU partners corroborated with most of the AILG 2030 findings, and in some important areas, such as attitudes towards future aquaculture VET qualifications and developments, added further useful insights.

The survey revealed that the industry has become increasingly self sufficient and sophisticated regarding the development and delivery of company inhouse training, designed to ensure all staff comply with legal operational requirements, quality assurance standards, driven by their own company Standard Operating Procedures (SOPs). This inhouse training is complemented by external training providers offering enhancements and some of the compliance-based training as well as the delivery of the only active NQ in Scotland, the work based Modern Apprenticeship (MA) in Aquaculture.

Some important skill gaps were were revealed within the workforce, including fish biology, health and welfare and the aquatic environment, as well as a dearth of effective preparation for those staff stepping up from a husbandry operative to become a site manager. There was a general consensus that the recent specialisation within the workforce had rendered the Nos and therefore some aspects of the MA out of date and a review of both was seen as beneficial.

In addition, although reasonably satisfied with the MA, it was noted that improvements to learning resources through the addition of well contextualised ‘e learning’ would benefit their own in-house training as well as the MA delivery, potentially. There was a relatively low awareness of the potential to develop and offer alternative NQs, but a receptiveness from the main companies to explore these alternatives and the advantages they may offer

**WP5 VET demand Scotland**

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# 1 Industry description

Aquaculture in Scotland has been active for many years and the sector has grown considerably since the 1970'. It is now an important part of the Scottish food production industry and has brought economic growth and employment to rural regions of Scotland, particularly the west coast and Highlands & Islands. The main production areas are the coastal zone waters and sea lochs which offer suitable fish growing conditions and shelter.

The Scottish aquaculture sector is dominated by finfish culture, with most of the production attributed to Atlantic salmon (Salmo salar). There are a range of other fin fish species farmed in smaller quantities (Table 1). Most of the salmon production is carried out in marine cages, but there was a small marine land-based production of 21 tonnes in 2016. The lack of growth in this area is due to the high capital costs of land-based farm construction and the additional running costs. Most of the land-based pump ashore sites are used for either brood stock or marine fish production.

## 1.1 Scottish annual production survey 2016

The total aquaculture production for the UK in 2016 was 194 492 tonnes (OECD). The bulk of this was Scottish Atlantic salmon. Figure 1 shows that salmon production output has decreased since 2014 (179 700 t), however, over the long-term, Scottish salmon production is predicted to increase. A growth target of 210 000 tonnes has been set by the recently established Aquaculture Industry Lead Group A(ILG 2030), on the proviso set by the Scottish Government that this is achieved sustainably, without detrimental environmental impact. For the salmon sector to achieve a production target of 300 000 – 400 000 tonnes per annum (1) represents an approximate doubling of the current production. Advances in production and fish feeding technologies will be necessary to reduce the associated environmental impacts, in addition to better health management and sea lice control.

| **Species** | **2016 Production (T)** |
|---|---|
| Atlantic Salmon (Salmo salar) | 162 817 |
| Rainbow trout (Oncorhynchus mykiss) | 8 096 |
| Halibut (Hippoglossus hippoglossus) | 67 |
| Brown/sea trout (Salmo trutta) | 41 |
| Lumpsucker (Cyclopterus lumpus) | 10 |
| Wrasse (Labridae spp.) | 4 |

Table 1. Total fin fish production for Scotland in 2016, adapted from the Scottish annual production survey 2016(2).

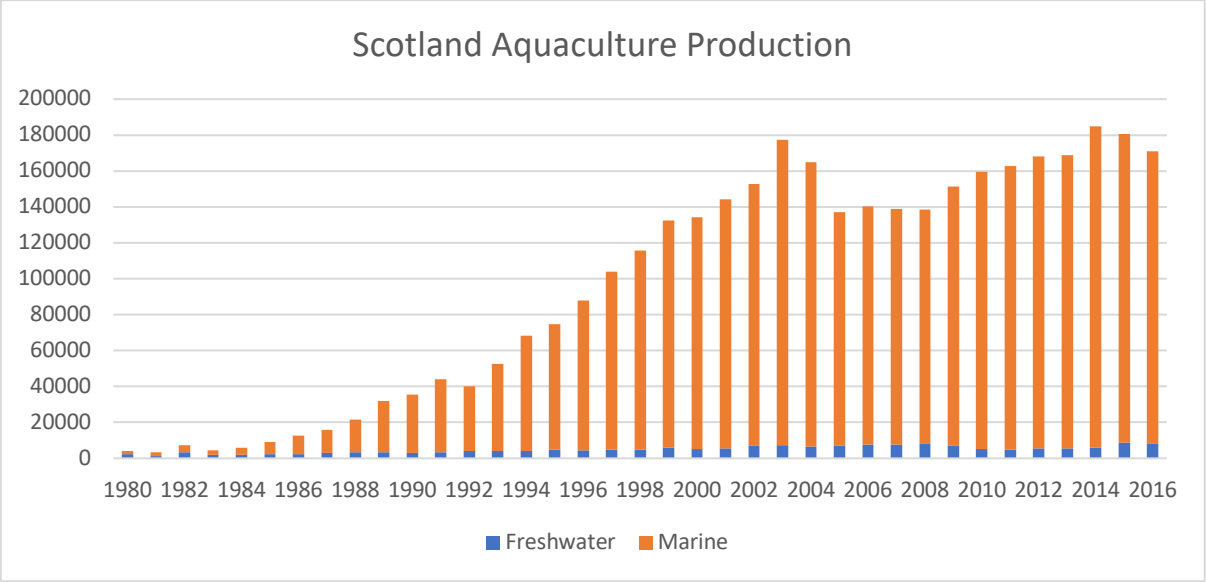


Fig 1. Adapted from FAO data (3) & Scottish Fish Farm Production Survey (2016) data (2).

Globally, Scotland is the third largest producer of farmed Atlantic salmon, and the largest producer in the EU, at 162,817 tonnes in 2016 with a value of £765 million. In 2016 freshwater salmon production was conducted by 26 companies across 87 sites, 48 of which produced more than 43 million smolts. In 2016 on-growing production was conducted by 15 active companies across 253 active sites (Fig 2). Not all active sites in 2016 produced fish for harvest due to the different age classes, with 136 sites producing harvestable stock. Most of the active sites were producing less than 500 tonnes, with most of the production coming from <50% of the active sites. Over 82% of the production came from 73 sites producing >1000 tonnes and over 11% from 26 sites producing 501-1000 tonnes. Organic salmon is quite low when compared to Ireland, as only five sites were certified as organic and produced 3,903 tonnes.

Over 80% (6 595 tonnes) of the Rainbow trout production in 2016 was conducted in freshwater and marine cages. At 2 836 tonnes freshwater cage production represented 35% of the output and marine cage production accounted for 3 759 tonnes (46%). In 2016 seven companies dominated Scottish salmon production, but five companies were responsible for approximately 93% of the Scottish Atlantic salmon production (Table 2).

| **Company** | **Ownership** | **Tonnes produced 2016** |
|---|---|---|
| Marine Harvest (MH) | Norwegian | 45 000 |
| Scottish Sea Farms (SSF) | Norwegian | 28 000 |
| The Scottish Salmon Company (SSC) | Scottish registered (parent company listed on Norwegian SE) | 24 300 |
| Cooke Aquaculture | Canadian | 21 000 |
| Grieg Seafood | Norwegian | 13 500 |
| | **Total** | **131 800** |
| | **Scottish total for 2016** | **141 700** |

Table 2. Scottish Atlantic salmon production for 2016. Tonnage totals represent gutted weights, adapted from the Scottish annual production survey 2016(2).

In 2016 the salmon farming sector directly employed 1780 staff (294 smolt; 1486 production), predominately in the Highlands & Islands. The Scottish Government acknowledges that the sector supports many other jobs in other areas including, processing, transportation, equipment/technology supply, feed production and veterinary products/services. Highlands & Islands Enterprise (4) estimate the total employment supported by salmon production in Scotland is >10 000.

Fig 2. Scottish active salmon (on-growing) production sites 2016 (Scottish annual prod survey 2016(2))

## 1.2 Industry representation regarding VET and Skills

In Scotland there are six organisations that represent the aquaculture industry, and some are actively involved in skills and workforce development. Excluding educational organisations and private training providers, the main bodies involved in skills and workforce development in Scotland are:

- Highlands and Islands Enterprise (HIE)
- Scottish Aquaculture Innovation Centre (SAIC)
- Sector Skills Councils (SSC)
- Skills Development Scotland (SDS)
- Scottish Salmon Producers Organisation (SSPO)
- Aquaculture Industry Lead Group (AILG)

In addition, the Codes of Good Practice (CoGP) influence farm operations and therefore in company training schemes (non-formal VET). Most companies respect the CoGP, and the standards are promoted by the SSPO and the British Trout Association (BTA)

### 1.2.1 Highland and Islands Enterprise (HIE)

Highlands and Islands Enterprise (HIE) is an organisation with remit from the Scottish Government that integrates economic and community development. The HIE jurisdiction covers more than half of Scotland and includes the Highlands, Argyll, Western Isles, Moray, Outer Hebrides and Northern Isles (Orkney and Shetland).

HIE has a vision for the Highlands and Islands to be a highly successful and competitive region that will attract people to live, work, study and invest. To achieve this vision HIE have set out four strategic priorities detailed in their operating plan. The four strategic priorities are:

- Accelerating business growth
- Strengthening communities and fragile areas
- Developing growth sectors
- Developing regional attractiveness

HIE also supports workforce development and assists the creation of learning infrastructure. This is an important factor in encouraging economic growth, which is part of HIE's remit. The remit is informed by the Scottish Governments skills strategy (Skills for Scotland), which highlights the importance to economic growth of having people equipped with the required skills, expertise and knowledge.

HIE have future ambitions, to 2030, for the Highlands and Islands that include:

- A distinctive place-based economy
- An innovative, productive and internationally competitive business base
- Resilient and resourceful communities that are empowered, capable and inclusive
- A growing population, particularly through the attraction of more economically active and young people
- Well connected, with fit for purpose digital and transport links
- A vibrant and distinctive culture

HIE have been actively involved in aquaculture related projects for many years and collaborated with SDS in orchestrating the recent Scottish Aquaculture Skills Survey, published in May 2018 on behalf of HIE and the Industry Lead Group (AILG 2030) (5).

### 1.2.2 Scottish Aquaculture Innovation Centre (SAIC)

SAIC is one of eight centres introduced by the Scottish Government to drive growth in areas of key economic and social importance. SAIC's role is to help the industry meet this rising domestic and global demand for farmed fish. Financed by the Scottish Funding Council, in partnership with Highlands and Islands Enterprise and Scottish Enterprise, SAIC are helping Scotland's aquaculture sector to tackle challenges and grow. Consequently, SAIC plays an active role in the Aquaculture Industry Lead Group (AILG) and the delivery of the industry led strategic plan, *Aquaculture Growth to 2030*(1).

As the Scottish aquaculture industry has ambitious plans for further growth, SAIC has been working alongside the sector to help it achieve this ambition, by:

- Connecting industry with academia to encourage collaboration on the priority issues;
- Sharing the insights and knowledge gleaned with the wider sector;
- Attracting additional UK and EU funding into Scottish aquaculture;
- Encouraging new generations into the sector and developing those already working within Scottish aquaculture.

SAIC encourages Industry-academic collaborations which unites industry knowledge with specialist academic expertise. To achieve this SAIC connects businesses, researchers and other stakeholders, stimulating and supporting commercially-relevant collaboration. This represents a pooling of resources, which shares the risk of innovative R&D and enables more businesses to invest in areas that will help them grow.

SAIC supports the growth of the industry through:

- Skills development – working to fill skills gaps and ensure the industry has the right workforce to compete globally
- Knowledge exchange – sharing project outcomes, and communicating best practice and industry intelligence
- Attracting additional EU and UK funding to Scottish aquaculture – and signposting businesses to other relevant funding sources.

SAIC has worked with industry to identify priority areas for innovation and investment. These have been called Priority Innovation Actions (PIA), and four have been identified:

- PIA 1 Address environmental and health challenges, particularly sea lice and gill disease
- PIA 2 Develop feeds that optimise fish health and nutrition
- PIA 3 Unlock additional capacity for aquaculture development through innovative, evidence-based approaches
- PIA 4 Establish a reliable supply of mollusc spat

The PIA's are not set in stone and have evolved over time to ensure that they maintain pace with the industry priorities and deliver the maximum benefit from the investment. The main aim of each is to deliver a tangible benefit to the Scottish aquaculture industry such as increased harvest volume, enhanced fish welfare, additional job creation or new revenue streams.

### 1.2.3 Sector Skills Councils (SSC's)

Sector Skills Councils (SSC) are independent, employer led organisations, which actively involve trade unions and key stakeholders. They are a UK wide network of sectoral representative organisations, which are responsible for identifying the skills, education and training needs of the workforce in each sector they represent whilst maintaining the National Occupational Standards (NOS) of those sectors. All SSCs in the UK are licensed by the UK government, and all SSCs have the same four key goals:

- reduce skills gaps and shortages
- improve productivity, business and public service performance
- improve learning supply
- increase opportunities to boost the skills of all individuals in the workforce

The Sector Skills Council which represents aquaculture is Lantra, the awarding body for land based and environmental training courses and qualifications. The development and revision of the NOS has been undertaken by a LANTRA sub-committee in the past, but the engagement by industry in the process has been variable.

National Occupational Standards (NOS) are definitions specifying the standards of performance, knowledge and understanding, which individuals are required to carry out their occupation. They are developed through the relevant SSC with employers. Once complete, they are used to inform the development and revision of all National Qualifications (NQs). In Scotland the NOS are used by SSCs, in partnership with industry and awarding bodies, to create qualifications such as the Modern Apprenticeship (MA) in Aquaculture, National Certificates and fish husbandry level and Higher National Certificates and Diplomas at Higher VET Level (See Table 3 on page 16). The Awards are then validated by the SQA, before going live. The NOS have been used to define the practical skills and knowledge requirements assessed within the MA Units, some of which are mandatory, and others optional, to allow flexibility to suit the learner, their farm and their employer.

### 1.2.4 Skills Development Scotland (SDS)

Skills Development Scotland (SDS) is the national skills agency in Scotland, which supports people and businesses in developing and applying their skills. The aim of SDS is to make 'skills work for Scotland' by improving the response of education, training and careers services to the needs of Scotland's economy and employers, thereby providing Scotland's people with the best possible chance of succeeding in the world of work. Working in partnership with a diverse range of stakeholders, SDS seek to understand and articulate the needs of industry and employers within the Scottish economy and build a robust labour market and careers intelligence base.

SDS also support the development of a high-performing and inclusive labour market by encouraging and supporting employers to adopt fair work practices, with a focus on workforce development and inclusive recruitment. They equip individuals with the skills they need, through their career services (for all age groups), work-based learning options and employability support. These include career management skills; empowering individuals to make informed decisions and achieve their potential, throughout their learning and career journeys.

Learning providers, including those delivering the Modern Apprenticeship in Aquaculture, are also funded by SDS. All learning providers receiving funding from SDS are required to demonstrate that they meet SDS quality standards as set out in the SDS quality assurance framework. The learning providers will record their actions, achievements and improvements by completing a self-assessment and quality action plan workbook.

### 1.2.5 Industry producer organisations

The aquaculture industry in Scotland is represented by three main organisations:

- Scottish Salmon Producers Organisation (SSPO) whose members represent approximately 98% of all Scottish salmon production.
- British Trout Association (BTA) who represent most trout growers across the UK.
- Association of Scottish Shellfish Growers (ASSG) who represent shellfish producers across Scotland.

The Scottish salmon sector is represented by the SSPO, formed in 1994, which provides a voice for the sector on many levels including the UK, EU (FEAP) and internationally. The SSPO represents members from across Scotland not only at a political level but in other areas also including regulatory, managing the media, informing the public and offering technical advice. The majority of the SSPO members are in rural areas, mainly in the Highlands, Western Isles, Argyll and the Northern Isles (Orkney & Shetland).

At the political level in Scotland the SSPO will work with all MSPs to:

*Streamline the planning system to increase production by:*

- Representing industry in Local Authority planning and economic development departments.
- Providing advice to companies, on a variety of topics including Audit and Review, industry protocol, alterations and modifications to existing fish farms, the Environmental Impact Assessment Regulations and Permitted Development Rights.
- Offering planning workshops which equip environmental staff from member organisations to engage with consultants, Statutory Agencies and Council planners.

*Create jobs to grow local economies and build sustainable communities*:

- SSPO members are committed to investing in training and skills development for employees.
- Delivers a wide range of essential short course training, via a diverse range of training bodies in the remotest parts of the country. Some of the organisations include, Skills Development Scotland, Scotland Food and Drink Skills Academy, individual colleges and training providers, and the sector skills council LANTRA.

*Improve digital and traditional infrastructure to benefit productivity*:

*Improve the sectors ability to contribute to Scotland Food & Drink Export Strategy*:

- The Scottish salmon sector has achieved EU Protected Geographical Indication (PGI) status, marking its quality and distinctive origins.
- Scottish salmon was the first non-French food to receive the coveted French Label Rouge designation. This is awarded by the French Government to food judged to be of superior quality and taste.

### 1.2.6 Code of Good Practice for Scottish Finfish Aquaculture

The Code of Good Practice (CoGP) for Scottish Finfish Aquaculture was introduced in 2006 as the production standard for the farming of all finfish species in Scotland. The CoGP has been widely adopted by fish farming businesses and is subscribed to by the SSPO and BTA member companies.

The Scottish aquaculture industry consulted with a range of stakeholders during the development of the CoGP, and included Government, NGO's, environmental groups, angling groups, feed companies, fish processors, equipment suppliers and supermarkets.

The CoGP is designed to meet three clear objectives:

- A robust, well-constructed and closely observed CoGP plays an important part in helping to achieve balanced and proportionate regulation of the industry's activities, without overwhelming preoccupation with regulatory detail or bureaucracy;
- Through its adoption and independent auditing, the CoGP provides assurance to all stakeholders, consumers and the general public that Scottish finfish aquaculture is a highly responsible food sector, producing a range of products of which Scotland can be justifiably proud;
- The CoGP establishes a high minimum standard of practice for every participating farmer and provides a framework for industry development through continuous improvement, which reflects the Scottish industry's desire to remain at the forefront of good practice.

The CoGP is designed to be "best practice in action" and is regularly updated to incorporate the latest developments in fish farming. It is independently audited by a management group with an independent chair. The provisions within the Code are routinely inspected and audited by independent bodies specialising in fisheries, aquaculture and other aspects of seafood production.

The CoGP encapsulates the expertise and professionalism of the Scottish aquaculture industry and contains a comprehensive set of provisions. There are compliance points (>500) within the Code covering all aspects of fish production, which set out good practice for each area of activity. It is available to all finfish farmers operating in Scotland and it is the intention that it should be adopted by all producers, although this is not a legal requirement, some industry organisations do require members to adopt the Code.

Some of the fish production aspects covered include:

- Brood-stock production – ova to adult fish
- Freshwater production – hatchery, tanks, ponds, raceways, cages
- Marine production – tanks, cages, on-growing, harvesting

The use of cleaner fish such as Lumpsucker and Wrasse are also included in the Code, due to their increased use to manage sea lice. Best practice on cleaner fish husbandry is now outlined within the Code.

The CoGP is drawing interest from the international aquaculture community as it has earned a world-leading reputation and is being looked at as a model across the international aquaculture community for the self-regulation of the industries in other countries. In company training schemes are influenced by the CoGP.

The CoGP is available on line at http://thecodeofgoodpractice.co.uk/

### 1.2.7 Scottish Aquaculture Industry Lead Group (AILG 2030)

The ILG 2030 are a group that were established by the Scottish government in 2017 to guide the development and expansion of the industry. They are an influential body and have a wide-ranging remit addressing the legal and technical constraints to expansion, including workforce development. They established a strategic framework to help to ensure that industry expands, profitably and harmoniously. A target to double the industry output by 2030 has been set by this group. In May 2018 a Scottish Aquaculture Skills Review was completed and published and was the most comprehensive piece of research in to the industry's skills needs and by implication, the response required from the education and training sector. In October 2018 a well-attended meeting was held in Aviemore, led by the SDS, to start the process of action planning in response to the AILG 2030 Skills Survey findings.

## 1.3 Staff recruitment and development policies

The Scottish Salmon farming industry is in the Highlands and Islands, with one third of production coming from the Shetland Isles. These are relatively thinly populated rural regions of the coastal zone. Rurality can be a problem when attempts are made to attract staff to some remote areas, due to a lack of suitable housing and infrastructure.

The recruitment of staff to operative positions has become very reliant on the local communities and as in many cases these is no suitable local provider of aquaculture VET, the companies increasingly depend on their own staff development schemes. The three main salmon farming companies are co-operative, and their HR Managers meet regularly to address shared staff development issues. This positive trend towards collaboration this century bodes well.

There are generally no formal entry requirements for husbandry or operative positions as most companies have adopted inhouse training schemes to train staff to the level they require to work within their company. Important requirements are a willingness to work out doors, experience of team working, a passion for fish/fishing and the right attitude to work in an aquaculture environment.

Inhouse training schemes can vary depending on the company but will generally support staff development through all stages, irrespective of the level they enter.

There are opportunities for staff with the right attitude and ambition to progress to site manager/supervisor levels within most companies, which is encouraged. Management training schemes have been developed by companies to provide additional training to current managers and to encourage new entrants to management. Managers and supervisors are recruited by all companies externally if there is no one suitable internally, but unlike husbandry staff, there is a need for relevant mandatory qualifications (boat certificates, first aid, fork lift, sea survival), experience working in an aquaculture environment and a proven ability to lead a team.

### 1.3.1 Qualifications held by staff

All companies interviewed acknowledged that they have a range of husbandry staff who either hold an NQ or are working towards one. No definitive figures were available that could quantify the percentage across all companies. One company did have figures that almost 13% of their husbandry staff hold an NQ, and another company have 27 staff completed a Modern Apprenticeship (MA) and 37 ongoing from levels 2-4. It was generally felt that the MA is an appropriate qualification for their

needs at this time, depending on the job role as it cannot fully address all requirements, and additional training was required in some cases.

Historically site managers have been recruited internally for most companies or recruited from other areas if they had relevant experience, with no major emphasis on qualifications. This has now changed however with many companies looking for site managers with a range of additional skills and qualifications, beyond fish production management. The salmon companies interviewed have started in-company management training programmes and/or are putting current and potential managers through the new MA level 4 programme, designed for management development. Although the MA level is beginning to be recognised by the industry, it is felt that this qualification is not a perfect solution to the training of all managers but does cover the basic site manager requirements.

### 1.3.2 Husbandry operatives

The inhouse training schemes developed by many companies have well defined pathways, encouraging staff to progress and become fully competent in their job role within the company. Although there is a general recognition of NQs and other important qualifications awarded by national bodies such as the Royal Yacht Association (RYA) and Lantra, company specific training has been added. This is delivered by internal and external trainers, which can include site managers. It is provided using a combination of practical training and in some cases, paper-based learning packs to support knowledge and understanding.

Induction training is generally site specific and covers areas such as: Standard Operating Procedures (SOPs), Health & Safety, Fish Welfare, Husbandry, Containment, Site Equipment, Feeding and feed management systems.

The prior knowledge and skills of a recruit are established at the interview stage and later validated when they are observed during the induction period. The prior learning and existing skills are often established through 'competence-based interviews', taking account of NQs and industry experience. The completion of an NQ relevant to aquaculture can enable faster progression within the company, but does not lead to any formal exemptions, as all recruits must complete the company induction program and are subject to the appraisal system. Another company's inhouse training scheme can be recognised to some degree, but it is the observations of the recruit's performance during induction that provides the validation and reassurance companies rely on.

This issue was highlighted as a key finding of the *Skills Review for the Aquaculture Sector in Scotland (5)*. This report recognised the need for increased recognition of alternative in company training schemes. However, it was acknowledged that some employers may resist the alignment of their inhouse training with others, due to the trust and transparency this would require. The report recommends that If companies could recognise each-others training programs systematically, the career progression opportunities and mobility of recruits would be enhanced. Individual employers could benefit, as experienced entrants could receive a reduced bespoke training, saving time and cost. The report concludes that through such measures, staff retention within the sector could be improved, retaining knowledge and skills to increase the availability of skilled operatives. It went on to note, that although some employers harbour concerns that improved mobility could result in a loss of staff to other companies, many do recognise the benefits that improved retention could bring to the

workforce's skills and capacity. Aquaculture could be more competitive with other sectors, thereby taking pressure off staff recruitment, and development, to the benefit of employers in the longer term.

#### 1.3.2 Site managers

Managers and supervisors recruited internally are selected based on their performance and progress. However, when recruiting externally there are more requirements to fulfil, such as relevant qualifications and experience.

The inhouse training schemes developed and adopted by most companies include management training competency frameworks, which can require potential managers to undertake 'Personality Profiling' and 'Management Competence' assessments, specific to each company. In addition to completing the inhouse management training schemes potential managers must also have relevant experience working in the aquaculture industry. The level of experience will vary from company to company, with some expected to have a minimum of 5 years-experience, whether recruited internally or externally. Managers recruited externally, in most cases, will be asked for relevant qualifications and depending on the company requirements may undertake a competence-based interview process to establish their suitability for the job role.

#### 1.3.3 Secondary School engagement

Companies located in rural areas engage well with local schools as this is a source of many potential future young recruits. One company has engaged with Argyll College offering the NPA in Aquaculture (SCQF 4), an award designed specifically for schools (14-16-year olds). This included school visits to college and farm sites to take part in practical activities.

This collaborative delivery system is ongoing, at a modest local level in the Argyll region, but many in the industry believe it should be expanded to raise awareness of the positive benefits of aquaculture and aquaculture careers and provide a first step towards productive aquaculture career pathways, nationally.

There are also school engagement activities being delivered by supply companies, with one offering short sessions to Secondary school students on the Isle of Skye. They are introduced to the company's work and services as well as having an opportunity for hands on fish health monitoring activities.

### 1.4 Industry regulation/QA – and the training implications

All the companies interviewed are part of accreditation schemes, which place rigorous standards on the companies and the way they produce fish. The Quality Assurance (QA) standards they are required to comply with ensure that the fish supplied have been grown and harvested to a high standard in all areas of production, including feeding, environment, husbandry, welfare and processing. Each of those areas are covered in detail in the Code of Good Practice, and companies ensure staff are trained in relation to the guidance in the Code. The combination of the QA standards and the CoGP are used to inform the development of Standard Operating Procedures (SOP's) each company adopts and in turn influences the training staff require and receive to ensure the standards can be met. One of the

main QA standards Scottish companies have adopted is the Global G.A.P. Aquaculture Standard (Appendix 1).

The Standard sets strict criteria for:

- Legal compliance
- Food safety
- Workers occupational Health & Safety
- GLOBALG.A.P. Risk Assessment on Social Practice (GRASP)
- Animal Welfare
- Environmental and ecological care

These key elements are well balanced and cover the key sustainability aspects that animal production for human consumption is required to achieve across the full production chain before GLOBALG.A.P. certified status can be claimed. The full production process includes:

- Broodstock
- Hatchery/seedling
- Feed
- Farming
- Harvest/post-harvest (up to the point of sale to the final consumer)

Note: It is mandatory that all stages of production are verified and assessed as compliant.

# 2 The investigative process

A range of formal quality assured investigative survey methods were deployed, as described below. In addition, many informal conversations were held with a wide range of stakeholders, including VET regulatory and finding bodies, to promote engagement with BlueEDU, which were increasingly fruitful during the final 6 months of the BlueEDU Lot 1 project. In addition, the promotion of BlueEDU to an influential member of the Board of Management of a large Norwegian owned Scottish based company, helped in getting a meeting organised in Scotland, which led to subsequent engagement with and support for the BlueEDU mission.

## 2.1 Overview and evaluation of investigative methods and processes

Information was gathered from industry following a four-phase process, culminating in the production of an evaluative report on the Scottish aquaculture education and training demand.

a. Completion of a stakeholder analysis to identify Scottish stakeholders pre-disposed towards the BlueEDU research mission and with access to reliable information and/or influence over other key stakeholders.

   See Appendix 1 Scottish industry stakeholders consulted.

b. The creation of a quality assured structured interview, devised to support research into aquaculture skills and VET demand in Scotland, through one to one engagement.

c. Interviews with stakeholders conducted through phone calls and face to face meetings, which led to documented interview responses which were accuracy checked by the interviewee before submission to the BlueEDU partnership.

d. The offer of an 'on-line survey' to engage individual staff in companies at all levels and to allow them the opportunity to provide their opinion of aquaculture VET and their future skills needs.

e. Analysis of interview results, identifying conflicts in information, information gaps and discrepancies, leading to follow up enquiries to seek clarification on important points of detail for inclusion in the final report.

## 2.2 Quantitative survey results

The opportunity to conduct on-line surveys with the workforce were discussed with companies during or after a structured interview had been completed, encouraging them to offer their staff the opportunity to provide their opinions on personal skills development needs and aquaculture VET. This negotiation was held with HR Managers, or equivalents, and the opportunity to receive a company bespoke data set and analysis was offered as an incentive. Cooperation was considered seriously by one major producer company who were keen to gather company specific feedback on attitudes internally towards skills development, but unfortunately data was not ultimately submitted prior to the reporting deadline.

## 2.3 Qualitative survey results

The response rate from the industry was not as high as hoped, particularly from the smaller companies and supply sector, despite repeated attempts through a range of formal and informal contacts to engage them. In many cases this persistence paid dividends, and the companies that did respond include all the main producers of both Atlantic salmon and Rainbow trout in Scotland. The relatively low response rate from the smaller producers could be attributed to 'survey fatigue'. On the recommendation of the *Aquaculture Growth to 2030* strategic plan, the Aquaculture Industry Lead Group employed a consultancy to undertaking a national 'Skills Review for the Aquaculture Sector in Scotland' which was published in May 2018. This was based on extensive field work earlier in the year, which made it difficult to convince some of the industry to take part in an additional BlueEDU survey, due to the high degree of overlap. Survey fatigue was a real issue, and some went so far as to say, "*we have been surveyed on and off the last 10 years, but see little change happening as a result of the time we invest*" This message was taken on board and the BlueEDU team worked hard to convince the industry that BlueEDU would lead to actions to improves VET provision nationally, and at European level. The interest shown by a major Norwegian company with Scottish business interests, helped to give a key Scottish based company the confidence to engage. Consequently, two of the three main salmon farming companies in Scotland are keen to work together to develop a current and accessible curriculum that will help them train and qualify those in their work force that are the hardest to reach.

The salmon companies interviewed account for approaching 70% of Scottish salmon production. The structured interview process was effective in revealing key work force development issues and the attitude of companies towards formal and non-formal VET.

## 2.4 Previous surveys

There have been several previous surveys undertaken in Scotland over the last 15 years. One comprehensive study was conducted on behalf of the salmon farming sector by LANTRA approximately ten years ago, and other less comprehensive market research into VET needs have been undertaken by VET providers, particularly the former Barony College, as a requirement of the SQA when preparing to evidence demand to support the validation of new NQs.

However, all previous national surveys have been superseded more recently. Consultants Ekosgen completed a major survey commissioned by HIE and led by the Aquaculture Industry Lead Group (AILG 2030), that immediately preceded the BlueEDU survey by 6 months. It was agreed with industry leaders that BlueEDU survey activities would follow the AILG 2030 Skills Survey, to avoid confusing and frustrating the industry. It was designed to be complementary, 'digging deeper' into some of the key issues and findings. The results of the ILG 2030 Skills Survey were published in May 2018 and informed the BlueEDU survey design, as planned. An analysis of the AILG survey reports results and recommendations (See Appendix 2) helped to define the BlueEDU structured interview questions. Many of the ILG 2030 Skills Survey findings were discussed with each of the main Scottish producer companies during the process.

As a result, as well as corroborating with most of the ILG 2030 Skills Survey findings, the BlueEDU interviews provided some insights into industry attitudes towards, qualifications, future VET delivery systems and an appetite for collaboration regarding workforce development, not so evident from the AILG 2030 Skills Review.

# 3 Industry opinion of the aquaculture VET supply

The industry was asked to give their opinion on the National Qualifications that they were aware of, as well any non-formal VET that they relied on. Scotland's aquaculture VET in is illustrated by table 3 below, including NQs that are not currently active. The companies that were interviewed generally have a positive attitude to staff training whether that be inhouse, external or NQs. When asked about the suitability of the available NQs the industry was aware of the Modern Apprenticeship (MA) and acknowledged that it was '*doing the job*' although not entirely suitable for all industry needs, hence their reliance on inhouse training schemes. The MA is the only aquaculture NQ currently being offered in Scotland, although there are others available in the SQA catalogue. The MA has been described as useful for new entrants and compliments the training received inhouse, but more formal VET options may be required.

## 3.1 Summary of available VET

Whilst the Modern Apprenticeship is the only NQ currently offered in Scotland, there are other NQs live on the Scottish Qualifications Authority (SQA) catalogue, but not currently offered and others that have lapsed, that could be revised and re-instated, albeit delivered through alternative modes.

| VET description | Status | Qualification | Delivery mode |
|---|---|---|---|
| Modern Apprenticeship (MA) in Aquaculture (Levels 2-4) | Offered on the mainland and Shetland Isles | SCQF Level 5-9<br><br>(EQF level 4-7) | Work based, supported by Distance Learning |
| National Progression Awards (3 credit NPAs)<br><br>Fish Husbandry, Fish Health and Welfare and Fish Feeding and Nutritiion | Live on the SQA catalogue, but not currently offered | SCQF Level 5<br><br>EQF Level 4 | College and work-based in the past. Could be futher developed to compose a 12 credit National Certificate (Husbandry Operative) |
| Higher National Certificate (HNC) in Fish Production Management | Lapsed - no longer live on the SQA catalogue | SCQF Level 7<br><br>EQF Level 5 | Attendance based in the past. Could be converted to blended learning |
| Higher National Diploma (HND)<br><br>Fish Farm and Sport Fisheries Management | Lapsed- no longer live on the SQA catalogue | SCQF Level 8<br><br>EQF Level 6 | College based in the past with an extended work experience period mid program |

| | | | |
|---|---|---|---|
| Professional Development Awards (PDAs)<br><br>Aquatic Science and Fish Biology | Live on the SQA catalogue, but not offered | SCQF Level 8<br><br>EQF Level 6 | This has never been delivered, but could be developed and offfered on a distance learning basis |
| Mandatory certificated short courses<br><br>(Including ; Boat handling Fork Lift Operations Water Safety and Capstan Winch) | Accessed local, but availability varies in different regions | Certificated<br><br>company compliance | Small group<br><br>Attendance-based training<br><br>'on and off farm' |
| Non mandatory short courses<br><br>E.g. Fish VET group short courses on a range of fish health and welfare related subjects<br><br>Supply company courses | Sometimes delivered as a part of a customer back up services | Non-Formal | Attendance based in small-groups 'on and off farm'<br><br>Technology supply compagnies such as AKVA and feed and health product supply companies, all offer training |
| In Company training<br><br>Designed to reflect company SOPS and CoGP | Mandatory for all recruits (company policy) | Non- Formal | Group Learning and individual mentoring.<br><br>Dependent on company training and supervision, linked to induction and appraisals |

Table 3 Summary of currently and previously available Formal and Non-formal aquaculture VET in Scotland

## 3.2 Occupational standards

In Scotland the National Occupational Standards (NOS) are used to define the knowledge and skills required by each occupation and occupational level within the industry. The aquaculture industry is involved in the development and revision of the NOS. However, the process has not always been supported by the best-informed staff responsible for staff development and training within the main companies. Some of the staff interviewed have been involved in the recent NOS revision, but recognised that they were not very familiar with detail within the standards or the structure and specific components of the MA in Aquaculture based on the NOS. The last revision took place in 2016 and some believed that another review was now required as technology and methods have progressed rapidly over the past 2 – 3 years. Keeping the NOS up to date regarding industry advances has been identified as major challenge. One company stated, "*The 2020 Technical Standards are about*

*to have a big impact, and we (as an industry) need better foresight of the skills implications to ensure we can anticipate emerging new knowledge and skills, allowing us to be more responsive with our staff training*". As the NOS revision normally runs on a five-year cycle, this is seen as inadequate as they are out of date long before the next review, leading to increased reliance on inhouse training to address any gaps.

At the recent AILG 2030 Skills Review action planning meeting in Aviemore in October 2018, the joint chair of the AILG that there called for a 'root and branch review of aquaculture occupational standards in Scotland, as the foundation to future education and training reform. This was in recognition of specialisation within the industry which had led to specialists that are not currently recognised, and for whom no occupational profile (knowledge and skill requirement) definition exists. In addition, this would provide the opportunity for a more comprehensive update of the standards with both producer and technology supply companies involved in the process, to ensure its 'technical currency' and credibility.

#### 3.2.1 Company standards

Those companies interviewed have all defined the knowledge, skills and competencies required by their company's husbandry staff and site managers, although not all have completed documenting them. All agree that these definitions are an asset once fully developed, especially for the managers responsible for quality assurance and standardisation across the company. Company occupational standards and inhouse training are all driven by or closely aligned to each company's SOP's and therefore can may vary, to some degree, between companies. One company revealed that it has been a major aim to link up their 'competency framework' to their SOPs, learning pathways and annual assessment process. To get the full benefit of their own inhouse training scheme they are looking at improving the consistency and reliability of internal assessment and verification process.

No company provided their occupational standards or SOP's for analysis, but some did reveal that they were dynamic, and as such are updated when technology, processes or regulations change, which in turn may lead to a change to internal training schemes. This appetite for immediate updating contrasts starkly to the 5-year review policy operated by the Sector Skills Council Lantra, which can lead to the NOS becoming out of date.

One company thought there was an urgent need now for companies to work together more closely on occupational standards. They suggested a more responsive 'Aquaculture Skills Forum' would be a great step forward. This is now achievable as there is a willingness to collaborate and share between companies. Empowered by the CEOs, the HR managers of the three main salmon farming companies have formed a close working relationship. They recognise that this is essential to improve skills development, education and training at sector level whilst maintaining each company's 'individuality' and appeal as an employer.

### 3.3 Formal VET leading to NQs

The companies interviewed all provide their staff with the opportunity to complete an NQ whilst employed with them. Not all companies could quantify the number who have completed NQs, but one estimated a figure of 20%. All companies encourage and support their staff when undertaking

NQ's. However, the operational requirements of each farm site take priority. To counter this, staff are encouraged to use the quieter periods of the working day as study time to complete course work.

### 3.3.1 Modern Apprenticeship in Aquaculture

The mentoring role is an essential part of the process for any work-based training programme and in most companies the site managers are encouraged to act as mentors for trainees. They fulfil a range of roles including supporting the trainees, working with external tutors/assessors and can be part of the assessment process themselves by providing witness testimony for use as assessment evidence relating to practical competence. Those managing the trainee's day to day are best placed to judge their competence in relation to both the company SOPs and the assessment requirement of the NQ, which are generally reasonably consistent.

The MA level 2 is thought to be a good NQ for new recruits and is utilised to complement company inhouse training schemes. None of the companies insist that their recruit enrol on the MA programmes, but it is encouraged for those who are motivated, as employers recognise that the award can add additional none site specific background aquaculture knowledge, when well supported by college tutors and good learning resources. One company prefers to delay MA entry until the recruit has accrued some hands-on experience. This is a logical policy when considering the practical requirements of the award.

The MA level 3 is used to help prepare staff for moving into a team leader/supervisory role for the first time. Whilst generally felt to be appropriate, commonly, it is still enhanced by the internal training schemes offered by each company.

The MA level 4 is a new award and therefore opinions are still forming. Companies that have staff enrolled on the MA level 4 feel it is suitable for preparing staff progressing to the site manager role but does not stretch their more experienced but unqualified site managers. There was a suggestion that a more challenging program may be required to motivate them. However, the detailed competencies and learning outcomes were not outlined at this stage.

No company makes MA registration and/or completion mandatory. One company acknowledged that if the MA awards are completed early in the staff members career it could greatly increase their development and depth of understanding, but they saw the MA as being of less value for those with more experienced.

### 3.3.2 Alternative Scottish NQs

There have been a wide range of aquaculture NQs available from EQF level 3-6 in Scotland over the past 30 years. However, the ones that all companies interviewed are most familiar with are the current MA's level 2 and 3 with some awareness of the relatively new MA level 4.

Most companies interviewed recognised some of the other qualifications that were (or still are) available but no longer active. The most recognised were the NPAs (SCQF 5) in Fish Husbandry, Fish Health and Fish Feeding and Nutrition NPAs, with one company being part of a Scottish Funding Council Skills Utilisation developmental pilot with Barony College in 2011-2012(6). Unfortunately, this pilot study was prematurely terminated, due to internal changes within Barony College and the company involved, and the general distraction caused by Scottish College mergers in 2013.

The awareness of the Higher VET program and progression pathway to Degree level that operated in Scotland during the 1990s very successfully by the former Barony College, was not referred to. As Higher VET has not been available in Scotland for over 8 years, this is unsurprising as all the main company HR managers were not been in post 8 years ago. However, anecdotally, many of those who completed this higher VET program and are now in senior positions in the industry and speak highly of the preparation it provided them for progression from husbandry to managerial level.

In addition, the recent AILG 2030 Skills Review published in May 2018 refers to Higher VET as a necessary part of a future education and training strategy for Scotland, implying that the previous NQ and Units at this level should be reviewed and brought up to date. They could then be offered by a provider as clusters of Units packaged as 3 credit Professional Development Awards (PDAs) and delivered through work based and blended learning to ensure it is accessible to those in work.

## 3.4 Non-formal VET

Some training, although not classified as formal VET, does lead to certification that companies require in order to remain legally compliant, and/or to satisfy buyer (and consumer) driven quality assurance standards as fish producers.

Short courses are often sourced externally, however, the larger companies have developed their own qualified instructors to service key regular requirements and avoid being held up by intermittent external trainer. This has built capacity in house to deliver the training and certification needed to remain compliant. A lot of non-formal VET in key subjects is also offered in house, driven by company SOPs compliance. (See 3.4.3 below)

The HR managers in the industry have referred to a confusing plethora of short course training providers and alternative certification that can be recognised for standards compliance purposes. At the recent AILG 2030 Skills Review action planning meeting in Aviemore (October 2018), a review of these types of courses was proposed, in order to develop industry recognised equivalencies, and make progress towards rationalisation. The lack of a local supply was noted as a barrier in some of the more remote regions in the coastal zone, hence the development of inhouse capacity.

### 3.4.1 Certificated short courses supporting compliance

Depending on the operatives' role and the equipment they need to safely and competently operate, there are certificated short-courses that staff are required to undertake. One company is accredited to deliver and certificate several core qualifications, including; RAYA boat handling, fork lift operations and 'Capstan' winch' operation. The company has qualified inhouse instructors to deliver those courses, when and wherever required More specialist courses, such as IOSH accredited Health and Safety and ILMS accredited management courses are outsourced by all companies interviewed.

Curses within this category include:

- Sea survival - is an essential pre-requisite for all marine operatives.
- Fork Lift Operations - for those using forklifts.
- Lifting equipment training - for marine operatives, including the NPORS Appointed Person Qualification.

- Boat operations Roya Yacht Association (RYA) – Power/work boat handling mainly for marine operatives.
- VHF Radio - for marine operatives responsible for communications at sea.

### 3.4.2 Uncertificated short courses

Although those short courses lack any form of assessment process and do not lead to recognised certification, some do make a useful contribution to staff development and are considered to have a very important role and compliment inhouse training schemes.

These courses include:

- Fish health and welfare, such as the course offered by the Fish Vet Group
- Feed management systems, such as those offered by AKVA to their customers
- Fish feeding and Nutrition, such as the courses offered by the fish feed companies
- Fish Health courses provide by companies supplying health products

### 3.4.3 In company training schemes

The inhouse training schemes developed by many companies interviewed were initially created through necessity, as commonly, a suitable and accessible aquaculture VET provider could not be accessed. Initially, the primary driver was legal compliance and to ensure staff conform with all company standards. Over time, the content was increasingly more driven by the company Standard Operating Procedures (SOPs), which reflected external QA requirements such as GLOBALG.A.P, and informed by the NOS on occasions and the CoGP. One salmon farming company systematically mapped its SOPs to the NOS in 2012, in order to develop a strategy for the assessment of practical competence that was consistent with their SOPs and generated assessment NQ assessment evidence, simultaneously. This concept has merit and represents good practice that could be shared with other companies.

Inhouse training schemes have become much more structured latterly, offering well designed progression pathways. Companies believe this will appeal to existing staff, as a 'secure way' of motivating their continuous learning and development and keeping them up to date with company policies. In addition, the larger company's consciously use their inhouse schemes to present a picture of company career progression to help attract high calibre young entrants. In this sense, companies recognise that they are in competition within a national labour market. However, this does not deter them from collaborating when necessary to resolve a wide range of sector workforce development issues.

The interviews revealed that all companies rely on internal and external delivery within their training schemes. Basic farm skills are usually developed internally on site, with recruits shadowing more experienced staff during their induction. A combination of on farm practical instruction and assessment is integrated with the observations of a new entrants' performance during daily farm routines. Some companies have well designed learning and assessment materials to support and consolidate aquaculture underpinning knowledge and understanding. One company uses 'off the

shelf' generic on line learning to satisfy specific subject needs but believes that 'e learning' would be more effective if contextualised for aquaculture for a range of technical subjects.

New entrants are often encouraged to enrol on NQ programmes such as the MA to complement the inhouse training schemes. However, encouraging some of the mature learners to commit to an NQ can be more challenging. Allegedly, many fear failures and lack the confidence as learners to enter a 'formal VET system'. This may explain why no Scottish company has insisted on NQ registration, and/or completion by their staff.

There are significant costs associated with the design, development delivery and assessment of inhouse staff development and training programmes. One company acknowledges the need to further develop and standardise its internal assessment processes as a result of the variability they have noted in the judgements made by their internal company assessors. They are considering applying for SQA centre status to enable them to adopt more rigorous SQA QA processes to resolve this issue.

External trainers and the staff time 'committed to learning' can further add to costs. Most companies try to deliver internal training as locally to the farm as possible, and when essential external training requirement arise, they will try to recruit local providers to benefit the local community and economy. One company delivers 11 days of company specific training/year and encourages continual development of its staff beyond the fish husbandry and farm operations basics, providing opportunities to specialise.

# 4 Aquaculture learners

The industry has observed learners undergoing inhouse training and NQs and are aware of their 'attitudes to learning' and the range of support needs that can arise. They are also aware of common knowledge and skills gaps and the company's priorities in addressing them.

## 4.1 Learner profiles and characteristics

Most learners recruited at the operative level are from the coastal zone and many have no formal qualifications on entry. This has been more accentuated recently, as last century there were two colleges on the Scottish mainland offering full time attendance-based VET and Higher VET in aquaculture. Many of the graduates entered industry on the strength of these practically based vocational qualifications and some progressed to supervisory and management roles.

Today, some staff start their management career unqualified for the role, having worked through the company ranks to demonstrate their practical capabilities and suitability for management. Performance that has been recognised within the company appraisal system is often instrumental in their career progression. Others have undertaken supervisory qualifications as a route to a management role and tend to be more experienced and confident learners. Latterly, the MA in Aquaculture at levels 3 and 4 has been used by some for this purpose

## 4.2 Learner confidence and learning difficulties

A significant minority of husbandry operatives in companies are known to have some learning difficulties and have not thrived during their compulsory schooling. At the start of their employment they are not confident learners, and this has been found to be a common issue common amongst north European aquaculture. As a result, companies do not insist on NQ registration and/or completion. Conversely, most managers tend to be more confident learners and company HR Managers believe that those with more experience require a more challenging program, implying that they are very confident learners.

## 4.3 Learning style preferences

The companies interviewed use a range of training delivery methods, which suit a variety of learning styles. The interviewees were asked to identify which approaches to learning were preferred in their company by husbandry staff and site managers. Most husbandry operatives are 'kinesthetic learners' and respond well to the hands-on training, some of which is one to one, supported by work shadowing as they are becoming established within the 'SOPs driven' farm routines.

When asked about their learners' receptiveness to alternative delivery modes, the companies revealed the following thoughts for the development of knowledge and understanding:

- One to one mentoring – a good approach to learning for husbandry staff and site mangers.
- Peer discussion (supported by communication technologies) – considered an ideal approach for site managers.
- Paper based distance learning – ideal approach for site managers

- Computer-based and/or on-line learning – some companies favour this approach for husbandry staff, whilst others favour it for site managers.
- Learning delivered via hand held devices – one company favors this approach and is using it for all staff.
- Short courses on technical subjects – two companies favor this approach for both husbandry staff and site managers, whilst one uses it for site managers only.
- E-portfolio evidence gathering to demonstrate practical competence) – husbandry staff and site managers.

One company deployed the full range of approaches but favored the use of workshops, followed by on site instruction and ongoing mentoring by formally appointed company mentors. They found that 'on line learning' works well for all staff as it is flexible and causes less disruption to site operations. The inhouse trainers used by all companies are aware of the learners' different learning styles and preferences and adapt their training accordingly and are responsive to those with learning difficulties.

There appears to be a growing awareness among the inhouse trainers of learning difficulties such as dyslexia, and the companies have developed support processes to assist learners and ensure any impact is minimised.

# 5 Skills gaps identified

There were some specific skills gaps referred to by those interviewed from the producer companies. The observations of a technology supply company were particularly revealing. The BlueEDU findings have been cross referenced with the findings of the AILG 2030 Skills Survey (Appendix, to reveal a reasonably close correlation.

## 5.1 Fish Husbandry Operative

All companies feel that the training they provide inhouse for husbandry staff does the job, but the following skill and knowledge could be improved, with the specific priorities varying between companies:

- Health and Safety
- Fish feeding
- Fish Health management
- Fish farm equipment and maintenance
- Boat operations
- Aquatic environment and monitoring
- Fish harvesting

Observations by a major technology supply company indicated that many operatives in the industry lacked a basic knowledge of fish biology and the aquatic environment. This was to some extent reflecting the trend towards increased specialisation, leading to the employment of some operatives with a very narrow range of specific technical operator kills, some of whom are not directly responsible for the fish stocks. However, anecdotally, many industry members are aware that technological advances and too high a reliance on technology in the absence of a deeper understanding of fish biology and the aquatic environment could lead to some negative consequences in the future.

The AILG 2030 Skills Survey (Appendix 3) corroborated with the BlueEDU findings and refer to some additional significant skills that are consistent with anecdotal evidence from informal industry contacts.

This included:

- Anticipation of a growing focus on digital and ICT literacy, as sophisticated software driven systems, such as camera surveillance, stock control and fish feeding become pervasive.

- The application of STEM (Science Technology Engineering and Maths) within aquaculture was noted, particularly data analysis skills.

- A significant unmet demand for boat skills are also key across aquaculture "*and not just driving boats, but whole range of different specialist vessels, feed barges, etc*." Another employer added, "*Working from boats requires boat and crane skills*"

- Health and Safety training was a high priority and a major challenge by some.

- Some employers recognise that "*staff need a range of softer, transferable skills to respond to the current and future needs of the sector"*, including team working, building positive relationships and customer care".

- Engineering skills are a key requirement across the sector. This ranges from mechanical engineers for routine maintenance, through to design engineers for example fish pen fabrication……Employers all recognise that *"Engineering roles are the most difficult to fill*".

## 5.2 Site manager

There is a general agreement across all companies that specific training targeting supervisors and managers is in demand. Observations by a major supply company indicated that many husbandry staff progressing from husbandry to site manager level were not well prepared for the new demands of a supervisory role. Team leading, and other management and soft skills were often lacking and not being formally developed:

In addition, the specific skill gaps mentioned by others were:

- Management of fish health and welfare
- IT skills and the operation of digital aquaculture management systems
- Health and safety management
- Preparing for Quality Assurance and compliance audits
- Staff management and team leading - including communications, leadership, absence management, discipline and grievance and interview skills.
- Budgeting and financial management for supervisory/management roles.

The AILG 2030 Skills Survey corroborated with a general perception that the dearth of management skills within the sector was a significant issue. Most finfish companies reported a lack of skilled assistant managers in the current workforce, contributing to the overall demand for farm management skills and indicative of a 'succession planning' issue.

As the sector has grown and developed, the skills needed to manage and run aquaculture businesses have become more pronounced… Managing larger operations, and larger work forces requires strong leadership and management. They recognise" a *growing need for business management and commercial skills and knowledge*"

# 6 Future VET needs

The industry appears to be seeking evolution of the aquaculture VET system as opposed to radical change. The HR Managers of the main salmon farming companies were all appointed relatively recently and have been the driving force behind the well-designed in-house training schemes that now dominate Scottish aquaculture staff development strategies. More recently, the work-based MA in Aquaculture has risen in prominence, and consequently, many HR managers are less unaware of the alternative NQs and delivery modes available through SQA that predate the MA and may have future value.

They are reasonably satisfied with the status quo. Their strategy has been based on site-specific inhouse training (non-formal VET) to ensure all operatives can safely conduct tasks within their remit whilst complying with legislation and company quality assurance requirements, complemented by work based NQs for their more ambitious staff seeking a National Qualification. However, the lack of transparency when comparing different company in-house training schemes in order to establish meaningful and reliable equivalencies, is becoming recognised as an issue with growing cost implications that needs to be addressed.

There is support for a radical review of the aquaculture industry's 'occupational map' to redefine 'occupational profiles' and the NOS underpinning them. Most agree that the NOS should be updated more regularly to inform a comprehensive NQ revision and development, and to allow companies to cross reference their inhouse training and assessment plans. This would help the companies define the 'common ground, informed by respected national level definitions of the knowledge, understanding and skills required of husbandry operatives and site managers. The recognition of equivalencies for key competences and the harmonisation of different inhouse training schemes could then become a reality.

## 6.1 VET (EQF 3-4)

The currently available NQs are supported by industry and are positively promoted by some companies, particularly to new entrants, to complement their in-house training. However, there appears to be a demand for NQs that offer a wider range of optional units and increased flexibility. Following the completion of the imminent NOS review referred above, selected aquaculture NQS in the SQA catalogue could be reviewed and revised accordingly. Once complete, learning outcomes could be mapped to company SOPs and assessment processes within inhouse training schemes. This would identify opportunities for assessment evidence gathering towards the completion of a selected NQ. Subsequently, an unconfident learner could be shown their progress towards a formal NQ as a result of their inhouse training, encouraging them to register and complete.

### 6.1.1 National Certificate (NC) composed of National Progression Awards (NPAs)

In the interest of greater flexibility and confidence building, a series of National Progression Awards (NPAs) at SCQF 5 could be provided within a new and progressive formal VET program, following their review and revision, and designed to appeal to 'hard to reach 'work-based learners and school leavers

(16 years plus). There are three NPAs live on the SQA catalogue (Fish Health and Welfare, Fish Feeding and Nutrition and Aquatic Environment). The development and validation of one more NPA would provide a 12 credit National Certificate, composed of 4 NPAs equivalent to 12 credits (480 hours of learning and assessment activity).

This revised and updated program for husbandry operatives could be offered within a college or work-based delivery mode, or a blend of the two. With industry cooperation, which has already been muted by one major company, well-equipped commercial fish farms could be accessed for significant components of work-based training whilst on program. Learners could experience two types of farm operation selected from a choice of given options - salmon smolt production, salmon on-growing and rainbow trout production. One company proposed that they could refer young job applicants (16-18 years old) to the programme following recruitment, under some form of company sponsorship, with the prospect of employing them following their successful NQ completion. By which time they would be over 18 years old and able to legally operate all the farm equipment.

#### 6.1.2 Upgraded MA in Aquaculture

There is some interest in specific improvements to the delivery system for the work-based MA in Aquaculture, which when aggregated, amounts to a significant upgrading. This could include; the Accreditation of Prior Learning (APL), e portfolio to support the assessment of practical competence and 'e' learning. Some companies have also expressed an interested in the development of 'e learning' resources, contextualised for aquaculture, to displace some of the 'uninspiring' generic e learning being used within inhouse training currently.

### 6.2 Higher VET (EQF 5-8)

The new Level 4 MA in Aquaculture has been welcomed by industry generally, as it filled a void that has persisted at Higher VET level since the Scottish full time Higher National Certificate and Diploma provision terminated early this century. There have been some non-formal management development programs organised by the Scottish Aquaculture Innovation Centre which have also been well received.

Some HR managers have noted that whilst the MA level 4 is adequate for preparing some staff for progression to their first management post, it is less suitable for the more experienced site managers as it does not sufficiently stretch and motivate them. An accessible and more challenging NQ would be welcome.

#### 6.2.1 Higher National Certificate composed of Professional Development Awards (PDAs)

The Higher National Certificate in Fish Production Management and Higher National Diploma in Fish farm and Sport Fisheries Management previously available in the SQA catalogue have lapsed. However, a Professional Development Award in 'Fish and Aquatic Science' made up from two of the constituent Units remains available, although it has never been offered since being validated over 8 years ago. Following the updating of the NOS, three more PDAs could be devised, containing management level learning outcomes as required by industry. They are 3 credits Awards, equivalent to 120 hours of learning and assessment. Together, they would make up a revised HNC in Fish

Production Management, a 12-credit complement, which could be offered to work based learners preparing for a management level role in fish production, as well as other learners

#### 6.2.2 Alignment to University Degree pathways

An interest was expressed by some AILG 2030 Skills Review respondents in work-based Degree level studies in aquaculture as a means of advancing their careers. This fits well with a current Scottish Government education policy drive for work-based qualifications and apprenticeships pitched a higher technical level of and accessible by those in work who wish to upgrade their qualifications to degree level without leaving their employment. The Scottish Aquaculture Innovation Centre (SAIC) is supportive of programs that promote internships and match undergraduates to suitable employers.

A combination of PDAS offering specific clusters of Units that can be aggregated to make up a Higher National Certificates and potentially Higher National Diploma, could provide a progression route to a work-based degree, effectively reinstating the Higher VET to Degree pathway that served learners and industry so well in the 1090's. Previously, this was an attendance-based delivery mode, but in the future, it would need to be offered in a flexible distance and/or blended learning format. Such a development may have to take cognisance of the on-line course in Aquaculture already being offered by a leading Scottish University that attracts learners employed in aquaculture with ambitions to progress.

### 6.3 Delivery modes

The work-based MA in aquaculture dominates as the sole NQ being offered in Scotland. However, the way delivery is supported varies between providers. Anecdotally, there is some application of e learning within MA delivery by the North Atlantic Fisheries College on the Shetland Isles. However, this resource has not been available to main land providers, and paper-based learning packs have been used as an alternative to support delivery in the past, although are rarely deployed today and need updating. Latterly, the delivery of knowledge and understanding has been heavily dependent learner led enquiry, based on the farm, supported by on-line resources, guided by the tutor. The assessment of the learners' knowledge is based on open book internet-based research and farm-based enquiry, which allows most learners to 'deepen' their aquaculture knowledge in relation to their own farm operation. Based on a summation of the BlueEDU research feedback, industry and providers both seem reasonably satisfied with this strategy for those with some practical farm experience

The MA system co-exists alongside inhouse company training. On the mainland, according to one provider, the MA delivery has not been fully evaluated for some time, and no detailed comparison has been made with inhouse training. Therefore, it is possible that opportunities for the recognition and accreditation of prior learning are being missed. An appetite for improving work-based MA resources and delivery processes on the Scottish mainland is apparent.

#### 6.3.1 Reinstatement of college-based VET

As one mainland provider recognises, the existing MA delivery mode has significant limitations for young new entrants who arguably need a more structured resource and tutor led approach and would

benefit from a more diverse aquaculture learning experience at the start of their careers, as opposed to one focussed on their farm and company SOPs.

There is interest from a former aquaculture VET provider in the re-instatement of full-time aquaculture VET. Revised NPAs could be aggregated to form a more flexible National Certificate program offered through blended learning in partnership with industry. (see 6.1 above). This could lead to the introduction of a very different assessment strategy, including the reintroduction of more closed book assessments, as well as a final examination requiring learners to apply their knowledge across different subject areas. A full time National Certificate program would provide the underpinning knowledge for the MA at level 2, allowing learners to fast track to the MA level three once in employment. This new MA pathway founded on the National Certificate, would provide the aquaculture diversity required by a young person starting their career as well as on farm training experience and the assessment of competence in the workplace, providing the best of all worlds.

### 6.3.2 Higher VET

Bearing in mind the relatively low volume of demand, in order to ensure viability, it is essential that the programs referred to in 6.2.1 above are available in a distance learning mode. For those in employment enrolling from industry, action-based learning would be an integral element of their blended delivery and assessment strategy.

In addition, there should be a strong emphasis on group and peer learning to encourage a 'problem solving approaches to learning' that require the application of soft skills, such as communication and team leading. Some of the constituent PDAs would be designed to suit the needs of more experienced farm mangers seeking recognition through the completion of an NQ.

# 7 Industry roles within future VET development

There are a range of opportunities for industry, to get more fully involved with VET development nationally and within Europe over the short to medium terms. Many have the potential to transform and improve the national aquaculture VET supply, which has been in decline this century. The most beneficial activities depend on forging closer cooperation between industry and the VET providers within shared VET delivery systems that unite the non-formal VET, currently favoured by industry, with formal VET, more effectively.

## 7.1 National level initiatives

The recent AILG 2030 Skills Review Action Planning meeting held at Aviemore in October 2018 and led by SDS set out a wide range of proposed activities in response to the skills review findings.

The following abstracted summary provides an indication of the 'all encompassing' nature of this ongoing national initiative.

- Updating the aquaculture occupational map, profiles and National Occupational Standards (NOS)
- The harmonisation of company 'in house training' to derive equivalencies
- The development of a higher level of digital skills within the workforce
- More effective marketing of aquaculture careers to young -people
- The development of Leadership and management training

These workstreams have the potential to positively impact nationally but will depend on the active participation of industry (producer and supply companies) in close cooperation of VET providers. It is worth noting that ensuring high quality and sustained industry representation has been a major challenge in the past. In addition, effective coordination between a plethora of public sector support agencies with some form of workforce development remit (see 1.2) will be a pre-requisite, to avoid frustrating the industry and VET providers.

It is important to note that the leading public sector VET providers are developing strategies to facilitate the realignment of future revised NQs to the mainstream funding system governed by the Scottish Funding Council (SFC). This will be mission critical in Scotland, in order to provide the resources necessary to sustain the development and delivery of a future VET provision that meets the quality standards that the industry will require.

## 7.2 European level opportunities

Whilst the industry is not currently involved in European workforce development initiatives, there is clearly interest from the main Scottish based salmon farming companies in joining Norwegian led north European 'innovative VET development projects.

Following the revision and updating of the aquaculture occupational map, the Scottish aquaculture VET system will need to be reviewed. Therefore, the environment and timing are very conducive to more radical 'industry led' change. In addition to the 'upgrading' within the boundaries of the status quo' that industry welcome, there is also an appetite for realignment of the VET delivery systems, EQF

levels, shared learning resources and assessment strategies, to meet the future needs of the Norwegian owned companies in Norway, Scotland, Iceland, Ireland and the Faroes, more effectively.

## References Scotland

(1)- Aquaculture Growth to 2030, accessible from: http://scottishsalmon.co.uk/wp-content/uploads/2016/10/aquaculture-growth-to-2030.pdf

(2)- Marine Scotland Science – Scottish Fish Farm Production Survey 2016, Scottish Government 2017.

(3)- FAO Fishery Statistical Collections, Global Aquaculture Production, Statistical Query Results accessible from: http://www.fao.org/figis/servlet/SQServlet?file=/usr/local/tomcat/8.5.16/figis/webapps/figis/temp/hqp_2638913183769692296.xml&outtype=html

(4)- The Value of Aquaculture to Scotland; A Report for Highlands and Islands Enterprise and Marine Scotland, 2017.

(5)- Skills Review for the Aquaculture Sector in Scotland, Highlands and Islands Enterprise (HIE), 2018.

(6)- Aquaculture Work Based Learning Survey, Barony College, 2011.

## Appendix 1 Scottish industry stakeholders responding to consultation

| Organisation | Address |
|---|---|
| Marine Harvest Scotland | Marine harvest scotland, Blar Mhor industrial estate, Fort William Ph33 7Pt, Scotland, UK |
| Scottish Sea Farms | Laurel Ho/Laurelhill Business Park, Stirling FK7 9JQ |
| Scottish Salmon Company | 8 Melville Cres, Edinburgh EH3 7JA |
| Dawnfresh | Bothwell Park Industrial Estate, Uddingston, Glasgow G71 6LS |
| Cook Aquaculture | Kirkwall Orkney Isles KW15 1RG United Kingdom. |
| AKVA | 36F Shore St, Inverness IV1 1NF |
| Biomar | North Shore Rd/Grangemouth Docks, Grangemouth FK3 8UL |
| Scottish Aquaculture Innovation Centre (SAIC) | Scion House, Stirling University Innovation Park, Stirling FK9 4NF |
| Scottish Salmon Producers Organisation (SSPO) | Isla Rd, Perth PH2 7HG |
| AILG 2030<br><br>CO Chair | 136 Anderson St, Inverness IV3 8DH |
| Highlands and Islands Enterprise (HIE) | An Lòchran, Inverness Campus, 10 A9, Inverness IV2 5NB |
| Skills Development Scotland (SDS) | Monteith House, 11 George Square, Glasgow G2 1DY |
| Lantra Scotland<br><br>Sector Skills Council | Inveralmond Business Centre, Auld Bond Road, Perth PH1 3F |
| Scottish Qualifications Authority (SQA) | The Optima Building, 58 Robertson St, Glasgow G2 8DQ |
| Scottish Credit Qualifications Framework (SCQF) | 201 W George St, Glasgow G2 2PQ |
| Scottish Funding Council (SFC)<br><br>LANTRA | Apex 2, 97 Haymarket Terrace, Edinburgh EH12 5HD |
| Energy Skills Partnership | Argyll Court, Castle Business Park, Stirling FK9 4TY |

| | |
|---|---|
| St Andrews University | St Andrews Scotland |
| Skillfish Ltd | |
| Polaris Learning Ltd | 12 Meadows Industrial Estate, Station Road, Oldmeldrum, Inverurie AB51 0EZ |
| Inverness College (UHI) | 1, Inverness Campus, Inverness IV2 5NA |
| Scotland Rural College (SRUC) | Peter Wilson Building King's Buildings, W Mains Rd, Edinburgh EH9 3JG |
| Argyll College | University for Highlands and Islands |
| Fish Vet Group | 5 M Benchmark |

## Appendix 2 The GLOBALG.A.P. Aquaculture Standard

The GLOBALG.A.P. Aquaculture Standard sets strict criteria for:

- Legal compliance
- Food safety*
- Workers' occupational health & safety
- GLOBALG.A.P. Risk Assessment on Social Practice (GRASP)
- Animal welfare
- Environmental and ecological care**

*The GLOBALG.A.P. Aquaculture Standard has been successfully assessed against the Global Food Safety Initiative (GFSI) Benchmarking Requirements and achieved GFSI recognition for scope A2 farming of Fish - the ONLY Aquaculture farming standard to have achieved this**.** For more information on the GFSI, please see here: http://www.mygfsi.com/certification/recognised-certification-programmes.html

**The Standard has also been benchmarked against the Global Sustainable Seafood Initiative's Global Benchmark Tool Version 1 and are recognized by the GSSI Steering Board. A seafood certification scheme is recognized after successfully completing the 7-step Benchmark Process. The expert-led process involves objective assessments made against the Benchmark Framework. For more information on the GSSI please see here: http://www.ourgssi.org/benchmarking/recognized-schemes/

The Standard covers the entire production chain from feed to fork:

**Compound Feed:** Aquaculture producers are required to source the compound feed used at the aquatic farming and hatchery levels from reliable suppliers. Learn more about the GLOBALG.A.P. Standard for Compound Feed Manufacturers.

**Aquaculture Hatcheries and Farms:** The GLOBALG.A.P. Aquaculture Standard applies to a diversity of fish, crustaceans and molluscs and extends to all hatchery-based farmed species, as well as the passive collection of seedlings in the planktonic phase. It covers the entire production chain, from broodstock, seedlings and feed suppliers to farming, harvesting and processing.

**Chain of Custody:** The GLOBALG.A.P. Chain of Custody Standard gives aquaculture producers a high level of transparency and integrity by identifying the status of your product throughout the entire production and supply chain, from farm to retailer. For added value, read more about the GLOBALG.A.P. Chain of Custody Standard here.

## Appendix 3 Analysis of Scottish AILG 2030 Skills Review

**1. Supply Analysis**

| Ref | Abstract | Commentary and further questions to address |
|---|---|---|
| P 31, P 32-34 | "220,000 passes at school level in aquaculture related subjects" | Does this element of supply analysis have much relevance? Seems too tenuous. There is a detailed tabulated analysis of school science registrations and results provided that serves no meaningful purpose. |
| P31 | "Since 2010 the overwhelming majority of students studying aquaculture Fish Production/Fisheries Further Education courses have studied on a part-time basis" | This relates to the demise of FT provision in Scotland when applications declined, and Barony College were the last provider to run a small cohort at SCQF4/5. |
| P31 | "Shetland College accounted for 75% of all enrolments on Fish Production/Fisheries Further Education courses in Scotland in 2015/16." | They are the only significant public-sector VET provider remaining and are active with MA, short courses and possibly NPAs to schools |
| P31 | "At Higher Education level, there were 1,539 students studying aquaculture related courses across 11 Scottish institutions in 2015/16" …"Following graduation, in 2015/16 38% of graduates from aquaculture related degrees were in work or studying and working. However, it is not possible to tell what sector they were working in" | Again, the link to aquaculture seems tenuous, as implied by the final summary point on page 31 |
| P34 | "Training providers are trying to address this demand. The delivery of Apprenticeships in aquaculture at SCQF Level 5 (SVQ Level 2) and SCQF Level 7 (SVQ Level 3), introduction of an SVQ in Boat building and repair and the recent development of the Technical Modern Apprenticeship in aquaculture Management at SCQF Level 9 (SVQ Level 4) indicate that providers are seeing | This shows no recognition of the distinction between HE and VET. The tradition was not BSc and MSc arguably, it was NC and HNC/D for many years in the VET sector, with pathways to HE. College provision is described from the perspective of what is currently offered, with no historical perspective. |

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| | the need to create further training opportunities, in addition to the traditional BSc and MSc courses already on offer" | Does an SVQ in boat building and repair really serve the needs of boat handling and maintenance within salmon farming?<br><br>Has our aquaculture education legacy been entirely forgotten? |
| P34 | SDS is continually engaging with industry to assess demand for work-based learning to expand the Apprenticeship Family. For example, they are currently exploring demand for a rural skills Foundation Apprenticeship that would cover agriculture, forestry, and aquaculture. | Is this not targeting 14-16 year olds at school as opposed to school leavers? Check with SDS. |
| P37 | However, there was a sharp rise in 2015/16 to 435 enrolments, up fro,m 162 in the previous year (Table 4.4). The reason for this rise is unclear. | How can this be left unclear? SQA must have the registration data to show which Units/programmes this represents. |
| P39 | The age profile of the Fish Production/Fisheries students tends to be slightly older. In 2015/16 those aged 25+ accounted for 66% of total enrolments. Fourteen percent of those enrolling on Fish Production/Fisheries courses were aged between 20 and 24, while the under-16 and 16-19 cohorts accounted for around a tenth of enrolments each… | This is a significant demographic. Mature learners are not necessarily 'better learners'… In fact, they are often more, not less lacking in confidence and in need of support. (This is shown to be the case later in the survey) |
| P40 | In 2015/16, 75% of all enrolments to FE-level Fish Production/Fisheries courses were for courses that do not lead to any recognized qualification | The number one issue, arguably, and one that can only be solved with industry support. |
| P42 | In 2017, the delivery of a new Technical Modern Apprenticeship in Aquaculture Management at SCQF Level 9 (SVQ Level 4) was launched at NAFC Marine Centre. | How sustainable is the demand at level 9?<br><br>How many people are there in the industry unqualified at this level? Do individuals put themselves forward or is it their employer? |

**2.Skills Challenges and Opportunities**

| Ref | Abstract | Comment and further questions to address |
|---|---|---|
| P 48 | Engineering skills are a key requirement across the sector….. *This covers a range of engineering skills, from mechanical engineers for routine maintenance, through to design engineers for example fish pen fabrication……engineering roles are the most difficult to fill.* | Is this reflecting the specialisation within the workforce frequently referred to?<br><br>What essential engineering skills to all husbandry operatives require and which skills are considered specialist? |
| P48 | Boat skills are also key across aquaculture and there is significant unmet demand…."*Health and Safety is a challenge. Working from boats so you need boat and crane skills……Boat skills – not just driving boats, but whole range of different specialist vessels, feed barges, etc."* | Is this provided on farm currently, by external trainers visiting the farm or by attending a centre?<br><br>What are the current legal requirements in Scotland?<br><br>(Check with Scottish Sea Farms) |
| P 48<br><br>P 60 | ….a growing need for business management and commercial skills and knowledge…..As the sector has grown and developed, there have been developments in the skills needed to manage and run aquaculture businesses… Managing larger operations, and larger work forces requires strong leadership and management……..Most finfish companies also report a lack of skilled assistant managers in the current workforce. Whilst this contributes to the overall demand for farm management skills, there is also an issue here for succession planning…….The recently launched Technical Modern Apprenticeship, delivered at NAFC Marine Centre is seen as very positive. | Is the recently introduced Technical Modern Apprenticeship in Aquaculture Management sufficient to address this<br><br>Is the award structure appropriate?<br><br>What other management training has been offered and delivered to the sector by other providers such as the Forth Valley College?<br><br>Has there been an effective functional analysis of the skills needed at the management level? |

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| P 48 | ……they need staff to have a range of softer, transferable skills to respond to the current and future needs of the sector. This includes team working, building positive relationships and customer care…..farm managers and staff to be more sensitive to the local community in which they are based….Employers specifically value all-round and highly transferable STEM and analytical skill | How are these skills to be developed?<br><br>Where do they fit within NOS and NQs currently?<br><br>(Note in Norway there is an emphasis on team working skills, problem solving and collaboration) |
| P 49 | ….there is a significant demand for specialist skills, relating to fish health, biology and husbandry | The basics remain important. However, some treatments such as those for sea lice are evolving rapidly as the industry fights this scourge… and are much more innovative and specialist.<br><br>Would these skills and SOPs benefit from fine definition and comparison between salmon farming countries? |
| P 49 | With a move away from manual processes to mechanised and automated systems, the demand for Digital Technologies skills is increasing….. Similarly, pens can be monitored remotely – for oxygen, temperature, turbulence, fish behaviour, etc……One finfish producer noted that: *"The main focus will be on digital and ICT literacy, as so many things use sophisticated computer programmes, e.g. feeding. This will be the challenge going ahead."* | This needs to be specified and related to current equipment, technology and processes used by the industry.<br><br>To be included in SSF consultation and by reference to AKVA to specify 'digital competences for cage farming salmon' at operative and site manager level. |

**Supply of skills in aquaculture**

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| P 53 | [There is] not a lot of people coming out of the education system looking for a job in the sector…….. This has required a financial outlay to deliver the training, but can also end up with over-commitment of resource and duplication of effort……..a consequence of the lack of skilled workers is that companies have to train up employees on the job……"*[We] have to spend more time training and educating people which means that the costs of training increases. At the* | Industry needs to collaborate more, but who is willing to work with who? The SSF CEO implied that SSF are doing some "pretty special" things they do not want their competitors to know of…<br><br>Conversely in Norway there are a lot of people coming out of the education system of a higher quality looking for a job in aquaculture |

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| | *moment we have three people doing the job of one and a half people in smolt production."* | Do we know whether industry is ready to work together to standardise the aquaculture VET supply?<br><br>SSF and SSC will be asked this question…. |
| P 54 | An issue facing employers across the sector is that trained and experienced workers often move from one employer to another. | This seems to re-enforce the 'old view' that keeping them unqualified helps to keep them captive.<br><br>But, how many really share this view today? |
| P 53 | Employers acknowledged that industry engagement with schools and colleges was limited, and that there was a responsibility for them to increase activity in this regard. | This recognition by employers should help the creation of a BlueEDU SSA lot 2 (innovative VET development) and a secondary schools aquaculture VET project bid under development (ASKS). |
| P 56 | Consultees highlighted that the production of internal training manuals is often expensive. Training is delivered by a mix of internal provision and external training providers. ……Statutory training and other required certificates for on-site operatives such as Health & Safety and boat handling is a gap in the existing workforce that currently must be addressed by employers through induction courses and ongoing in-house training. Statutory training and other required certificates for on-site operatives such as Health & Safety and boat handling must be addressed by employers through induction courses and ongoing in-house training. | Does this imply companies would be willing to develop training manuals and other resources, collaboratively?<br><br>Would they be willing to also share assessors and verifiers?<br><br>Could assessors and verifiers be provided through a national VET provider to increase consistency and efficiency? |
| P 56 | Whilst some short courses, e.g. Health & Safety, are delivered by NAFC Marine Centre, this is not accessible to all employers……"*There is a lack of [external] training, especially in the more rural areas, but this is something that we just have to accept."* | What can be done to improve the accessibility of mandatory short courses on the mainland and the other isles? |
| P 57 | As employers, particularly within finfish, are often providing their own in-house training, there is a lack of consistency in training across the sector…… *Despite* | Does this training make any reference to the NOS? |

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| | *good examples, the lack of consistency presents some issues. For example, it means that training can often be repeated if an employee moves from one company to another.*<br><br>*"In-house training is often not transferable between companies. If it's accredited, then employees can transfer [qualifications], but this is not guaranteed. Mobility of qualifications is important, and it is not clear how standardised CPD is amongst aquaculture companies."* | Are the NOS known in Scotland by employers, or ignored?<br><br>Are company SOPS driving instructional design instead?<br><br>Is there any form of in company assessment process and is it effective?<br><br>Do employers realize that NQs, if they are involved in their design can bring them the consistent nationally standardised qualifications that they are lacking? |
| P 58 | There is a perception that a sizeable proportion of employees are reluctant to undertake accredited training, for fear of how not successfully completing the training may impact on their employment…… They are happy to do non-accredited courses that are provided by the companies." | Is this just a perception, or is it a reality?<br><br>Could we undertake in company staff surveys to establish whether it is true and for how many?<br><br>Would the offer of bite sized SQA qualifications help to build learner confidence, (such as NPAs and PDAs)<br><br>Would industry find this alternative to MA funded by the SFC more flexible and more attractive? |
| P 59 | However, businesses report that the pipeline of graduates from colleges and universities entering aquaculture is insufficient to meet the sector's growth ambitions……. there is evidence to suggest that wider availability of undergraduate aquaculture degrees – and graduates – would be valued by employers in the sector, rather than more general courses such as marine biology which can then lead into more specialist postgraduate study. This reflects the desire for more specialist degrees to align the needs of the role and of the employer and the more niche roles that are emerging……..Some felt learners were overqualified…….. but others claimed that employers often have | Would the HNC/HND model serve industry more effectively as it can be more applied in nature and less academic. AKVA referred to the need to consider HND in the future in April 2018 when visited…This required a lot of analysis and a major review of the NOS with industry involved. Although reviewed 2 years ago, SDS may feel the ILG 2030 evidence sufficient to trigger another review. This time, the staff development decision makers from the major companies would need to be and stay involved, not only the HR staff. |

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| | to provide training to graduate entrants to meet their own, and industry requirements……Conversely, many employers believe that better qualified staff, but with the right specialisms, would benefit the sector and help realise growth ambitions; it was pointed out that many Norwegian farm managers have PhDs, in contrast to Scottish farms | The deployment of mangers on Norwegian farms with Degrees has been mentioned in Norwegian research, but may reflect the fact their VET is limited to the Journeyman Certificate and they have no Higher VET in their system |
| P60 | There is also qualitative evidence that workers/learners can find it difficult to progress from FE into HE……Whilst employees can undertake FE qualifications and complete Apprenticeships whilst in work, consultees consider that there is no equivalent opportunity to gain a degree while they are working……A degree with a considerable practical work element would help to address this, and there is an appetite for this in the sector…….For example, one stakeholder said the following: "*It would be amazing to get a degree with a large work-based component."* | This may indicate a demand for the re-introduction of a more flexible HNC/D pathway to degree. This could be packaged as a part of an aquaculture degree. The current IOA model offers a lot of pure science in years 1 and 2, before aquaculture starts in year 3 and may less than ideal.<br><br>Could an HNC/D pathway avoid this drawback and offer industry a better prospect? |
| P 60 | the geographical pattern of provision is not adequate for employers and is not located close to their operations. ……Some vocational qualifications are available through Inverness College and other UHI colleges in the Highlands and Islands, but much of the vocational training delivery is provided through NAFC Marine College. | Why is access an issue when UHI could operate as one network to provide both the MA and other VET programmes on the Islands and the mainland?<br><br>How good is UHI collaboration currently within its aquaculture VET members?<br><br>Argyll College interview to come will investigate this. |
| P 60 | Many courses including the aquaculture Modern Apprenticeship are delivered remotely and employers believe that students require more hands-on support…. | This implies that the employer and learner do too much of the work themselves currently due to a 'light touch' input by VET Providers, which could be a funding related issue. |

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| P 61 | Similarly, there is clear demand for provision of more vocational training at an FE level. This is not just in terms of volume, but also in geographical reach of the education provided | Are companies part funding MA completion currently, allowing the quality standards to be raised?<br><br>Could the re-introduction of alternative flexible Higher VET programmes funded by the SFC rectify this? |
| P 60 | Employers and stakeholders broadly agree that course content and education does not, generally, reflect the pace of innovation and change in the sector and so there is a lag in the currency of what is being taught and what is happening in the workplace……..An example is that the equipment used to teach students is no longer used in industry so employers are having to fill this gap in knowledge and skills when graduates enter the workforce. | A revitalised aquaculture VET could overcome this and update the resource base for staff and learners alike.<br><br>Erasmus+ collaboration could facilitate and accelerate this process. |
| P61<br><br><br><br><br><br>P 62 | Evidence from ekosgen's research for HIE into the attitudes and aspirations of young people from the Highlands and Islands61 suggested that there is a considerable cohort of young people willing to return to work and live in the region……Employers suggested that previous efforts to attract skilled workers to the Highlands and Islands may work again, if done in a more targeted way……<br><br>Qualitative evidence points to a demand for changes to HE provision for the sector, to reflect the changing skills and expertise required as the sector evolves and grows. This should cover more varied provision by HEIs, as well as the inclusion of a greater work-based component and a work-based degree where this is appropriate. | This is optimistic and tends to imply a national strategy to re-establish aquaculture education and training pathways could be well received and find a viable market, especially if the access was flexible.<br><br>The flexibility offered by PDAs may be more appropriate |
| P 62 | There is an identified need for better promotion of the sector, and work to raise awareness of it both generally and specifically in relation to the career opportunities available…….The aim would be not just to educate the public, but also to inform key influencers, such as careers advisers, parents and schools and so on, to act as champions to promote careers in the sector……..There | Again, this needs a concerted national strategy linked to the aquaculture national curriculum development plan. It is a high priority, but which public sector agencies will support and fund it in Scotland |

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| | is a wide range of work being delivered as part of Scottish Government and SDS work on developing and promoting STEM skills, and the aquaculture sector should ensure that it is engaged with and able to benefit from this. | Discuss with SDS in the first instance. |

**BlueEDU VET demand Iceland**
Ann Cecile Ursin Hilling
NTNU

## Iceland introduction

The Icelandic Aquaculture industry has grown immensely over the past 10 years.

In 2009 aquaculture jobs provided 40 full time equivalents (FTE) and in 2016 the number had grown to 500 FTE`s[6]. This was with a production of 15.000 tonnes farmed fish (all species included) and in 2018 the production will probably exceed 30.000 tonnes.

With the growth of the industry there is an increase in the need for skilled workforce. The industry is facing having to hired unskilled workforce and trying to train them to the best of their ability. This is a challenging task when one is working with a high amount of biology in sea and quote “no day is the same”.

In order to face these challenges, the industry has initiated projects trying to establish VET studies in Aquaculture. As described more thoroughly in WP5 the industry has contributed in initiating one specific project where the aim is to establish a vocational education in aquaculture leading to NQ with a master craftsman certificate.

This project was started the fall of 2017 and originally included one upper secondary school in Iceland. By the end of 2018 the project includes two “on-site” teaching schools and their lectures is possible to transmit via e-learning to 14 upper secondary schools in total. The study is still pending approval from the Icelandic government, but the government is positive and has given approval for the schools to start teaching with the intention that the study will be approved in time before the first-class graduates.

[6] Landssamband fiskeldistödva, 2017, lf.is

## Description of industry

In Iceland the main produced aquaculture species is Atlantic Salmon, rainbow Trout and Artic Charr.

Production in tonnes 2017: Atlantic Salmon 11.265 Artic Charr 4.454 Rainbow Trout 4.628
The export value of salmon in 2017 was close to 12 billion ISK ≈ 87mill €.

The future prognosis for Icelandic fish farming is very promising and the aim is that the total annual production will rise to 150.000 tonnes. The timeframe on this expansion is not set, due to there being high political activity in Iceland around giving licences.

But if granted this will result in over 3.000 direct and indirect jobs towards this industry alone in a country with 330.000 inhabitants. About 60 % of the population is living in the area inside and around the capital Reykjavik.

In July 2018 the unemployment rate in Iceland was 2,5%. The labour force from 16-74 years old was 252.600.

The investment needed today to put out fish in one site in Iceland is close to 3-3,5mill€. This amount will keep rising with the fish growing and reaching new price grades dependent on the weight. One site might often contain more than 1 million salmon.

With a careful estimate of the salmon being 4kg sold (whole, gutted) and the price being 5,86€ per kg (week 5,2018) the total biological sold value of one site would be 23,4 million €.

These estimates only calculate the value of the biology in sea, in addition there is hardware, feed, social costs, software and several other significant costs that has to be counted in.

For any aquaculture company, there will always be predominant risks with production. The production of living matter is seldom stable and predictable; therefore, it is important to have skilled personnel that in addition to mastering all practical tasks of a site, also has the ability to read fish behaviour.

## Production area

Fish farming in Iceland is a rural industry and there is a strict regulation for where it is allowed to conduct sea-cage farming. This is done in order to protect the wild salmon strain.

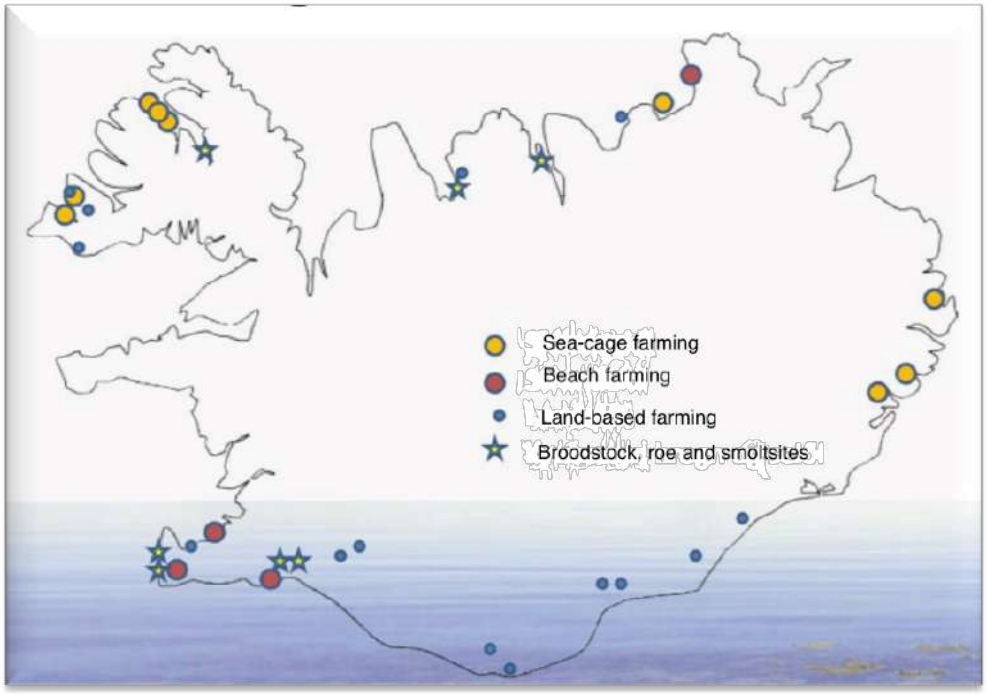



Figure 76: Distribution of aquaculture in Iceland[7]

The 3 main areas of production are in the West and East-fjords in addition to one fjord in the North. The south of Iceland is not eligible for farming due to natural circumstances.

Iceland is one of the few fish farming nations in the world where the specific licence to farm fish is free. In sea, the production is regulated through the carrying capacity of the fjords and the allowed area to farm in. The temperature profile of the fjords, the clean water and availability of land to build on, makes Iceland an attractive country for industrial growth.

For every fjord that is open to fish farming the Marine and freshwater research institute has conducted a study of the sustainable production capacity, thus establishing the limit for how much each company may produce in each fjord.

The maximum volume that can be sea cage farmed in Iceland today, based upon the studies of the sustainable production, is 150 000 tonnes.

[7] Presentation Landssamband fiskeldistödva 30.08.18

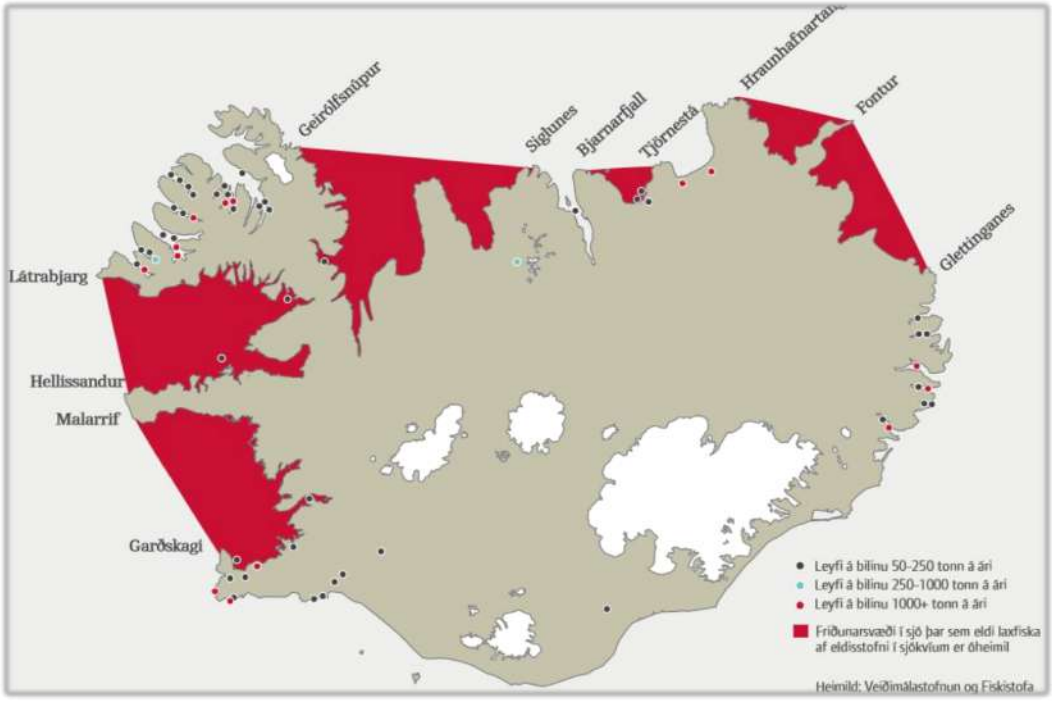



Figure 77:Red Areas marks where sea cage operations are illegal.[8]

## Icelandic Aquaculture Association – Landssamband Fiskeldistödva

An organisation which will be essential for future progression in aquaculture VET will be the Icelandic Aquaculture Association (LF). The association represents all fish farmers in Iceland as a unified voice, at government level and matters relating to legislation. The Association also offers an advisory facility to fish farmers and education to the public about fish farming and its importance to the economy.

## Investigative process

Data gathering for this delivery has been conducted through:

- Structured interviews

[8] Presentation Landssamband fiskeldistödva 30.08.18

    - With 3 major aquaculture companies in Iceland

- Survey
    - Survey conducted in 2018 to stakeholders in Icelandic aquaculture. The survey was sent to 41 respondents working in all registered aquaculture companies in the country. The list was provided to us by the Icelandic Veterinarian institute MAST.
- Conference
    - One day conference with major stakeholders (fish farmers, supply org, unions and ministry of Education).

## Structured interviews

For the structured interviews there was set up a few topics that was up for investigation:

1. Basic information on the organisation:
2. Staff qualifications, recruitment policies and staff development policies:
3. Awareness of aquaculture qualifications in Iceland:
4. Occupational standards:
5. Delivery of education and training:
6. Learning difficulties
7. In general

## Questionnaires

The questionnaires were sent out to 41 respondents representing the complete aquaculture industry in Iceland (20+ companies and all species) and continued for 3 weeks with reminders being sent every week.

## Aquaculture skills demand by industry and current situation

First, it has to be addressed that the industry in Iceland are not content with the lack in educational opportunities and the low amount of skilled staff. Research has shown that the largest risk on a sea-cage farm is personnel. No matter how good the equipment might be, one needs skilled personnel in order to run a safe production. The industry is aware of this issue and has a desire to change it.

## Basic information on the organisation:

The interviews were conducted with 3 sea-cage farming companies in Iceland, representing approximately 75% of the total produced salmon in the country. The interviews were with strategic personnel with titles such as: quality manager, production manager and public relations officer.

## Staff qualifications, recruitment policies and staff development policies:

**Questions:**

1. Do you prioritize hiring staff locally?
2. What qualifications do you ideally look for when employing staff as operatives and site managers?
3. For which roles do you experience the most difficulties recruiting qualified staff?
4. How do you train you`re husbandry operatives/site managers?
5. How do you make sure they have the knowledge, skills, competences and attitudes you require of them?

**Summary:**

Through interviews, the general feedback from the interview objects is when in an employment process there is generally no lack of applicants, the jobs in aquaculture are increasingly popular.
But, the number of applicants who have desired qualifications are very low. In general, recruiting staff as husbandry operatives at sea is the most difficult due to the requirements of boat licence. The companies otherwise report that they are able to train people for all positions but prefer if they have some prior knowledge that can be of use.
All companies reported that their majority of employees were locally hired.

### Employing and Training Husbandry operatives

#### *Employment process:*

In the employment process the companies has expressed that they are looking for staff that has prior work experience which can ease and possibly shorten the introductory training and contribute to the overall skills of the husbandry group as one.
The companies try to combine different skillsets between their employees in order to broaden the skillsets.
Desired prior skills in the hiring process:

1. **Biology majors**: Preferably in aquaculture or other aquatic subjects. Will have knowledge of the importance of routines (lice counting, water sampling, registering mortality etc.) and the effects of changing conditions. It is also believed that a biology major would possibly more easily recognize changes in fish behaviour and identify a possible disease outbreak.

2. **Mechanics**: Has an understanding of machinery that is useful in practical operations, would also be able to do repairs and maintenance on machines.

3. **Electricians**: Has a practical approach to work tasks and will be able to do minor repairs and maintenance on equipment.

4. **Captains/fishermen**: Knows boating, navigation and general boatmanship. Are used to rough weather conditions. Could have leadership experience, knowledge of equipment that is in use in aquaculture (nets, pumps, etc) and fish physiology.

Unfortunately, due to the companies being situated so far from the capital, many of those who apply have no prior experience which is relevant for the work. The industry however is expressing that there have been improvements in the applicant's prior knowledge over the past years. This is probably as a direct consequence of the good salaries the industry provides, many prior fishermen apply to be a husbandry operative in order to get better workhours and a steady salary.

### *Husbandry operatives Training:*

The companies are today investing a great amount of time in training of their staff.
One interview object stated:

"*We know that finding husbandry operatives with aquaculture education is extremely slim, therefore we look for additional skills which can aid the training process. – We know we have to train them extensively" – from interview*

Due to there not being any Aquaculture VET available in Iceland which focuses upon production and technology, a massive amount of time is being invested in training husbandry operators on all bases. One interview object said it is easier training staff that will serve the on-land operations. This, due to easier management of parameters. One does not require boating skills and need attending the same amount of safety regulation compared to someone working on sea. This means that the time one uses to train an on-land operative in the basics of biology and the specific work tasks will take a shorter amount of time.

This is an industry which is very focused upon effective time management and therefore the time to train their newly hired staff is hard to find but is of priority.

Through interviews most companies have similar training when it comes to newly hired husbandry operatives:

1. Brochure of standards and operations
2. Safety course (mandatory from the government)
3. Introductions to fish biology and fish health (given by veterinarian). How to recognize disease.
4. Buddy system

Number 3 is time dependent upon time of hiring, one company stated they are running this course twice a year, so in worst case a newly hired would have to wait for close to 6 months to attend that course.

## Employing and Training Site managers

### *Site Manager Employment process*

In the employment process of site-managers several companies expressed in the interviews that they often tend to choose aquaculture operators who are showing "promising features" and promoting them to site managers. With "promising features it is described" that the husbandry operative is showing interest in the field beyond the tasks that are assigned. In addition, the person would have to be good in people management, be structured and goal oriented.

In Iceland the ownership of the 4 salmon farming companies has changed a great deal over the past 2-3years. Norwegian salmon farming companies has acquired a major share in the Icelandic aqua industry and are very present in the productional decisions of the companies.

List of company and Norwegian ownership:

| **Icelandic company** | **Norwegian Investors** |
|---|---|
| Arnarlax HF | Salmar ASA |
| Laxar HF | Måsøval Fiskeoppdrett AS |
| Fiskeldi Austfjarda HF | Midt-Norsk Havbruk AS |
| Arctic Fish HF | Norway Royal Salmon |

These changes have led to an increased work migration from Norway to Iceland to supply the increased need of skilled site managers. In addition, several Icelandic husbandry operatives has travelled to Norway for shorter periods of time. In order to receive inhouse training in the Norwegian salmon industry.

Given that the Norwegian aquaculture industry is at the front of the line in the world when it comes to technical advancement and safety management, the Icelandic industry has started to adapt the Norwegian standardisations.

The Norwegian standard NS9415 (equipment standard safety requirements) was voted by law into the Icelandic aquaculture in 2016 and by the 1$^{st}$ of January 2017 all sites in sea in Iceland had to be compliant with the standard.

### *Site Manager Training*

Site manager training varies upon the company's structure and the site managers assigned tasks.
In some companies, a site managers role is to oversee the production of one site, to make sure the work shifts of the husbandry operatives are in order and further deal with minor personnel issues.

In other companies the role could be much more extended, with the control of several sites in production, meaning more staff management, budget responsibilities and production planning.

As earlier described in this report the investment needed today to put out fish in one site in Iceland is close to 3-3,5mill€. This amount will keep rising with the fish growing and reaching new price grades dependent on the weight. One site might often contain more than 1 million salmon.

With a careful estimate of the salmon being 4kg sold (whole, gutted) and the price being 5,86€ per kg (week 5,2018) the total biological sold value of one site would be 23,4 million €.

These estimates only calculate the value of the biology in sea, in addition there is hardware, feed, social costs, software and several other significant costs that has to be counted in.

This shows that the values a site manager is responsible for are significant and it is crucial for a company to have good site managers with a good sense of structure and routine.

In all companies the role of site manager means an increase in responsibilities from the position of husbandry operative, like this example provided from one of the companies:

**A site managers responsibility:**

1. In charge of the biological production and has to answer to the management group on targets.
2. In charge of the husbandry operatives on their site:
    a. Manage their training
    b. Manage their shifts
    c. Keep control on safety standards
3. Create site budgets
4. Feed control (ordering, optimal feeding)
5. Responsible for all work operations
6. Fish health status on sites
7. Continuing improvements on site
8. Keep control on the KPI`s (Key performance Index)
    a. Productional cost
    b. Feed factor
    c. Growth
    d. Mortality percentage etc.

One company replied to the question that they have in some instances hired skilled site managers from Norway. The reason for this is that they require very little training in order to fill the position and has in addition helped in the company's aim for reaching Norwegian standards in production. When asked upon how they train their Icelandic site managers it was replied that the company have over the past three years done a lot of work in standardizing what a site managers role should be and implementing it. They are continuously looking within their staff for people who have the skills (leadership, structure, follow through) that will fit in a position as site manager.

When found and employed in the position, the first thing the site manager will experience are weekly meetings with defined tasks that has to be completed. The site manager in the company in question has three persons within management that they can go to for assistance. The production manager handles all cases related to staff, the biological controller handles all issues related to biology and the quality manager handles issues related to quality.

By having weekly meetings between all the site managers and the three key management personnel, where there is expected weekly reports from all, one will have continuous progress and development for both the company and its staff.

## Awareness of aquaculture qualifications in Iceland

1. Which aquaculture qualifications do you know are available in Iceland today?
2. In your opinion, how suitable are any of the NQs that you are familiar with for your staff?
3. If there had been available an NQ in Aquaculture in Iceland, would you encourage the staff to take it?

All interview objects mentioned the diploma study in Hólar. Hólar University college has over 10 years had a 1year diploma study in Aquaculture. Many fish farmers have taken the study themselves due to it being the only NQ present in Iceland. When asking the interview subjects if they felt the study was up to date with the industries requirements one object replied:

*"I don´t believe the study is good enough, they are left behind. Their focus is mainly upon land farmed Artic Charr and have no extensive knowledge in sea cage farming"*

The interview object was further asked: If there were to be made a course which was fitting to the operations of the company, would you encourage the staff to take it?

*"if it was suitable, yes of course, I would probably take it myself"*

One of the interview objects did not know of the direct content of Hólar`s courses, but when asked if the company was encouraging workers to take courses while in employment the response was:

*"No, and I think the reason for that is that the courses available today are not good enough and not well enough structured to fit for those in employment. If they were, my company would absolutely support it"*

The general opinion from all who was interviewed was that the current aquaculture studies available in Iceland is not meeting the requirements of the sea-cage farming industry in Iceland. The knowledge upon sea-cage and salmon farming which is the fastest growing industry is lacking and needs to be addressed.

All companies asked would send their staff attain courses if the courses where constructed such that it is compliant with full time employment and the content of the course is relevant enough. It was then further asked*: If a course was not fully compliant with a work schedule and meaning a worker would have to take some time off in order to achieve a qualification would you still let the worker do it?*

All companies said they would consider it if it was a course that they were in need of.

4. Do you think your company would be willing to compensate an employee in order to have him/her complete a course that was of value to the company?

"*Yeah, it wouldn't surprise me that the CEO would be interested in some kind of scheme where the worker would be rewarded for taking a course."*

*"We are currently sending our site managers and selected staff to Norway for training with Norway Royal Salmon. The workers are then on full salary and all expenses paid".*

*"If there were courses of value available, we would send our workers with full pay"*

## Occupational standards

1. Occupational standards: Do you have a company definition of the knowledge, skills and competences you require of your fish husbandry staff and site managers?
   If yes... How do these relate to your Standard Operating Procedures (SOPS)?
2. Has the industry developed National Occupational Standards (NOS) that are applicable to your fish husbandry staff and site-managers?
   If yes... do you believe these are up to date and providing a useful framework for the industry?

When asking all companies if they apply occupational standards, all company representatives replied no. However, they said their superiors might have some standards that they are using from the Norwegian owner companies, but it is not applied through the Icelandic company. They do have work descriptions that the employee is working from.
Two companies replied they are in the process of creating occupational standards.
When asked why they have started to create standards, they replied that they are seeing advantages by having more standardizations and structure within the company and in addition there is a want from the Norwegian ownership for these forms of standardizations.

The industry in Iceland has grown considerably over the past three years, and they have had to adapt many changes over this period of time. Increase of demand in standardizations is one of them. In general, for these companies the most pressing tasks are those who will directly contribute to the revenue of the company. This meaning applying standardizations like the wholefood standard that has contributed to opening markets where the revenue is higher. Over time when completed, the companies will start to work more upon other internal standards like occupational standards.

There does not exist any national occupations standards for husbandry operatives today, but it is believed that there are assessments being conducted as to whether this should be created and applied.

## Delivery of education and training

1. What are the most influential cost components for your company to consider when designing company staff development and training programs? *(For example, is it the cost of instruction, bought in trainers, the time cost of face to face Vs other methods of training and development?)*

The general consensus upon the highest cost factor in delivery of courses to the employees is time-related costs. With time-related cost they further explained that to compensate for the time the staff

is out of their workplace, getting replacements and in some instances cover the employees' wages while attending courses are the highest cost factors.

Travels for course attendants if they have to leave home for courses and hiring of teachers are additional cost factors that was mentioned through the interviews.

2. How many of your staff has attended one or several courses during their employment?

All interview objects responded that 100% of the work staff had attended one or several courses during their employment, this is mainly due to the mandatory safety course all staff has to attend. In addition, many had received additional courses like fish health courses, technology course (related to bought in software), boating license and other training that was related to either practical work performance or required via quality standards that the companies has applied.

3. What form of learning do you believe would be of the best value to your workers?

*"Due to distance issues, e-learning and having a teacher coming for short seminars"*

*"The buddy system works very well for us, in addition we like on-site training where an instructor could show us in real time how to do things"*

When asked upon if the companies have any form of assessment of their workers after course completion, the response was that none was doing assessments, but one company was hoping to change that soon.

4. What is your in-company training scheme composed of, in broad terms, and through what process has it been developed?

All companies replied that in company training is mainly delivered by management staff. Due to the lack of education within the field, the companies have taken it upon themselves to educate their staff using the knowledge they have within the company.

In some instances, they might use outside personnel that are delivering some sort of product (veterinarian, equipment supplier) for internal training.

In addition, for some companies, the buddy system is providing a good knowledge delivery using senior husbandry personnel to train new employees.

5. How is your in-company scheme delivered currently and in what form do you deliver it?

The companies replied that internal training in larger groups are delivered through lectures given by the staff. The delivery of these courses will be scheduled upon necessity, like for example if there have been changes to the regulations upon the ASC standard. In that instance, the quality manager would give a lecture explaining what this will mean in practical terms of production.

6. Do you ever assess your staff after they have received training delivered by the company?

All companies replied no. But they all would like to do it, if they had time to develop the tools for it.

7. What is the company`s policy upon education?

One company replied to this question:

*"We don´t have any particular educational policy, due to the fact that there is no regulation in Iceland with regards to education of husbandry operatives. As it is today the employee will receive those courses, they are required by law to have and other than this it will be up to each and every company what courses they would like their employees to have"*

## Learning difficulties:

1. Are you aware if any of your staff has learning difficulties and if yes what percentage that might be?

*"Not more or less common than in the general population."*

*I would say around 15-20% has learning difficulties.*

2. How do you manage training staff with learning difficulties?

*"They in general ask more questions and receive the information they need that way, it is really not a big problem"*

The interview object explained further that the reason why they don't see any difficulties with these issues is that when training is provided it is often done with a practical viewpoint. Many of the workers prefer training which is directly related to practical work or could be explained with the relation to a practical task. This, no matter if the worker has a learning disability or not. This way of teaching also sits well with persons with learning disabilities and therefore the method is eliminating the differences between these workers. The person with a learning disability would then as answered above possibly just ask a few additional questions in order to fully understand the training given.

For the record the percentage amongst students in Iceland with learning difficulties is 14%, whereas 4% is severe[9].

## In General

1. What would you like to see changed or improved over the next 5 years?

*"It is vital for the industry, to have a bigger variety of what people can learn, not only in universities but on lower levels. Fish farming is pretty new to Iceland and we need people that are educated from top to bottom. Biology and technology are major components."*

[9] See: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5428689/

*"I would like for there to be aquaculture education in three steps: Upper secondary, higher Vet (diploma studies) and a bachelor in aquaculture."*

Comments:
For Aquaculture companies in Iceland there is a general consensus that they wish to have an educated staff and are willing to provide the means necessary in order to achieve this. The issue is that today there are no courses or educations which provide the training the industry demands. Therefore, the industry seeks to meet the most pressuring needs themselves in using staff as trainers in order to provide their operational staff with necessary knowledge. This is not ideal given that the staff which are providing the training often does not hold the competence in delivering training and it is harder for a company to measure whether the training given is good enough. The companies are aware of this and has involved themselves in projects trying to create NQs in aquaculture in Iceland.

## Aquaculture skills demand by industry and current situation – findings from questionnaires.

### Questionnaires

The industry is very interested in there being created more educational options. Not only for their staff, but also for the next generation of husbandry operatives.

Through questionnaires the industry was asked questions regarding the want for education and especially which subjects they would like to know more about. The questionnaire was sent to 41 employees in Icelandic aquaculture, representing more than 20 registered companies within the industry. The list was provided by Mast (Icelandic food and veterinary authority). The respondents were within all ranks in the company structure. The survey was written in Icelandic in order to have the response rate as high as possible. 50% of those who got the survey responded.

### Results

The respondents reported their job titles to be on all levels from the basic fish farmer on site to site managers, fish feeders and quality controllers.
The longest working employee in the industry had been there for 38 years while 30% stated that they had worked less than 15 years in fish farming.

When asked upon educational background 38% stated that they had or was in the process of completing education from higher VET (Hólar University college) to higher education (bachelor's degree and higher). 5% had only completed compulsory education and had no additional education.

The size of the companies the respondents work for varies in size from approximately 2-120 employees and the companies represent all forms of fish farming conducted in Iceland.

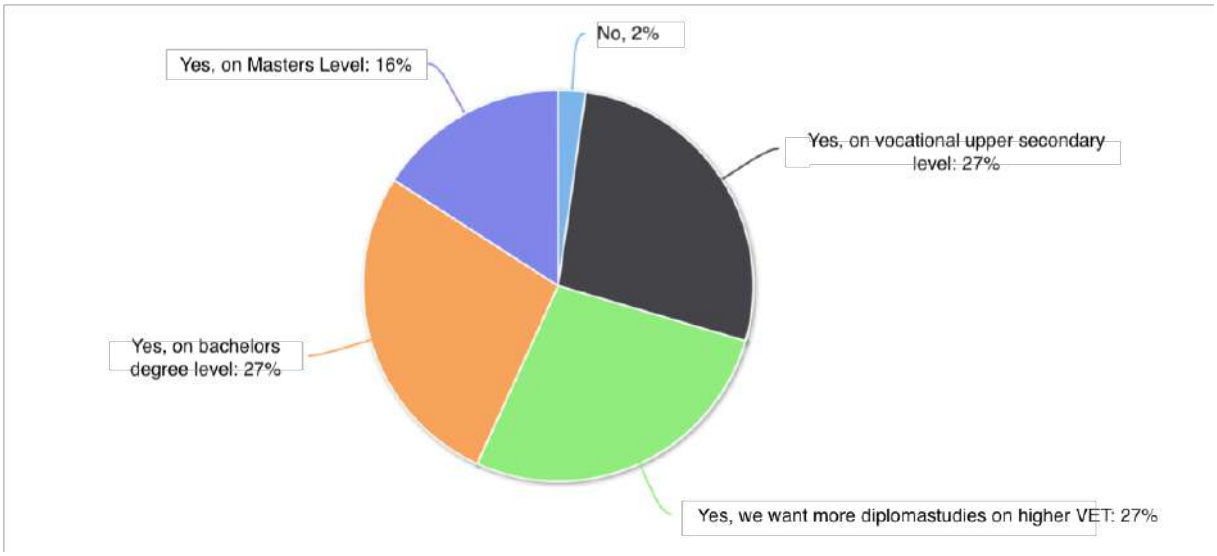



Figure 78:Do you believe there is a need for increased availability in aquaculture education in Iceland?

When asked to further elaborate in which subjects one would like to have more diploma studies in the answers was:

- Biology of the sea/ Seawater farming
- Feeding of fish, Technology, biology, content and optimal conditions in relations to feeding.
- Recirculation systems and water quality
- Specialisation between land based and sea-based operations.

86% of the respondents would like to see more educational offers for themselves and their co-workers, when further asked to elaborate in which topics they would like to learn more about the three majors were Feed composition and technology, fish health and supervisory programmes (see fig 4).

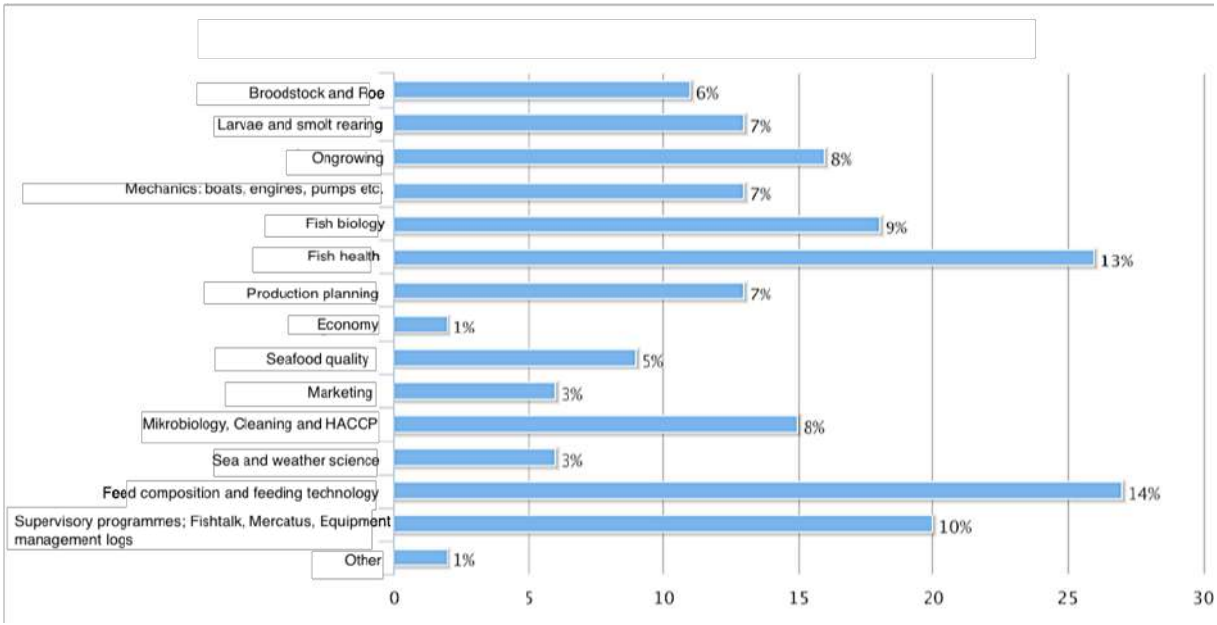



**Figure 79:Which topics do you believe to be the most important for your workers to gain more knowledge about? (choose the 5 most important)**

At the end of the survey we asked if there were other comments the responder would like to make. The responses made were:

- More education directed toward sea cage farming
- There should be cooperation with schools in other Aquaculture nations
- More technology focus in studies like RAS (Recycling Aquaculture Systems).
- More knowledge in cleaning, fish welfare and health
- More Specialised educations in the different operations in fish farming.
- More info on laws and regulations.

The results from both the survey and the structured interviews complimented each other with the opinions that was expressed. There is a need and want for aquaculture education in Iceland and the interviews with management of aquaculture companies concluded they are willing to put in both work and money into realizing this goal.

## Present required knowledge and skills for husbandry operatives and site managers

### Work safety course

All staff working on Aquaculture sites in Iceland are required to have a work safety course.
The course general principles are to teach the staff on the prevention of accident and unwanted incidents when handling machinery, the importance of following company procedure and safety rules, how to improve your work environment and in general better employee well-being[10].

### Boat licence

All husbandry operatives are required to have the boat certificate in order to work onsite.

In Iceland there are two boat licences that applies for the industry. One is for 12mtr in length boats and the second is for 24mtr boats[11].

In the aquaculture industry, most of the main work vessels are approximately 15mtr in length. This posed as a problem for the industry since the staff was required to have the 24mtr course in order to operate the boats. This course is very expensive and in addition the rule was that all the boats had to have a captain with this licence and a mechanic as if it would have been a fishing vessel.
In 2016 the industry managed to enter an agreement with the government where they were allowed to make an exemption from the rule where the staff could take the 12mtr course and still be allowed to carry a 15mtr boat if they had three months of experience after attaining the certificate.

By doing this, the salmon farming companies were able to afford the boating licence for the complete staff operating on sea. One company even sent all their feeding central staff to the course, so they wouldn't be dependent on the operatives in order to visit the feeding barges on site.

### Certification and quality standards

Some of the companies in Icelandic Aquaculture have adapted quality standards which grants them access to specialized markets for their products. The ASC and Whole Foods Standards[12] are the biggest ones. These are both strict standards where the company has to comply by their rules which also includes the staff's competence.
The general rule is that the staff`s competence has to be compliant with the rules and the regulations of the specific country in which production is conducted.

In addition, in the Whole food standard, there is a paragraph which includes Employee training:

***Employee Training***[13]
*Initial and ongoing training on the present standards must be provided by the producers to all farm employees. It is the responsibility of the producers to ensure that the requirements of*

[10] Fisktækniskolinn, 2018,https://www.fiskt.is/is/namskeid/hopa-og-fyrirtaekjanamskeid/oryggi-a-vinnustad
[11] Tækniskolinn,2018, https://tskoli.is/namskeid/smaskipanamskeid/
[12] Whole Foods Quality standards: https://eu.wholefoodsmarket.com/?destination=www.wholefoodsmarket.com%2Fquality-standards

[13] Whole Foods Standard, Whole Foods Market Quality Standards for Farmed Seafood: Salmon, Other Finfish, and Shrimp, 1st of January 2014

*these standards are understood by all individuals handling products sold to Whole Foods Market.*
*Producer guidance:*

- *Training should provide an overview of the entire operation as well as specific training related to the tasks that will be required.*
- *Training can be experience-based or through a formal program.*
- *Written confirmation of attendance at training or achieving expectations of training should be available.*
- *Training should provide information on the specific requirements of the Whole Foods Market standards for all responsible staff.*

Through the interviews conducted, one of the companies that are adapting to the ASC standard are creating new safety courses which are compliant both with the mandatory country regulations and the ASC regulations.

## School engagement

There are today only one government approved VET study in aquaculture in Iceland. This is a diploma study at EQF level 6 delivered by the Holar university college (HUC[14]). The study has been running for close to 10years and has primarily been focused upon land-based farming of Artic Charr. Due to the massive growth of the salmon industry in sea, the school are working on adapting their study to meet the increased need for knowledge in sea cage farming.

There is however another study present in Iceland being delivered from The Icelandic Fisheries college (Fiskt[15]) which is not government approved, but is industry recognized and delivers on an EQF 3/4.

There is a wish for more educational options in aquaculture VET in Iceland and therefore the Icelandic salmon farming industry has been involved in the current work of establishing a government approved VET study that leads to Master craftsman certificate[16] which would be directed towards attracting the next generation of fish farmers. In addition, to meet the need for increased skills for those already employed, the industry has been working with FRMST (see WP5) in order to create a study which can be taken whilst in employment. These educations are still in the establishment process. The curriculum for the VET study has been submitted to the government and is pending approval.

[14] Holar university college,2018, www.holar.is
[15] Fisktækniskolinn, 2018,www.fiskt.is
[16] Námskrá, curriculum view page, 2018, https://namskra.is/programmes/01771352-0989-4e30-ba81-642d35f11c69

# Obstacles in knowledge delivery for employees in Icelandic Aquaculture

## Distance

Aquaculture and in particular Sea-cage farming in Iceland is a rural business. Public transportation in Iceland is extremely limited and therefore sending employees to do courses is challenging.

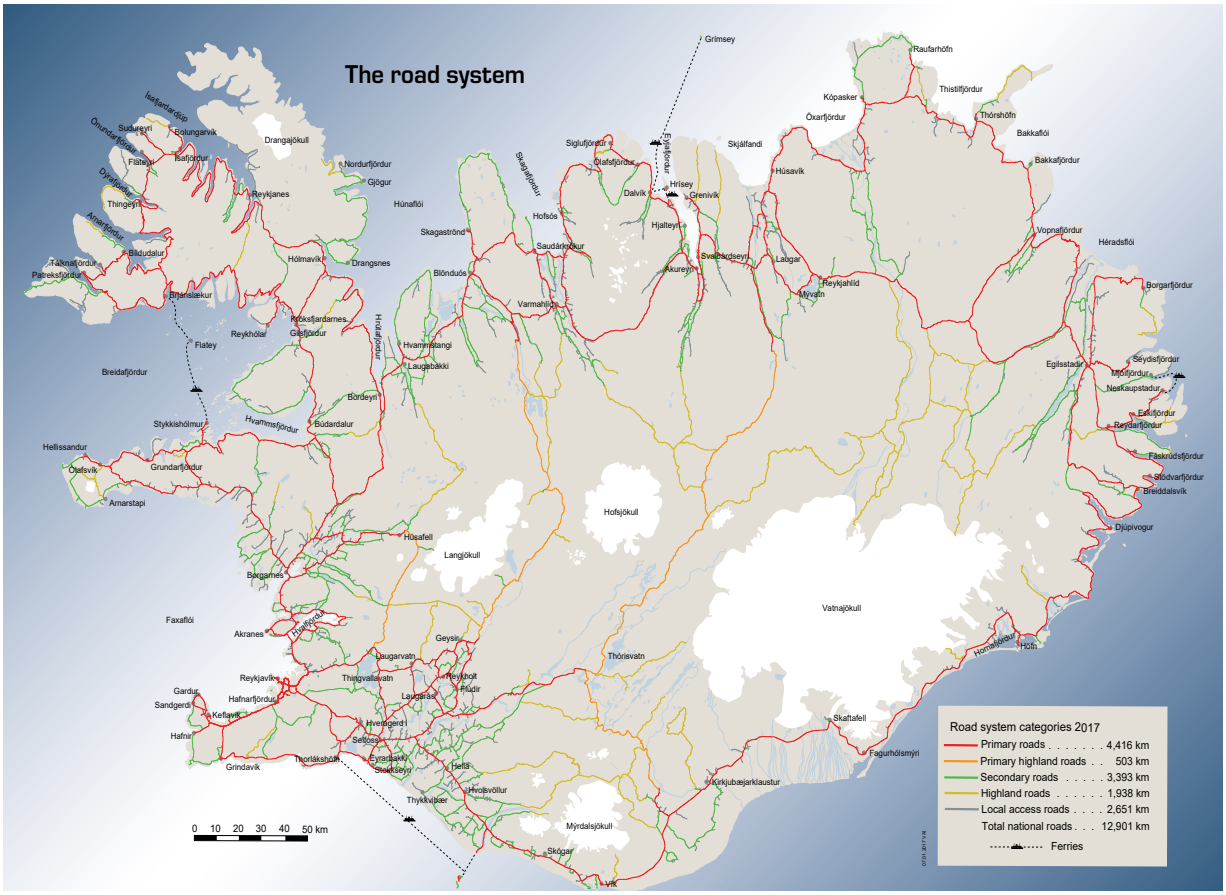



Figure 80: The road net in Iceland, Taken from the Icelandic road and coastal administration Vegagerdin.

As an example, the companies located on the westside of Iceland have a minimum of 6hours drive to get to Reykjavik, which in most cases would be the place most likely to run courses. This due to Reykjavik being a key point for all flight activity, but there are very limited flight options from the west to the capital. The reason for this being that there are not enough people living in the west to fill up the planes and the high prices (one-way tickets are a minimum of 176€); most people wish to use a whole day driving instead.

The companies in the east, have the possibility to fly to Reykjavik from Egilstadir, but due to high prices and limited flights, many choose to drive close to 9 hours to get to the capital.

Needless to say, the people of Iceland who do not live in the capital use a massive amount of time on travelling, not only for work meetings but also for private matters like doctor's appointment(specialists), dentistry, shopping, etc. And that travel expense is often up for debate when it comes to increasing competence in the work staff.

When asking the companies, they are hesitant in replying that it is socially accepted to spend workhours on travelling for example to attend a course. But when the company is initiating the travel, they will cover for all travel expenses, which includes the driving to and from the course site.

In order to be able to deliver knowledge, the schools have to make adaptions to their delivery.

HUC`s diploma program is mainly delivered through internet-based lectures. Over the course of one year, the students meet for in school lectures 4 times with the duration of 5 days per meet. The remaining time, the student has to study from home. This requires structure and motivation for the student in order to complete the study.

The dropout rate from HUC is around 30%, they do not consider this a high number which is believed to be as a direct cause from the high amount of e-learning conducted in Iceland. The dropout rate from upper secondary studies in Iceland differs between those who are studying within the capital region and those on the outside. Out of those who entered upper secondary school in 2012, the drop-out rate by 2016 was 8% higher out of those living outside the capital[17]

With delivery of short courses like for example the boat licence, the companies often solve the distance problem with gathering up enough students over time and have the teacher come to the company for delivery. By doing this, one is ensuring that the employees don't have to use days only by travelling to and from courses.

## Weather

The weather in Iceland is very unruly and there is a common saying in Iceland that one could experience "4 seasons in an hour". This makes planning travels difficult, the weather service prediction is often incorrect, and the weather is not very stable.

## Course teachers

As described in WP 5, the lack of teachers in the Aquaculture field makes it difficult to deliver knowledge to the industry. In some cases, the industry is using management to conduct courses which is difficult due to busy schedules and the fact that these might not be trained at knowledge delivery.

## Students

In order to conduct a course a teaching institution would like to have enough students in order to make the course profitable. The course could then end up being very expensive for the few students that might be able to attend that it wouldn't be interesting for the industry.

[17] See: https://www.statice.is/publications/news-archive/education/dropout-and-completion-rate-2014-2016/

## Icelandic Aquaculture Industry VET Recommendations

From the discoveries through the work of this report, the main recommendations for the delivery of Aquaculture education in Iceland is:

1. The creation of National Qualifications (NQs) in Aquaculture both on upper secondary level and for mature learners.
    a. Explore if unitization of study for mature learners might be a better form of delivering knowledge.
    b. New ways of assessments with regards to delivering knowledge and assessment after courses.
    c. Explore if specialized courses directed to specific work tasks might be a good form of delivery.
    d. A NQ for upper secondary should be structured similar to the existing educations in Norway and Denmark, both leading to Master craftsman certificate.

2. The NQ should to be delivered mainly through blended learning due to expensive travel costs and long distances.
    a. Explore possibilities for other effective ways of delivering knowledge.

3. Possibility of delivering knowledge/lectures/courses from countries with established NQ until the Icelandic one is approved.

4. Explore the possibility of harmonizing Aquaculture VET in Northern Europe.
    a. A certification that will be automatically approved in Norway, Iceland, The Faroe Island, Denmark and possibly Scotland (UK).

5. Reading material is of need, and there should be explored whether to collaborate across borders in order to create common reading material which can be used in North Europe.

6. Industry involvement is crucial with regards to:
    a. Keeping a study updated with industry progress.
    b. Lending key personnel to schools to aid in lectures where teacher's knowledge is lacking.
    c. Internships and apprenticeship in collaboration with study.
    d. Put pressure on government officials to put aquaculture education on the agenda and getting the study approved as NQ.
    e. Connecting education across borders and contribute to the harmonization of an NQ in North Europe.
    f. Application of mobility grants between industry in Northern Europe.

7. Find a common meeting ground between school and industry officials yearly, in order to ensure progress in establishing and run Aquaculture education of quality.

## Ireland summary

The research into aquaculture VET demand in Ireland revealed a strong level of interest in the formal aquaculture VET, despite deficiencies in the current supply and the difficulties that need to be overcome to improve access to formal VET by work-based learners.

Irish companies have a healthy attitude towards staff development, which is driven by the needs to keep records of the staff development delivered in order to comply with the organic production standards under which the entire industry operates. The companies are realistic and aware of the learners' needs, confidence issues and the learning difficulties of some individuals. As a result, the 'group based' learning culture companies have adopted, is supportive which bodes well, and will make it easy for VET providers to re-engage and assist companies in providing pathways to formal VET in the future, once these are made available.

Whilst currently heavily dependent on their own non-formal in-company training, companies are generally supportive of work-based VET and apprenticeships (called traineeships in Ireland). They are also supportive of an increased use of ICT to support learning, as ICT confidence of most staff in some companies needs to be further developed so as they can adapt to an industry which is 'digitising' many processes at an increasing rate. In addition, many see value in keeping more staff up to date with fish husbandry techniques, as well as providing the incentive to achieve a recognised National Qualification in the future.

## 1 Industry description

In Ireland the main aquaculture species farmed are Atlantic salmon (*Salmo salar*), Pacific Oyster (*Crassostrea gigas*) and Blue Mussel (*Mytilus edulis*). There are also a range of other species farmed in smaller quantities. The total aquaculture production in 2014 was 31,700 tonnes of which Atlantic salmon production was 9,700 tonnes and shellfish species at 20,900 tonnes, representing the bulk of aquaculture production. Irish aquaculture production value in 2014 was €116.3 million of which salmon production accounted for €58.8 million.

There were 277 aquaculture enterprises operating across Ireland in 2014 employing >1800 staff (FTE 941). Most of these direct jobs are in the rural areas of Ireland and 80% in the west coast. Surveys in 2015 by the Irish Farmers Association (IFA) revealed that 85% of the coastal zone population either support the development of fish farming or would not oppose it, due to the employment it offers these economically fragile communities. [Ref: Irish Farmers Association IFA]

On examining the production trends it is apparent Irish aquaculture dropped away rapidly after a peak in 2002 (Fig 1) but has started increasing again and reached 16,300 tonnes by 20016 worth 105 million Euros by 2016 and is predicted to increase by approximately 45 000 tonnes by 2023. To achieve this increase in production will require a heavy reliance on technology to minimise the environmental impact and ensure the sustainability of the salmon farming sector.

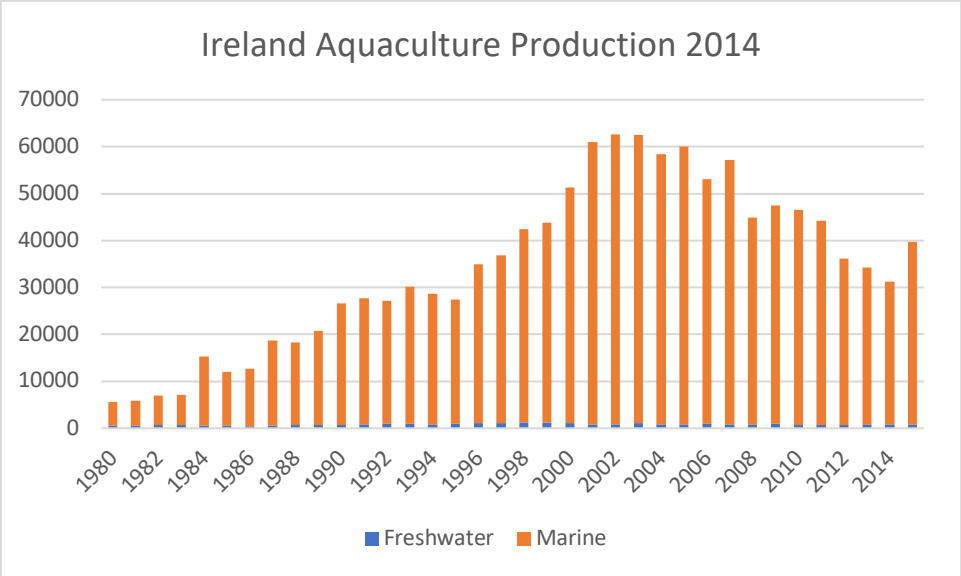



Fig 1 Adapted from FAO data.

### 1.1 Salmon production

The Irish salmon farming industry specialises in the production of organic salmon and has been an organically certified industry for over 25 years, leading organic farmed salmon production within Europe. Harvestable salmon are produced by 5 companies who between them own 13 cage farming enterprises operating over numerous sites. There are 3 farms in Cork, 7 in Donegal and 3 in Galway. Marine Harvest operates on a larger scale than the other producers combined, with an annual output of 10,000 tonnes, representing over 60% of Irish salmon production. They operate across 14 growing sites, 3 hatcheries and one processing facility, employing 163 staff in fish production, 120 in fish processing and have a site manager running operations at each of their 17 fish rearing sites. They are also collaborated with Mannin Bay Salmon, a smaller neighbouring company within a 'co-rearing' scheme. In comparison, the other companies have between 30 – 40 staff and do not have human

resource departments to take responsibility for matters relating to staff development and training. This responsibility is often held by a degree graduate level person who performs a range of functions for the company, which includes taking responsibility for the companies training requirement, largely driven by 'standards compliance'.

The value placed on the employment salmon farming provides and its social importance to the Irish coastal zone is well illustrated by Claire Island, which lies off the west coast. It is home to 140-150 people and 11 of the 25 staff working at the Claire Island Salmon Farm are Island residents. In 1987 a Norwegian company established the farm helped by islanders returning home from the United Kingdom to work on the new business. The farm stopped the extinction of the island and transformed the community's prospects as the return of jobs allowed the Primary school to stay open and a new extension was built to accommodate 14 pupils. The islands economy was based on traditional industries of fishing sheep farming and tourism with few year-round employment opportunities except other than the salmon farm. Neighbouring islands also benefitted as the salmon farm secured many of its services there. Over the years Claire Island Salmon has won many awards and is a key feature of many meals served to visiting dignitaries to Ireland. [Ref: Bord Iascaigh Mhara BIM] It was also the first farm to convert to organic production, and a 'trail-blazer' for the Irish industry and arguably Europe, regarding organically farmed salmon.

However, the Irish Farmers Association (IFA) are aware that the industry is very small in comparison to other European producers and support expansion. The Faroes, a small island in comparison to Ireland, produces seven times the Irish national output and Norway produces Irelands output every 2 days. They also acknowledge the economic and social value that a modest expansion of 10,000 tonnes of organically farmed salmon would add. This would be worth 250 million Euros to the Irish economy and create 1,067 direct and indirect jobs in coastal communities [Ref BIM, EU Commission]

A combination of issues, including designation of sensitive marine habitats and concerns about environmental impact, has undermined the achievement of projected growth nationally. There were some 600 finfish and shellfish licence applications awaiting approval in 2016. [Irish Times Jan 4th 2016]. Some key attempts to hasten the expansion of the industry in Ireland have been thwarted, most notably the Galway bay salmon farming development which failed to get political support and planning permission. An annual production capacity of 15,000 tonnes had been targeted.

Subsequently, the Irish Salmon Growers Association appointed Danish fish farming pioneer Ivar Warrer-Hansen, a specialist in land-based production systems capable of overcoming the environmental impact constraint. He calculated the capital costs would be €33 million for a 5,000-tonne a year farm on land. [Irish Times Jan 4th 2016] The investment needed was prohibitive and environmental constraints may continue to hold back the expansion of the Irish industry in the foreseeable future, unless the technology for land-based production in closed circuit recycling aquaculture systems (RAS) further improves, and/or the capital and running costs are reduced.

## 1.2 Industry representation regarding VET and Skills

There are several industry representative organisations that take some direct or indirect interest in the skills agenda and have expressed some concerns regarding the workforce constraints facing the sector.

### 1.2.1 Irish Farmers Association (IFA)

The industry is represented politically by the Irish Farmers Association (IFA Aquaculture) who are an active lobbying force within Europe to enable and secure a favourable regulatory environment within which Irish aquaculture can thrive and grow. IFA Aquaculture represents the 250 companies involved in freshwater, marine finfish and shellfish aquaculture in Ireland. To become a member you require an aquaculture licence to farm your products. IFA Aquaculture also has associate members involved in supply of inputs and sales as well as processing and alternative enterprises such as seaweed.

The main committees are the Irish Shellfish Association and the Irish Salmon Growers' Association.

The most important issues that the IFA addresses include aquaculture licencing, overcoming bureaucratic delay, meeting Harvest 2020 production targets, providing capital grant aid for producers, food safety issues and dissemination of EU legislation on the environment and water quality.

Although the IFA are involved in resolving a plethora of industry issues, they have also supported workforce development initiatives and acknowledge the education and training challenge in remote coastal zone regions for those trying to enter the industry as well as those already employed. They feel the there is a need for improvement in several key areas:

- Attracting young people to the industry
- Succession planning for family owned businesses
- In service training regarding new technologies

[Per Com. Richie Flyn former IFA Executive]

### 1.2.2 Irish Seafood Producers Group (ISPG)

Irish Seafood Producers Group (ISPG) established in 1986 is Ireland's leading supplier of organic salmon. They have a very significant role within the industry and an indirect impact on workforce development. As the principal organisation for the sales and marketing of Irish Finfish Aquaculture products, they ensure product quality and traceability. Only fish of the highest quality are packed and distributed to customers throughout Europe, North America and the Far East. Indirectly, they are the guardians of the organic standards and if queries are made by customers regarding any of their produce, the ISPG look for evidence of compliance from the farm in question. This consumer pressure maintains constant attention on organic production standards and product traceability, which indirectly impacts on workforce training and development requirements in Ireland.

## 1.3 Staff recruitment and development policies

The industry is located on the West coast of Ireland, a very thinly populated rural region. The recruitment of staff to operative positions is very reliant on the local communities and consequently, employee friendly policies and flexible staff attitudes are very evident.

Because of the thinly spread population, companies do sometimes have difficulty recruiting staff for some of their more remote farm sites. Some have developed a company culture whereby staff are flexible and are willing to move sites when necessary if a recruitment problem occurs, and provide cover, until the post is filled. This ensures the continuity of fish husbandry and farm operations and safeguards fish welfare which is paramount when operating within regulated organic production regimes.

One company provides their employees financial support with fees and expenses such as food, travel and accommodation. Exam and study leave are also given to the employees where necessary.

### 1.3.1 Husbandry operatives

In general, Irish salmon farming companies do not insist on recruits holding National Qualifications (NQs) in aquaculture. However, some do consider any existing qualifications and relevant prior experience is noted, informally. All companies are generally dependent on the recruitment of residents from coastal farming communities used to the west coast environment and have experienced working outdoors in all weathers. Although they prefer recruits to have had previous experience, they do employ residents from the community with a positive attitude that lack experience and rely on their in-company development programmes to get them quickly established within the workforce.

For those that are unqualified and inexperienced, there is a lot of compulsory training needed for compliance purposes. This includes Health and Safety, such as survival training, fork lift operations and boat handling. Generally, companies make a strong linkage between their appraisal system and training, to tailor requirements to the individual's needs revealed through appraisals, and in one company each member of staff keeps a personal training log up to date. Each company has similar mechanisms for maintaining records of the training individuals have received for compliance purposes.

One company operates a very effective 'buddy system', where by a buddy is offered to each new entrant. The buddy is chosen carefully according to their own appraisals and they are very experienced, but not normally the new recruits line manager. They act as the new recruits' mentor and guide, ensuring that they are safe and learning how to undertake all tasks according to company Standard Operating Procedures (SOPs)

Another relatively small company describes themselves as "*informal and reactive to the needs of the organic standards and any legal requirements"* regarding their staff development policy for husbandry.

### 1.3.2 Site managers

One company looks for a supervisory level qualification when recruiting a site manager from outside the company, as well as suitable experience and references. Most of their site managers have worked up through the company's internal ranks and have completed an 18-month 'management development' programme, which covers all aspects of the business, production, hatchery and processing from a managerial perspective.

Another relatively small company describes their policy for recruiting as follows. "*Site managers come from within the company and tend to be the most experienced operators, that the company has observed to have the characteristics needed for the role*".

1.3.3 School engagement

One company has invested significant time and resources into school engagement activities targeting 14-16-year olds, to make more young people on the West coast of Ireland aware of the career potential of aquaculture. The intention is to increase the pool of young people positively pre-disposed towards aquaculture as a career on leaving school. These initiatives which have included visits to schools to provide talks are ongoing and often involve well informed the graduate level staff making visits to present the salmon farming story.

## 1.4 Industry regulation/QA – and the training implications

The Irish industry is subject to the same regulations as most other European fish producers, including; health and safety, the operation of water crafts and food safety to safeguard consumers. The main body governing, and auditing compliance organic standards is the Organic Farmers and Growers Association (IOFGA). However, the German 'Naturland' standards adopted by some, achieve the same objectives and have equal status within Ireland. Compliance with both standards are audited by the IOFGA.

The standards are very wide ranging and have a significant impact on the SOPs and therefore training requirements, across the following range of farm operations. They impact on fish feed ingredients, fish health management, stocking rates, live fish transportation slaughter practices and the farm design and management. (See Appendix - Illustrative organic standards for salmon production derived from Naturland standards)

# 2 Investigative process in Ireleand

## 2.1 Overview and evaluation of investigative methods and processes

Information was gathered from industry following a four-phase process, culminating in the production of an evaluative report on Irish aquaculture education and training demand.

- Completion of a stakeholder analysis to identify Irish stakeholders pre-disposed towards the BlueEDU research mission and with access to reliable information and/or influence over other key stakeholders. See Appendix 1 Irish industry stakeholders consulted

- The adaptation of the generic structured interview, devised to support research into aquaculture skills and VET demand in Ireland, through one to one engagement.

- Interviews with stakeholders conducted through phone calls which led to records of interview responses which were recorded, documented and accuracy checked by the interviewee before submission to the BlueEDU partnership.

- On-line survey to engage individual staff in companies at all levels and allow them the opportunity to provide their opinion of aquaculture VET and their future skills needs.

- Analysis of interview results, identifying conflicts in information, information gaps and discrepancies, leading to follow up enquiries to seek clarification on important points of detail for inclusion in the final report

## 2.2 Quantitative survey results

The on-line surveys were discussed with companies during or after a structured interview had been completed, encouraging them to offer their staff the opportunity to provide their opinion of skills needs and aquaculture VET. This negotiation was held with HR Managers, or equivalents, and as an incentive, the opportunity to receive a company bespoke data set and analysis was offered. Cooperation was considered seriously by two companies, but unfortunately data was not ultimately submitted.

## 2.3 Qualitative survey results

A wealth of qualitative information was gathered through the structured interview process and notes recorded in responses to answers given. The process was interactive, and at times questions were adapted or new lines of enquiry followed in response to the answers given, ensuring that the dialogue was always meaningful to the interviewee, as well as providing useful information to BlueEDU. The interviewees were mostly HR Managers and in the smaller companies those responsible for staff development. In all cases they were well equipped to answer most of the questions, and when they did not know an answer, referred to others and came back with the answer. They all carefully checked the records and added missing information and/or made corrections to quality assure the information set.

## 2.4 Previous surveys

There has been no previous formal national survey into aquaculture skills needs by the industry or VET representative agencies in Ireland. However, their VET needs have been considered during the development of National Qualifications (NQs) within a process that ensured aquaculture industry input to the development of NQ Units and learning outcomes.

# 3 Industry opinion of current VET supply

## 3.1 Available VET summary

The available aquaculture VET in Ireland is illustrated by the table below. There is a low dependency currently by the industry on formal NQs and a high dependency on non-formal VET, both short courses and in company training schemes that support staff development and compliance with organic standards. In addition, the industry uses external providers who offer training leading to mandatory certification.

| VET description | Qualification | Delivery mode |
|---|---|---|
| NQ in Aquaculture | QQI Level 5 | College-based |
| Higher-Diploma in Aqua business | QQI Level 8 | College-based |
| BIM short courses | None | Attendance based in small-groups |
| Fish VET group short courses | None | Attendance based in small-groups |
| In Company training | None | Group Learning and individuel mentoring |

Table 1 Summary of Available Formal and Non-formal aquaculture VET in Ireland

## 3.2 Occupational standards

Ireland does not use National Occupational Standards (NOS) to define the knowledge and skills required by each occupation and occupational level within the industry, to underpin NQ development. However, as the development of its NQ, Units and Learning Outcomes includes industry within the process and a similar objective is achieved, namely, the definition of the knowledge and skills industry require, which are embedded in the qualification.

There are no detailed definitions of occupational profiles at national or company level. Broad task definitions and job descriptions are devised and used by companies when recruiting.

All companies have Standard Operating Procedures (SOPs) that they update in response to any changes or updates to the organic standards. This may lead to a new in company training requirement or update. In general SOPs are centrally important to the development of new employees, the appraisal systems and underpin company staff development programmes.

## 3.3 Formal VET leading to NQ

The NQ does not have a great influence on workforce development in Ireland currently and awareness of the NQ and its content is quite low in smaller companies. However, the potential value of an accessible NQ to company staff is recognised.

One company most familiar with the NQ look upon it favourably. "*It has the right content and is a good programme for the husbandry level but does not run often*". The NQ was last used by this company in 2008 when 10 trainees from the company enrolled but unfortunately problems with program delivery were encountered when the local Education Training Board (ETB) failed to recruit enough experienced tutors.

As a result, dependency on uncertificated non-formal VET provided as short courses by BIM and the Fish VET group has grown, to complement non-formal in company training as the mainstay. (See 3.5 below)

The Galway University is recognised as relevant for its degrees and Masters' programmes, which provide a flow of qualified graduates to the west coast salmon industry for the more scientifically orientated roles, as opposed to a reliance on Higher VET. The awareness of the Higher VET programme in Aqua business developed in partnership with BIM and launched by the Institute of Wexford campus, Carlow in 2016 is relatively low within the industry at this early stage.

## 3.4 Mandatory training and certification

The mandatory certificated training is provided by a range of private training providers across a range of topics

On exploring the influence of cost, one small company commented. *"Cost is not considered to be a barrier for mandatory training delivered by external providers"* However, it transpired that timing was often an issue to them and a potential barrier, as staff are too busy for training from June to Sept when some of these courses were being offered.

## 3.5 Non-formal VET

3.5.1 In company training schemes

Company Standard Operating Procedures underpin company training schemes in all cases. One company has a comprehensive and systematic approach towards the delivery and assessment of their in- company training. Generally, company training schemes are not linked or referenced to the NQs and there is no pathway to NQ achievement from in company schemes currently available.

The approach to staff development by the smaller companies is often 'reactive'. "*Our response to an issue is often to hold a problem-solving session which can lead to individual and group learning, but this may not be documented."* However, this same company ensures that each member of staff keeps an up to date training log to satisfy the requirements of the organic standards. (See Appendix 2 - Illustrative organic standards for salmon production - Naturland standards). The training provided impacts on all production stages, fish welfare requirements, feed selection, how to feed and stock

densities…It covers aspects of general fish husbandry that apply to all farms, as well as the organic production specifics. The member of staff responsible for staff development occasionally provides training on subjects within their fish health and organic standards compliance remit.

One company commented "*We have made e learning available to all in the company".* On further questioning it was revealed that all employees have access to SOPs and codes of conduct relevant to their jobs, policy documents and instructions for specific tasks from the company server. This is presented as a sub set of the documents held on the company's Total Quality Management (TQM) data base holding hundreds of documents relating to all aspects of their operation.

This same company has devised an effective ICT based internal assessment process, underpinned by their SOPs. Staff are allocated key pads when on a company 'e learning course' and they are led through the SOPs underpinning the learning process. Once ready, they undertake multiple choice questions and the data on each learners' performance is collected but not made publicly available. A pass mark is set for each course and some have a high pass mark if they are based on SOPs of high importance to the role.

On further discussion it became apparent that only key SOPs are made available to staff to aid navigability, as well as important documents, such as risk assessments.

### 3.5.2 Short courses

Although generally short courses are not certificated and do not include an assessment process, which places them within the non- formal VET category, they do contribute towards standards compliance and therefore they are considered to have a very important role to play. Short courses are delivered by Irelands Seafood Development Agency (BIM) and the Fish VET Group, sometimes working in collaboration and often linked to compliance with extensive organic production standards.

# 4 Aquaculture learners

## 4.1 Learner profiles and characteristics

Most learners recruited at the operative level are from farming communities and many have no formal qualifications. Some managers have started their career unqualified but have worked through the ranks and have demonstrated their practical capabilities and suitability for management roles informally. Others have undertaken supervisory qualifications as a route to a management role and tend to be more experienced and confident learners.

## 4.2 Learner confidence and learning difficulties

Those recruited to technical positions within companies tend to hold a relevant degree and are confident learners, able to undertake CPD and develop their role within the company. A significant number of operatives in companies are known to have some learning difficulties and have not enjoyed their compulsory schooling. At the start of their employment they are not confident learners. One company says, "*Yes, these problems exist I expect, and as mentioned previously, confidence is an issue for many, hence the emphasis we have on group learning in a secure environment*".

They recognised the issue and have implemented policies to address it very effectively, recognising that many of their recruits have had a negative experience during compulsory schooling. The management of confidentially within the internal assessment process described in 3.5.1 above further strengthens the staff's trust in those managers and mentors over-seeing and supporting their development.

A small company with less formalised staff development practices have also recognised the frequency of confidence issues and use informal group problem solving approaches as a form of peer learning, to take the emphasis off individual learning and to improve their sense of security.

## 4.3 Learning style preferences

Those HR Managers interviewed were confident that their staff would respond to a range of different learning styles. A range of approaches to learning were discussed with those interviewed to establish which may be effective for staff within their company.

One company already has a very diverse range of learning activities established within the company learning culture, including;

- One to one mentoring delivered via a 'buddy' system
- Facilitated peer and group learning supported by communication technologies
- Computer-based, or on-line learning which is central to their in-company training system
- Multiple choice assessment delivered via tablets
- Short courses on technical subjects delivered by BIM and the Fish VET group

Some companies have a less extensive range of learning opportunities currently and one smaller company believes externally delivered short courses are the most effective, partly due to the opportunity to meet other salmon farmers and because the courses delivered are very good. In addition to this they rely heavily on an informal group problem solving approaches to learning. (See 4.2 above)

# 5 Skills gaps identified

In general, there were few skills gaps referred to by those interviewed as their staff development policies appear sufficient to enable them to operate as organic salmon producers.

## 5.1 Fish Husbandry Operative

Several specific comments were made by a range of companies and provide some indication of the subject priorities which include; fish health, general husbandry, automated feeding systems and ICT confidence building. Learning difficulties are also common place within the workforce and are addressed sympathetically by the companies.

Specific quotes:

*"Auditing body 'Global Gap requires a big focus on Fish Health."*

*"The Aquatic Environment monitoring, and plankton sampling stands out as the area most in need of improvement"*

*"Husbandry courses are valuable in general"*

*"When staff go to Marine Harvest Sites to feed fish, they need training in the operation of their automated feeding systems as they use different technology to ourselves."*

One company has a widespread issue within the workforce regarding a fear of ICT to overcome. They say, *"this problem would benefit from some external assistance, as their staff to be more confident ICT users in the future as everything is getting 'digitised'*.

Others commented on learning skills... "*I am not aware of dyslexia specifically, but I have observed a wide range of abilities in basic skills (communication, numeracy and the use of ICT)"*

## 5.2 Site manager

Generally, in the smaller businesses, site managers tend to be selected from the workforce based on their experience and knowledge of the specific site and to some degree their temperament. No specific concerns were raised by the smaller companies, regarding their skills gaps. However, this may reflect an acceptance of existing constraints, as opposed to implying that there are no skills gaps of concern. One company is determined to improve their internal staff development capacity and training the trainer is being undertaken to improve company self-reliance. *"We need better internal tutoring capacity"* was the quote made.

# 6 Future VET needs

In general, the Human resource managers interviewed were not proposing major changes to the National Qualifications themselves. Whilst many see value in NQs, they are realistic regarding the constraints to delivery and seem to be satisfied with improving the status quo as opposed to seeking radical reform. However, some specific areas for development were referred to.

## 6.1 VET (EQF 3-4)

Industry recognise the potential value of NQs to their companies and staff. If delivery constraints could be overcome, they would encourage their staff to enrol. Consequently, whilst the NFQ Level 5 in Aquaculture has existed for some time, doubts over its future viability and sustainability remain, due to low and intermittent demand inhibiting the VET provider commitment. Considerable investment is needed to develop the more flexible delivery modes required to improve access. (See 6.3 below). This could then lift demand for formal VET to a sustainable level.

## 6.2 Higher VET (EQF 5-8)

There is a management level Higher Diploma in Aqua business available from the Institute of Technology Carlow Wexford campus. It is a part time attendance-based course currently and includes weekend attendance to make it accessible for employed mature learners. However, one company has requested leadership training from the public sector, implying that it may not fully meet the needs of finfish producers in Ireland.

## 6.3 Delivery modes

The Irish companies have become self-sufficient regarding staff-development but place great value on the short courses provided by BIM and the Fish VET group. Generally, this focussed face to face style of delivery to small groups suits their learners very well. However, there are also strong signs of innovation within one company regarding the use of company intranet-based delivery of e learning and the sophisticated use of e assessment within a secure group learning environment. Therefore, some existing company learning cultures would support the adoption of more flexible approaches including e learning, if the significant barriers to development, delivery and access could be overcome.

One company is already heavily committed to e learning but reliant on the interpretation of their SOPs. They would like to introduce more and better 'designed flexible e learning' to support their in-company training. Another company, although not using e learning currently, recognise that both e learning approaches and alternatives, such as access learning accessed via mobile devices, company intranets and paper-based learning resources may be more effective and accessible for some staff, implying they would pilot such resources, if made available. However, there are concerns that the ICT infrastructure and connectivity need to be improved in some regions to access 'e learning' delivered via the internet. This is a significant barrier currently for some people working on the Irish west coast.

Regarding assessment, competence judgements are commonly kept within a paper-based appraisal system and the records of the training individuals have received held on training logs to comply with organic standards. An interest was expressed by one company in e portfolio systems as an alternative way of holding information on competence judgements and assessments.

# 7 Industry roles within future VET development

## 7.1 National level initiatives

There are no national level initiatives targeting aquaculture VET. However, there is a significant new community partnership initiative emerging on the west coast called the 'Marine Park'. The ETB anticipate it will generate a need for 20 new VET places to develop the skills needed in the maritime economy, with most places being allocated to aquaculture. This will provide a renewed stimulus to aquaculture NQ delivery by the ETB, once the NFQ Level 5 in Aquaculture has been revalidated.

## 7.2 European level opportunities

There are no ongoing European funding projects supporting Irish aquaculture VET development currently. However, future collaborative Erasmus+ innovative VET development activities would be of benefit to Irish companies, particularly those who have established the use of e learning. This could provide them the opportunity to contribute to the planning, development and piloting phases, leading to adoption of new work-based learning and apprenticeship delivery systems and resources on completion, in partnership with public sector providers.

## Appendix 1 Irish producer and producer organisations consulted

| Organisation | Address |
|---|---|
| Irish Farmers Association | Irish Farm Centre, Naas Rd, Drimnagh, Dublin 12, Ireland |
| Curraun Blue (Co Mayo) | Mulranny, Co Mayo |
| Mannin Bay Salmon Company | Drinagh, Errislannan, Clifden, Co Galway |
| Marine Harvest Ireland | Rinmore, Fanad, Letterkenny Co Donegal |
| Bradan Beo (Teoranta) | Cill Chiaráin, Co, na Gaillimhe, Ireland - |

## Appendix 2 Illustrative organic standards for salmon production - Naturland standards

| Operation | Measure | R | M |
|---|---|---|---|
| Farm systems and management | Culture in tanks is permitted only for limited periods in juvenile stages (e.g. egg to fingerling or smolt). | | ✓ |
| | Preference is to be given to the use of renewable energy resources and re-cycle materials. Waste is to be kept to a minimum. Developments in these areas have to be recorded each year. | ✓ | ✓ |
| | For construction and management measures only materials and substances shall be used that provably are not causing any injurious effects on the organisms or the environment. | | ✓ |
| Stock density | Stocking density of salmon (Salmo) shall not exceed 10 kg fish/m3. | | ✓ |
| Environnemental management | Installation of so- called "lift-up" systems for net cages in order to facilitate the removal of feed residues | ✓ | |
| | Use of chemical "anti-fouling" agents is prohibited | | ✓ |
| | While protecting the farm areas from predatory birds and other animal species, measures not harming the animals physically shall be preferred (e.g. nets, dummy raptors) | ✓ | |
| | Where suitable, polyculture shall be preferred. Polyculture should lead to direct benefit for the species cultivated (e.g. wrasse for elimination of ectoparasites in salmon cages) or to more effective utilisation of the available resources | ✓ | |
| Health management | For controlling sea lice in marine net cages, stocking with wrasse as "cleaner fishes" | ✓ | |
| | The health of the organisms is, primarily, to be ensured by adopting preventive measures (e.g. optimised husbandry, rearing, feeding). Natural curative methods shall be preferred in case of a disease. | ✓ | ✓ |
| | Use of conventional medicine is only permitted in vertebrates and after detailed diagnosis and remedial prescription by a veterinarian. In this case, at least twice the legally prescribed waiting period must be observed. | | ✓ |
| Feed | Decrease the percentage of fishmeal/oil in the feed composition as far as possible | ✓ | |
| | Feeding of natural pigments (e.g. in the form of Phaffia yeast or microorganisms) is permitted | | ✓ |

| | | | |
|---|---|---|---|
| | Synthetic antibiotic and growth-enhancing substances as well as other synthetic feed additives (e.g. syn-thetic amino acids, chemo-synthetic pigments) are not permitted | | ✓ |
| | In order to work towards a responsible utilisation of wild fish stocks, special standard requirements are set on the origin of fish meal/oil | | ✓ |
| | Feed shall not be obtained from conventionally reared terrestrial or aquatic animals. | | ✓ |
| | The animal components in feed shall, where acceptable for nutritional physiological reasons, be re-placed by vegetable products. | | ✓ |
| | Feed from genetically altered organisms or their products is not permitted. | | ✓ |
| Fish transport | A transport density of 1 kg of fish to 8 litres of water shall not be exceeded | | ✓ |
| | Water exchange with water of the same temperature shall be done after a maximum of 6 hrs of transport duration. | | ✓ |
| | A live fish transport duration of 10 hrs shall not be exceeded | | ✓ |
| Slaughter | A reporting protocol for slaughter which governs procedures adopted in connection with catching, sorting, caging, stunning and killing in detail is to be submitted prior to initial certification | | ✓ |
| Hatchery | The stock (eggs or hatchlings, fries etc.) has to be reared on the farm itself or purchased from farms that are certified by Naturland or meet certification standards approved as equivalent by Naturland. Insofar | | ✓ |
| | Genetically manipulated (transgenic) organisms or those obtained by means of polyploidization or gy-nogenesis may not be stocked. | | ✓ |
| | The use of hormones, even from the same species, is not allowed. | | ✓ |

**BlueEDU WP6 VET demand in the Faroes Islands**

Ann Cecilie Ursin Hilling
NTNU

# The Faroe Islands

## Introduction

The Faroe Islands is a small island group located north of Scotland and about 600km vest of Bergen city in Norway. The island populates close to 50 000 people and is an autonomous country within the kingdom of Denmark. They have the right to govern independently several areas of their politic. This include conservation and management of living marine resources within the 200-mile fisheries zone, protection of the marine environment, sub-surface resources, trade, fiscal and industrial relations, transport, communications, culture, education and research[18].

Faroese fish products is a major economical factor, it represents 20% of the country's total GDP and 95% of merchandise exports.

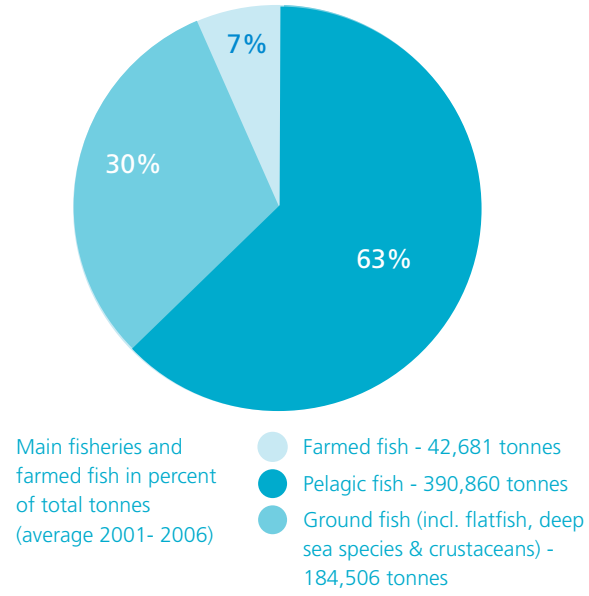



**Figure 81: Main fisheries and farmed fish in percent of total tonnes 2001-2006**

## Aquaculture in the Faroe Islands

### Production volumes

In the Faroe Islands the main produced species is Atlantic Salmon and Rainbow Trout.

[18] Faroe,2018: Faroe Islands fisheries and aquaculture, Ministry of fishery and natural resources.

In 2017 the total production volume of farmed fish was 86 830 tonnes(whole) equal to 71 172tonnes (gutted).

The production value of this production was 3.868 million DKK = 518 500 400 Euro

Table 1: Production of Atlantic Salmon and Rainbow trout in 2017.

| Year | Species | Atlantic Salmon | Rainbow Trout |
|---|---|---|---|
| 2017 | Production in tonnes: | 86.830(whole) 71.172(gutted) | |
| | Production Value: | 518 500 400 Euro | |
| | Export in tonnes: | 62.310 | 40 |

The production volume is expected to increase in the future and Bakkafrost who today has 68% of the total Salmon production in the Faroe Islands stated to the newspaper Fish farming expert in August of 2018 that they are to invest £360million over the next five years in order to increase their annual production by 55% to 76.000tonnes by 2023[19]. They were this year given the licence for two new sites on the island of Suduroy and plan to build a brand-new harvesting plant there with the capacity of 15000tonnes.

[19] https://www.fishfarmingexpert.com/article/bakkafrost-bids-to-increase-volume-by-55/

## Aquaculture stakeholders and location

In the Faroes there are three major fish farming companies:


Figure 82: Overview fish farming sites in the Faroe Islands.

Hiddenfjord which holds 15% of the total salmon production in the Faroe Islands and is a Faroese company.

Marine Harvest holds 17% of the total salmon production and has Norwegian ownership.

Bakkafrost which is the biggest stakeholder with 68% of the total production and is a Faroese company.

In 2017 the average amount of employees in the aquaculture industry calculated by the OECD method was 1170. The average unemployment rate in the country the same year was 2.4.

The company's sites are located all around the country with Bakkafrost`s activity mainly being situated to the east and the south of the country, Hiddenfjord in the vest and Marine Harvest in the middle. One unique thing about the govern of aquaculture in The Faroe Islands is that each company has their own fjord to themselves.

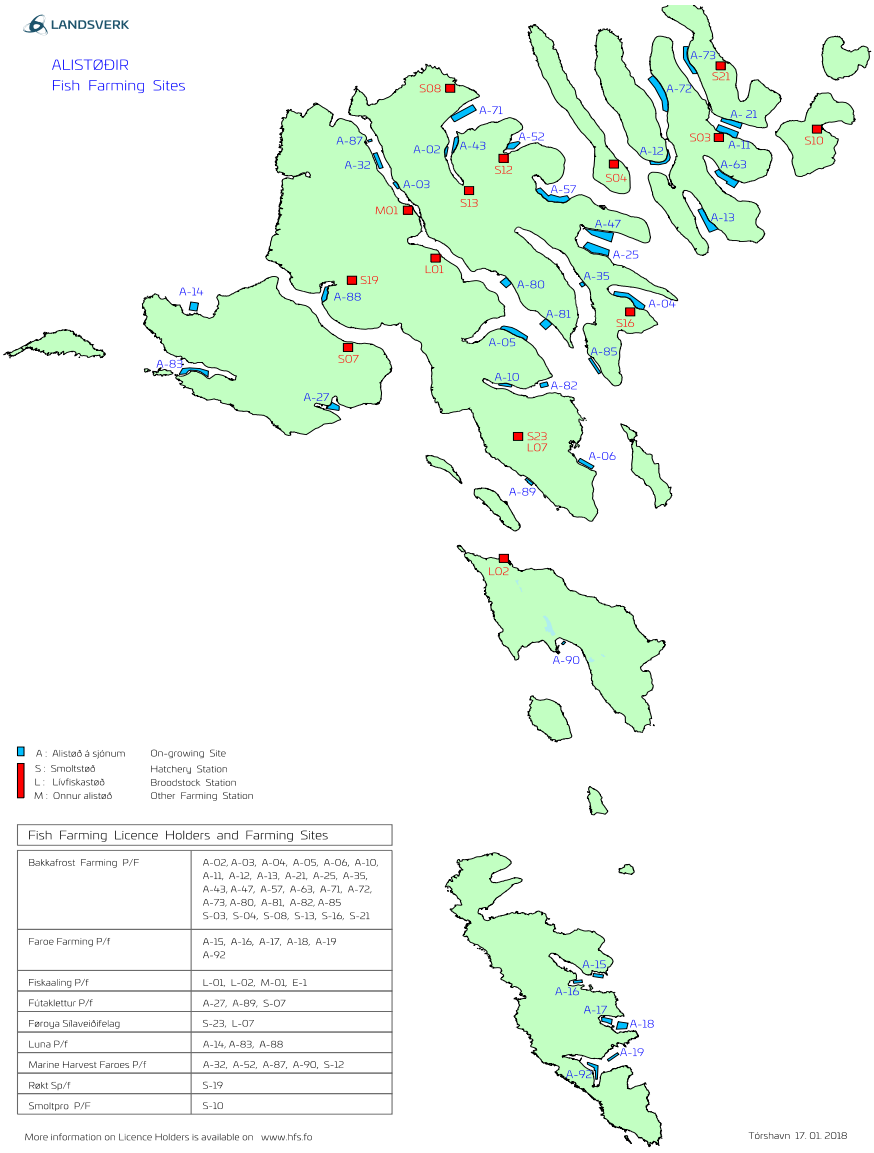



Figure 83: Aquaculture activity in specifics: Blue marks showing sea cage operations.

## Govern

The ministry of Trade and Industry is the government authority responsible for the public administration of fish farming in the Faroe Islands. Environmental impact is one of the key factors taken into consideration when deciding upon licenses to farm fish. Every fjord and bay in the country that is suited for fish farming, is applied for farming. At the Faroe Islands only one company may farm fish in one fjord. This is done in order to reduce risk of contamination and to make sure that every company is responsible for their fjord. There is continuous evaluation of the environmental footprint of the farming. There is no risk of contaminating

*Licenses for fish farming are only issued when minimum requirements have been met to prevent negative environmental impact, ensure responsible working conditions, and maintain the required high standards for animal welfare and hygiene*[20].

### Productional obstacles

For the Faroe Islands the natural challenges for farming salmon should be mentioned. The country's fjords are very shallow due to the whole country being situated on a plateau. This gives for stabile temperatures through the year with the gulf stream circling around the islands. Making a very good temperature profile for aquaculture production and excellent habitats for wild fish stocks.

The average depth of fjords suited for aquaculture are 30-40 meters. Having such shallow fjords also poses for issues due to very harsh currents and high waves. The weather conditions are so hard that equipment suppliers have to especially calculate and structure all components to fit these conditions. One example of how hard the conditions can get: one site where the company couldn't get out to it for three weeks due to weather. When they eventually did the feeding-barge was barely hanging on by one last piece of chain in the mooring which normally would consist of a minimum of 8 chain attachments to either land or on seabed.

In order to meet the obstacles and to shorten the time the salmon has in sea; the Faroese industry is aiming on producing big smolts which has longer time on land and are bigger and more robust when they are put in sea. The smolts now put in sea are about 500 – 2000gr compared to 70-120gr which have been the norm for many years.

### Aquaculture associations

The aquaculture association Havbúnadur félagid represents all the fish farmers in the Faroe Islands and consists of a board with representatives from the major stakeholders of the industry. The association has one employee which assists the industry in different areas such as:

- Lobbying
- Representation
- Cooperation with other associations
- Statistical work
- R&D projects
- Educational projects and courses

The association has been active in a collaboration project towards establishing an NQ in aquaculture in the country and is the projects representative in the Faroe Islands.

[20] Faroe Islands fisheries and aquaculture, Ministry of fishery and natural resources.

### School engagement

As described in D5.2 there is today no NQ in aquaculture in the Faroe Islands. There was in 2010 established a study on upper secondary level which was closed down shortly after due to the industry having a downfall and the need for additional workforce was not present.

However today there have been expressed a need for skilled workforce to the industry and therefore a project was formed in 2017 together with schools in Norway and Iceland with the aim to create a curriculum for a school in the Faroe Islands and have this be somewhat equal to the study which exists in Norway today and that is newly created in Iceland. This work is still in motion and the industry needs to involve themselves more in order to have the schools and the government move forward in the process.

The industry in the Faroe Islands have been engaged in having their young students attain degrees in aquacultures. Therefore, they have over year been granting scholarships to young students having to go abroad to study aquaculture and fisheries. This to help them cover financial costs during the study period. The grants are given with the clause that the students are to come back to The Faroe Islands to work for a certain period of time after completion.

## Investigative process and findings

Investigations were conducted via structured interviews with Hiddenfjord, Bakkafrost and Marine Harvest. These companies represent the entire salmon farming industry of the Faroe Islands.

### Staff recruitment and development policies

The Faroe Islands is a small country where everything is within not more that 2 hours driving. If you live on the southernmost island in the country and want to go to the northernmost point in the road-net, then with the ferry ride its 4hours. The road connection between the islands are very good and mostly connected by subsea tunnels. This means that geography in terms of recruiting is not an issue.

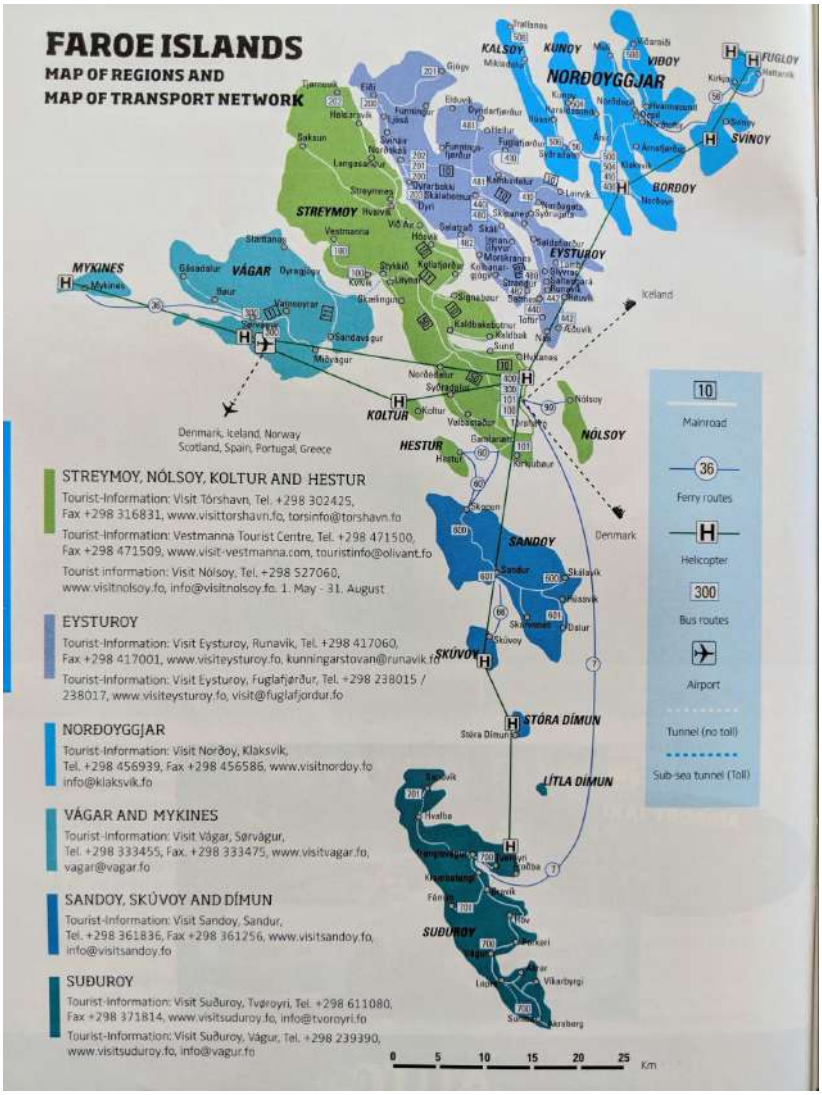



Figure 84: Showing the roadmap of the Faroe Islands.[21]

The Faroe Islands only have a population of 50.000 inhabitant, out of these only 29.000 are in the working age of 16-70 years old. The Aquaculture industry employs today 1170 which gives for about 4% of the total workforce in the country.

[21] See: The immage.eu/travelguide

The industry is expressing that the interest for the aquaculture industry is high, all staff are mainly hired locally, and it is a popular industry.

There is however an issue in recruiting people with skills within the field.

There is no lack of people with higher education in Aquaculture, but the industry is expressing that they wish for people who are more practically and technologically oriented to serve as husbandry operatives.

One company even commented that they would rather hire plumbers and nurses instead of people with higher education in Aquaculture. This due to them having a more practical approach to problem solving and work.

The companies when recruiting people as new husbandry operatives, will in general look for two categories; young people who has a willingness to learn and that can be shaped to fit the company profile and production and people with prior occupations and skills that will come in use for the job (fisherman, electrician, plumber etc.).

The companies informed that since the country is small and in order to eliminate differences, they have all decided upon a common wage rate which is equal between all companies. This way one ensures that the movement of staff between the companies is at a minimum.

When asked upon how the companies view staff moving in between, one company replied:

*"We don't see staff moving around as a weakness, but more as a strength. The worker will be able to learn more by moving around due to procedures varying, and when/if they come back, they will have more knowledge that will be to our benefit"*

Due to the lack of NQ in the Faroe Islands, the companies are completely reliant on in-house training for husbandry operatives and site managers.

When staff is recruited the companies have the new employee make him/herself familiar with the company's policies and safety regulations. The training will in a great deal be conducted via buddy system training where the newly employed will follow a senior for a period of time to learn. It was not disclosed whether the companies do assessments of the buddy system training. In addition, the companies will run courses often given by suppliers of equipment or fish health personnel. These courses are not certified and does not include any formal assessment.

One company have created their own in-house courses for their husbandry operatives with the aim of increasing their knowledge within the biology field having themed courses over a period of time:

1. Biology
2. The company
3. Environment
4. Animal welfare
5. Feeding and feed technology
6. Health and safety

The husbandry operatives are themed up in groups mixing them from different work operations and sites. Every module is set to last for 8 hours in total and the lectures are structured such that the students

will have 20minutes of lectures followed by a practical task. This to try enhancing the learning outcome for students that normally are not used to being confined in classrooms. These courses are set to be run every other year and the outcome of the courses have been very positive for the company.

The companies expressed that to recruit site managers is hard due to the lack of skilled personnel available, and therefore site managers are often recruited internally within the company. Husbandry operatives who shows a good work ethic, willingness to learn and which is showing good people skills will be eligible for a promotion to site manager.

It is not known whether the companies have adapted occupational standards within the companies, but they did have occupational profiles describing the work tasks of the different positions and what is desired skills of a husbandry operative and a site manager.

In general, the skills most desired for both site manager and husbandry operative positions is the certificates for manoeuvring heavy equipment such as; boats, forklifts, cranes etc. For a site manager it is also desired that they know the specific software that is used in the daily operations: feeding, mortality, equipment and others.

The skills desired to improve in today`s husbandry operatives were: biology, fish physiology, health and welfare and digital competence.

For site managers the skills desired to improve was: digital competence, feeding technology and planning and leadership skills.

## VET recommendations

The creation of NQ in Aquaculture both on upper secondary level and for mature learners.

- Explore if unitization of study for mature learners might be a better form of delivering knowledge.
- Short Courses/modules for mature learners currently employed in fish farming (industrial demand)
- New ways of assessments with regards to delivering knowledge and assessment after courses.
- Explore if specialized courses directed to specific work tasks might be a good form of delivery.
- Until NQ is established in the Faroe Islands, it should be considered whether courses could be delivered from other countries like Norway. Need governmental involvement in both countries.

- Explore the possibility of harmonizing Aquaculture VET in Northern Europe.
  - A certification that will be automatically approved in Norway, Iceland, The Faroe Island, Denmark and possibly Scotland (UK).
  - Increase mobility grants for students in an industry which needs more personnel. 50% productional increase at Bakkafrost might pose for a problem with country's small population

- Reading material is of need, and there should be explored whether to collaborate across borders in order to create common reading material which can be used in North Europe.

- Industry involvement is crucial with regards to:
  - Keeping a study updated with industry progress.
  - Lending key personnel to schools to aid in lectures where teacher's knowledge is lacking.
  - Internships and apprenticeship in collaboration with study.
  - Put pressure on government officials to put aquaculture education on the agenda and an aquaculture NQ approved.
  - Connecting education across borders and contribute to the harmonization of an NQ in North Europe.
  - Application of mobility programs between industry in Northern Europe.

- Find a common meeting ground between school and industry officials yearly, in order to ensure progress in establishing and run Aquaculture education of quality.

**BlueEDU - WP 6 VET demand**
Douglas McLeod
FEAP

# France

## Description of Industry

The main marine cage fish species farmed in France are Sea Bass and Sea Bream, totalling an aggregate 3,600 Tonnes in 2016, followed by minor volumes of Meagre (236 Tonnes) and Salmon (450 Tonnes), with novel tank-based production of Turbot (288 Tonnes) and Sole (248 Tonnes).

Total EU production of Sea Bass and Sea Bream in 2016 was some 377,000 Tonnes, indicating the limited scale of marine cage farming in France.

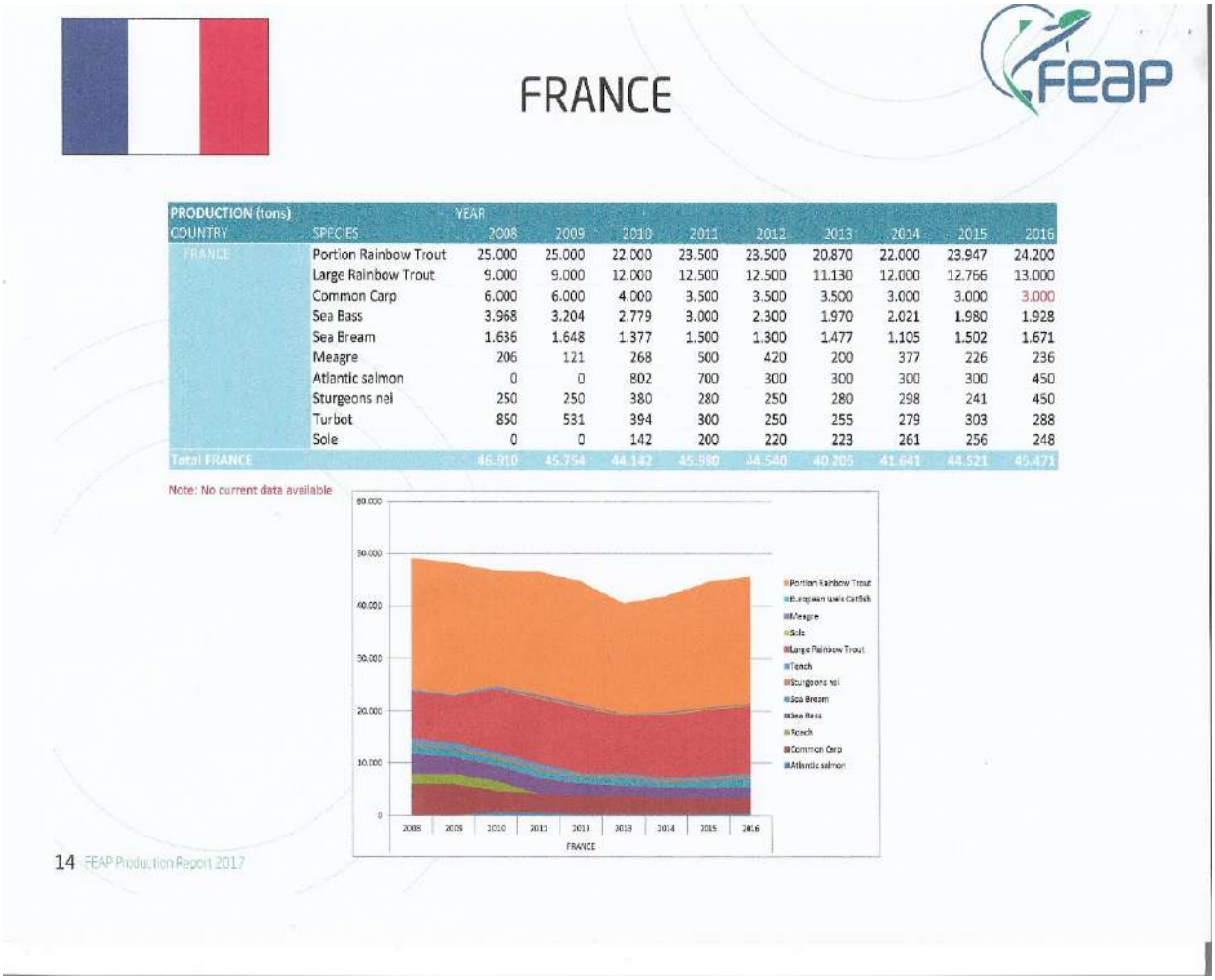
## Trends in Production

The main foci for aquaculture production in France are bivalve molluscs (oysters and mussels predominantly) and Rainbow Trout.

For marine cage farmed species, the volumes of Sea Bass have halved in recent years, from 3,968 Tonnes in 2008 to 1,980 Tonnes in 2016, while Sea Bream production has been largely stable at 1,636 Tonnes in 2008 and 1,671 Tonnes in 2016. The reduction for Sea Bass is believed to reflect the fiercely competitive market environment over the past decade for Mediterranean producers.

Reports from national associations indicate that a notable degree of supply and price stability has returned to the market in 2018, and there a indications that this may continue in future years, potentially encouraging expansion in output for smaller producers such as France.

Recent trends on production are summarized overleaf below.



FRANCE

| PRODUCTION (tons) | | YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| COUNTRY | SPECIES | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| FRANCE | Portion Rainbow Trout | 25.000 | 25.000 | 22.000 | 23.500 | 23.500 | 20.870 | 22.000 | 23.947 | 24.200 |
| | Large Rainbow Trout | 9.000 | 9.000 | 12.000 | 12.500 | 12.500 | 11.130 | 12.000 | 12.766 | 13.000 |
| | Common Carp | 6.000 | 6.000 | 4.000 | 3.500 | 3.500 | 3.500 | 3.000 | 3.000 | 3.000 |
| | Sea Bass | 3.968 | 3.204 | 2.779 | 3.000 | 2.300 | 1.970 | 2.021 | 1.980 | 1.928 |
| | Sea Bream | 1.636 | 1.648 | 1.377 | 1.500 | 1.300 | 1.477 | 1.105 | 1.502 | 1.671 |
| | Meagre | 206 | 121 | 268 | 500 | 420 | 200 | 377 | 226 | 236 |
| | Atlantic salmon | 0 | 0 | 802 | 700 | 300 | 300 | 300 | 300 | 450 |
| | Sturgeons nei | 250 | 250 | 380 | 280 | 250 | 280 | 298 | 241 | 450 |
| | Turbot | 850 | 531 | 394 | 300 | 250 | 255 | 279 | 303 | 288 |
| | Sole | 0 | 0 | 142 | 200 | 220 | 223 | 261 | 256 | 248 |
| Total FRANCE | | 46.910 | 45.754 | 44.142 | 45.980 | 44.540 | 40.205 | 41.641 | 44.521 | 45.471 |

Note: No current data available



14 FEAP Production Report 2017

## Industry representation regarding VET and skills

French aquaculture is overwhelmingly dominated by family owned SMEs, and largely in the shellfish sector – as a result, there are a high proportion of part-time and seasonal workers, although the significantly smaller scale of marine fin fish cage farming is characterised by larger corporations and full time workers.

As detailed in WP 5 for France, there is no shortage of VET providers, courses and qualifications – however, in view of the dominance of freshwater and molluscan cultivation, the main focus of all these results in few offerings for specific marine cage fish farming skills expertise.

Discussions with marine fish farmers have indicated that there is a continuing need for generic marine competences, such as boat handling and fish health and welfare, with companies content to continue to provide in-house training (usually workplace-based).

Indeed, there was some concern expressed at the high volume of 'aquaculture' training (estimated at around 1,000 places per year for aquaculture defined courses) and the number of entrants to the job market, leading to 'aquaculture trainees' departing for other industrial sectors (e.g. processors, retailers, ornamental sector, etc).

The only 'need' identified was that reflecting the potential introduction of digital/novel technologies, which at the moment rely on provision of training by the supplier companies.

Discussions with the French national trade association for aquaculture (Comité Interprofessionnel des Produits de l'Aquaculture) and the leading Sea Bass/Sea Bream producer confirmed that there were no indications of specific training qualifications or requirements from their marine fin fish members beyond novel technologies.

Life Long Learning/Ongoing vocational training, has the official aims of :

- Facilitating adaptation to changes in techniques/conditions (such as climate change, ocean acidification);
- Enhancing qualifications already achieved by the workforce;
- Encouraging social and vocational purpose.

Clearly there are requirements for such training opportunities from the marine cage farming sector in France.

### Marketing

Marine fish products are virtually all supplied to the domestic market, with significant imports (of almost all species, even mussels and oysters) from other EU MS and Third Countries (including North Africa).

The French fish market is perceived as being in a state of flux, in view of rising prices across the product range and the stagnation in the national economy, with limited growth in national income and consumer expenditure (exemplified by the 'Gilet Jaune' phenomenon).

### Staff recruitment and development policies

Recruitment is largely from local communities following generic subject training (e.g. maritime studies) at local/regional Institutes. Specific husbandry training thereafter is oat company sites on a workplace basis, with mentors and apprenticeship-style learning complemented by short courses at appropriate Institutes.

Career development generally follows in-house assessment supplemented by specific courses, including management, finance, etc, for specific candidates.

## Conclusions and Recommendations

The national framework of VET qualifications, aligned with European concepts of accreditation and delivery is well established in France, with a multitude of courses available

for aquaculture related competences. However, the availability of courses and qualifications focused on marine cage farming are remarkable limited. This reflects the marginal role of the sub-sector in the overall French aquaculture industry, both that sector of the aquaculture industry spectrum in France, and its minor role as a percentage of European production (approximately 1% in 2016).

The priority recommendation for the French VET sector regarding aquaculture is that there should be a study on the need for the inclusion of specific courses in national qualifications focused on innovative technologies (e.g. digitalisation, remote sensing), particularly in the marine cage farming sector.

There is a broader need for investigation into the constraints on marine cage farming development, which may identify that the lack of trained workers could be a leading restriction on companies' plans for expansion.

**BlueEDU WP 6 VET demand**
Pamela Ernstberger
NTNU

# Italy

## Description of industry

In Southern EU countries, and in particular in the Mediterranean Sea, Sea bass and Sea bream are the main aquaculture species. Total EU production is close to 150,000 tonnes [when?] at a value of EUR 800 million.

The main EU producers are Greece with 62% of EU production, Spain (20%) and Italy (7%). Italy and Spain are the two main Member States pioneering production of other marine finfish species. In 2016 Italy produced 6,800 tons of Sea Bass, including production in valleys and brackish lagoons (most common) and produced 7,600 tons of Sea bream (Source: API Production Report 2016, Sea bass and Sea bream).[1]

Aquaculture in Italy is based on a long tradition and history. European Sea bass and Gilthead Sea bream are the major Mediterranean marine farmed finfish species.

Traditional extensive aquaculture is still carried out in the *valli*, which are brackish lagoons - especially in the north-eastern regions. More modern aquaculture techniques for marine species include onshore intensive farms, cage systems in the sea (mariculture) and in the case of shellfish, cultivation on ropes and bags (mussels) or directly on the intertidal substrate (clams). Aquaculture is developed along all Italian coasts, with the highest density along the Adriatic coasts.

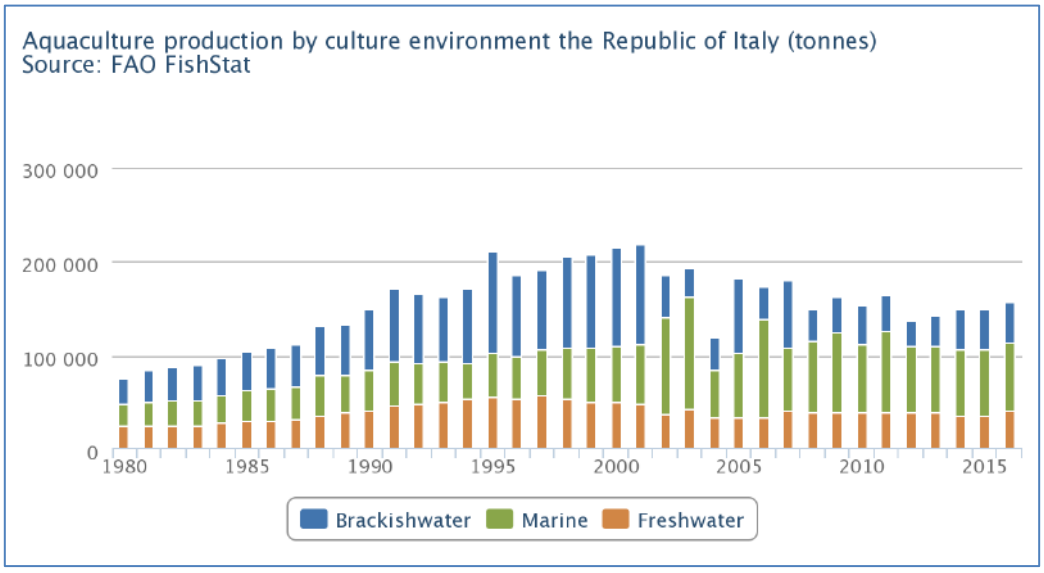



Table 1: Aquaculture Production in Italy, FAO Data[1a]

## Italian production

**Main fish farming systems used in**

The following are the types of aquaculture systems that are most utilised in the industry:

- Extensive farming of trout and carp in lagoons and ponds, enclosures and pens, recording a density of about 5 kilos per cubic meter;
- Semi-extensive farming of freshwater species in lagoons, ponds and tanks with higher level of production per cubic meter;
- Intensive farming of freshwater and marine species where the most widespread on-growing technology are cages for marine species and tanks for freshwater and salt water species;
- Shellfish culture which concerns mussels grown on-bottom and off-bottom.

At the moment the most significant production of salt water species is concentrated in few companies that have different production sites - on-growing in tanks and in cages. Usually, production of sea bream and sea bass are integrated in the same farm, with a small percentage of new species.

Sea bream and sea bass are by volume the third (36.4%) and fourth (28.15%) most farmed fish species in the EU. Looking at the total aquaculture production of sea bream in Europe and the rest of the Mediterranean in 2017 is estimated at 207,167 tons. This figure is practically similar to that of 2016. The total aquaculture production of sea bass in Europe and the rest of the Mediterranean in 2017 was 192,557 tons. This figure is 9.1% higher than them from the previous year.

Italy produced 9000 tons [in 2017 from aquaculture (a sharp decline for a combined 14,400 tons in 2016), in addition to 840 tons from fisheries and imports of 54,400 tons from its neighbouring countries, including Spain, Greece and Turkey.

The farming of sea bass and sea bream contributes significantly to wealth and job creation in Mediterranean rural and coastal areas. However, in recent years there's been a lack of growth and improvement in the Mediterranean Marine Fish Farming (MMFF) sector and as well as in the European aquaculture industry as a whole.

So, when it comes to meeting this high demand for fisheries products in Italy, there is a need to develop the aquaculture production sector and increase the number of qualified, trained workers for the industry. Some of the solutions to meet that need, is to create opportunities for further education and training at the 'local' level, which are discussed below.

Italian fish production and trade flows are summarised in the table below, data available for 2015:

| Italy : Fish production and trade: |
|---|
| Capture: **191,700 tonnes live weight (2015)** |
| Aquaculture: **149,000 tonnes live weight (2015)** |
| Export value: **€744 million (2015)** |
| Import value: **€5,034 billion (2015)** |

Table 1: Eurostat Data, FAO

The farming industry specialises in sea bream and sea bass, for cage sea farming.

| **Name:** | **Presentation:** | **Commercial size**: |
|---|---|---|
| gilt-head sea bream (*Sparus aurata*) | quite exclusively whole fish, ungutted, fresh or chilled. Fresh fillets and frozen fillets marginal (fillet yield: 25%). | 200 - 800 g (mostly), but some farms offer individuals up to 1,5 kg. |
| sea bass (*Dicentrarchus labrax)* | Fresh whole or in fillets. | Wild: between 25 cm and 70 cm.<br>Farmed**:** Portion-size (<400 gr.) or larger fish (between 800 gr. and 1 kg). |

Table 2: The Italian industry specializes in sea bream and sea bass [2]

**Biological parameters:**

| | |
|---|---|
| **Temperature** | **22 - 26°C** |
| **Habitat** | Saltwater |
| **Diseases in farming** | Vibrio sp, Pseudomonas sp, Pasteurella spp, Trichodina; Cryptocaryon spp |
| **Maturation** | After 13 months |
| **Diet in the wild** | Carnivorous |
| **Diet in farming** | Juvenile phase: live feed Grow-out: fish feed (50% of marine origin, hereof 35% fishmeal) |
| **Juvenile phase** | 140 days |
| **Grow-out** | 14-16 months |
| **Distribution in the wild** | Mediterranean, Black Sea, North Eastern Atlantic |
| **Farming** | Greece, Turkey, Italy, Spain, France, Malta, Croatia, Cyprus, North Africa, Egypt, Israel |
| **Farming systems** | Ponds/lagoons, tanks, cages, offshore systems |
| **Temperature** | 22 - 26°C |
| **Habitat** | Saltwater |
| **Diseases in farming** | Vibrio sp, Pseudomonas sp, Pasteurella spp, Trichodina; Cryptocaryon spp |
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| **Farming systems** | Ponds/lagoons, tanks, cages, offshore systems |

Table 3: Biological parameters for optimal growing conditions for sea bream and sea bass[2]

Although sea bass can be farmed in seawater ponds and lagoons, the bulk of production comes from sea cage farming. The cages are usually made of steel with areas of 4 to over 10 m², having nets suspended below the walkways up to 6-8 m deep. Some farms are anchored close to the land and can be served from a landing. Others are located in the open sea or in the middle of a protected bay and can only be served by boat.

Juveniles are produced in hatcheries and sold to farmers as on growing stock at a size of 1,5-2,5 g. The on growing juveniles reach 400-450 g in 18-24 months. Fattening can occur in tanks or in cages system.

**Production Cycle:**

Figure 1 – Production cycle of seabream/seabass

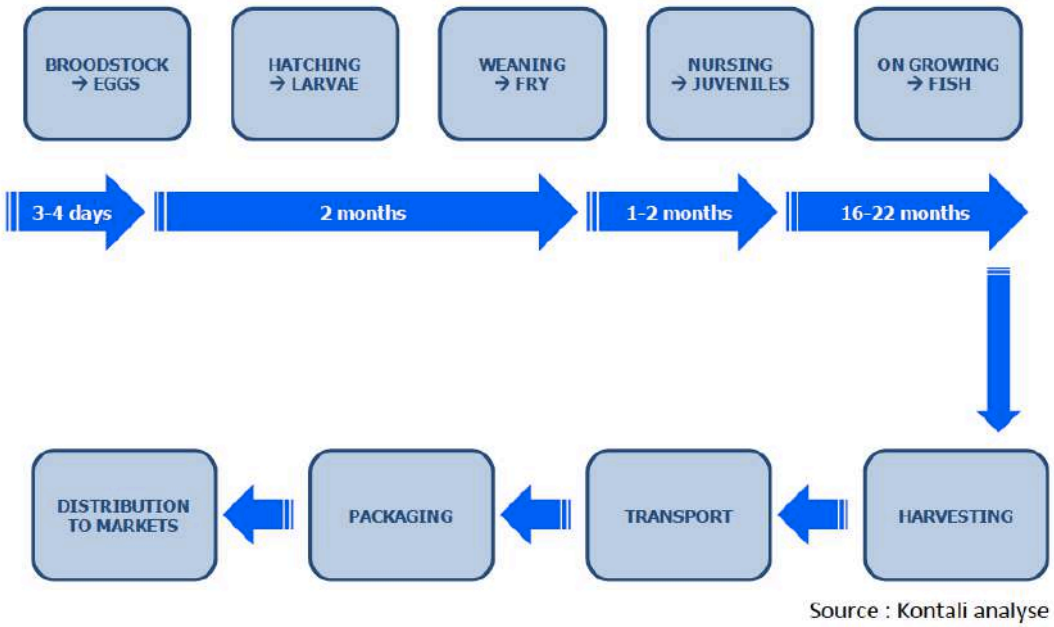


Fig 2: Illustrates lifecycle and production cycle of sea bream and sea bass.[2]

## Organisations and Associations:

INAPP, Association with the Ministry of Labour and Social Policies and the Ministry of Education, is the main instrument for the monitor of VET or IeFP activities

API Associazione Piscicoltori Italiani The Italian Fish Farmer Association, main organisation representing aquaculture producers

FEAP Federation of European Aquaculture Producers, represents the European aquaculture production industry in Europe

Fisheries Local Action Groups-GAC in Autonomous Community (Veneto, Emilia-Romagna and Sardegna[2] regions), which have been the main focus for this report. In total, there are 43 FLAGs in Italy.

FLAG's strategy focuses on modernising the local fishing community, increasing employment and improving the added value and the quality of fish production and fish products. Main actions include training activities for fishermen, increasing profitability, creating new jobs, diversifying fishing activities, and promoting interregional and transnational cooperation.

**Themes:** Labelling, Processing, Promotion, Short circuits, Pesca-tourism, Fisheries resources, Education and training (see for the different FLAG programmes in Education and Training in Europe)

### Locations of Aquaculture Production:

At the moment the most significant production of salt water species is concentrated in a few companies that have different production sites - on-growing in tanks and in cages.

Usually, production of sea bream and sea bass are integrated in the same farm, with a small percentage of new species. There are more than 300 fish breeding companies in Italy. This is composed mainly of small family owned businesses or corporate operations that are run on a smaller scale with a limited number of staff.

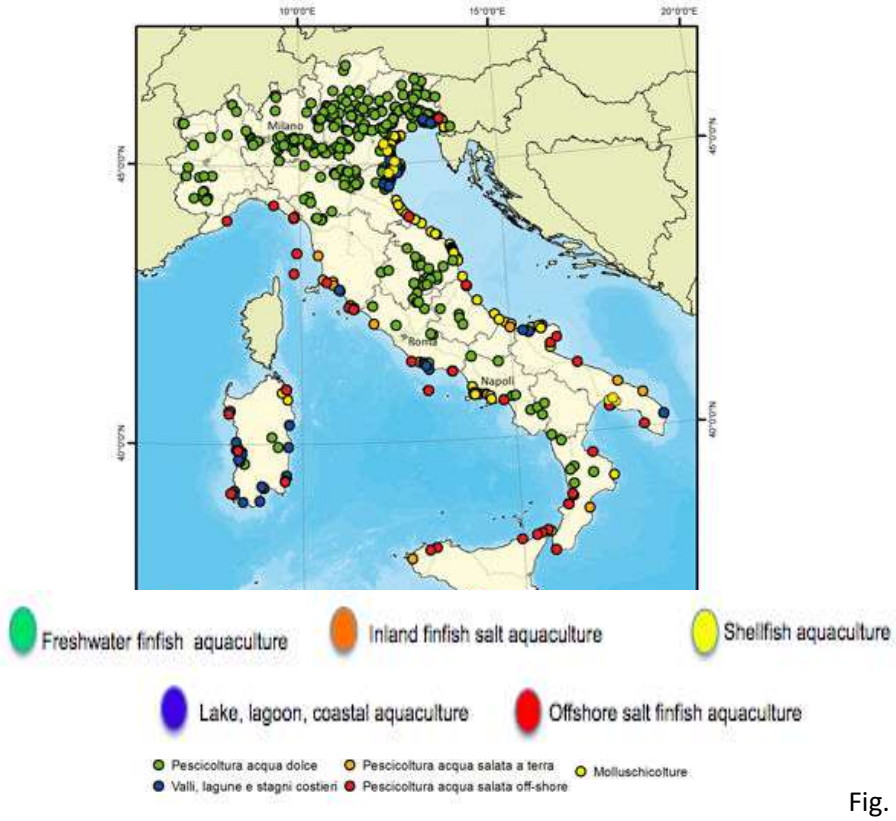


Fig. 3 Locations in Italy aquaculture production[1b]

## Industry and VET Needs

*'Knowledge is based on tradition which is passed down'*

Although the industry has been growing steadily in Italy at the national level, companies still rely on the recruitment of local, including unqualified entrants in particular and more for seasonal basis. It's therefore difficult for work-based learners, as they are at a disadvantage when it comes to accessing aquaculture VET qualifications; work based NQ pathways simply do not exist. However, more recently,

alternative options have been put in place especially in regions where there's a need for developing the sector and stimulating the local economy through the involvement of EU initiatives tapped into by regional focused groups and supporting organization, targeting in particular individuals who have been unemployed for more than six months, need some sort of incentive through training and providing the industry with better prepared workers. The EMFF, for example, providing fund for the EU's maritime and fisheries policies for 2014-2020 and is one of the five European Structural and Investment (ESI) Funds which complement each other and seek to promote a growth and job creation in Europe. The fund aims to:

- Help fishermen in the transition to sustainable fishing
- Support coastal communities in diversifying their economies
- Finance projects that create new jobs and improve quality of life along European coasts
- Support sustainable aquaculture developments
- Make it easier for applicants to access financing.

### School engagement

Similar to Spain, Local action groups such as FLAG or GAC, as known in Italy, are actively involved in creating avenues for schools to be involved in activities that promote youth engagement in the sector. Currently GAC in Veneto region has invested a lot of interest and drive for the new pre-VET in 'Commercial Fisheries and Fish Production' course in Porto Tolle.

There are many smaller organisations that have been set up in response to more recent environmental concerns expressed through social media and highlighting the need for more awareness in particular how food is produced from the oceans and what practices should be better regulated and monitored in respect to sustainable goals. Italy is a country that has a lot of focus on this.

ESF (European Social Fund) since its development has allowed the financing of training activities both planned and implemented at regional level with the support of social partners. These include many small projects that have been led by local action groups to create more awareness and need for education and training, at the school level.

## The investigative process is Italy

### Overview and evaluation of investigative methods and processes

Information was gathered from organisations and associations related to the industry as well as a former fish farm business owner. Companies were contacted, but unfortunately no communication was established.

### Quantitative survey results

No results obtained

## Qualitative survey results

The Employment in the fisheries sector report: *current* situation (FISH/2008/4) [3] from 2008, served as a good reference guide to transferable skills applied to the wider sector that includes the fish farming industry. Although not specifying cage farming, it does include the applicable skill training-option. The skill based training operations focus on the ability of a person to perform particular skilled tasks and the practical application of knowledge in a range of variable operational situations. Competency is determined when the fisherman or fish farm worker can prove his ability to perform a predetermined range of skills or functions to an agreed standard.

General Comments from an interview with a former fish farm business owner indicated that most fish farmers in general train their staff on their own farms. When workers enter the company, they generally do not have a background in aquaculture or its practices. There are no standard occupational standards in place.

Normally they train them for 1 year, then have to take a decision of keeping them or not, a decision dependent on their productivity and general attitude towards the job. In other words, observing their competence in work-related tasks. If they train them for a second year, or if the worker leaves the farm after 1 year, the fish farmer loses money, so they are very selective. The number of long-term serving staff is generally very low, with the cycle of seasonal staff being significantly higher.

It has been a challenge to engage companies in this study. For a start, reaching out to companies with no direct contact or lead was ineffective. Therefore, information from industry was limited.

However, it is evident from the two programmes implemented: ForMare and 2Fish, that in order to develop these programmes a skills needs analysis, involving local enterprises, was crucial. The needs analysis, involving more than 40 enterprises, for example for the 2Fish project, consisted of a questionnaire covering seven areas:

Area 1: Running a business

Area 2: Leadership, networking and marketing

Area 3: Work environment and safety

Area 4: IT skills

Area 5: Product development

Area 6: Product quality

Area 7: Fishing tourism and boat carpentry

Thereby, establishing a broad need for education and training in all areas

## 4.0 Occupational Standards

| Work title : Fishery and aquaculture operator | | |
|---|---|---|
| JOB DESCRIPTION | | |
| The fisheries and aquaculture operator is able to capture and withdraw the fish resource in the respect for the principles of environmental sustainability ; to breed species for human consumption ; using specific equipment and tools and intervening in the management of the boat handling according to current legislation. | | |
| PROFESSIONAL AREA | | |
| Maritime transport, commercial fishing and aquaculture | | |
| EQF Level | | |
| Level 3 | | |
| CONNECTED WORKER PROFILES | | |
| Reference system | Name | |
| NUP | 6.4.5.1 Fish farmers and similar<br>6.4.5.2 Fishermen of coastal fishing and inland waters<br>6.4.5.3 Deep-sea fishermen<br>7.3.1.1 Workers employed in fixed installations in aquaculture breeding<br>7.4.5.1 Deck crews | |
| ISFOL professions directory | Agri-food<br>- Fish processing worker<br>- Pescator | |
| UNIT OF COMPETENCE | OBJECTIVES | KNOWLEDGE |
| 2. Aquaculture and breeding | apply basic and routine maintenance techniques related to the various breeding environments (open sea, pools, basins, valleys, etc.) | • methods and techniques for preparation of tools and equipment |
| | apply techniques for the periodic cleaning and disinfection of the installations, in order to avoid the | • principles, mechanisms and parameters of |

| | | |
|---|---|---|
| | contamination of the various breeding environments | operation of the machines and the fishing equipment |
| | | |

Aquaculture still lacks a level of specific research, strategies, laws, and public policies to boost the sector with regard to occupational standards in some countries. It has been a challenge to find if these exist in aquaculture in countries where aquaculture development is at a slow pace, or even' stagnant'; the response from some organisations and company staff, is that they are satisfied with the standards, or competences which are aligned to VET programmes that have been introduced via 'formal' or 'external' entities. As these are formulated with direct input from the industry and enterprises, associated with the sector.

The 2Fish project compiled a list of competences in collaboration with the industry and stakeholders in producing the modules for the training.

| EXPECTED OUTCOMES |
|---|
| Aquatic species raised according to quality, sanitation and environmental protection standards |

| UNIT OF Competence | OBJECTIVES | KNOWLEDGE |
|---|---|---|
| 2. Aquaculture and breeding | identify specific treatment, feed management and sanitation of fish species in relation to their biological needs | • basic maintenance techniques and use of specific tools, equipment and machinery<br>• maritime navigation techniques |
| | use data collection techniques for the monitoring and control of health status of bred fish species | |

References for the development, evaluation, formalization and certification of skills

| COMPETENCE UNITS<br>2. Aquaculture and breeding | | |
|---|---|---|
| INDICATORS | SKILLS | KNOWLEDGE |
| • management and maintenance (cleaning and hygiene) of breeding areas<br>• care of aquatic organisms (hygiene, nutrition)<br>• health check | • apply basic maintenance techniques specific to the various breeding environments (sea open, tanks, basins, valleys, etc.)<br>• apply cleaning techniques e periodic disinfection of installations in order to avoid contamination of the various breeding environments<br>• identify the specific needs of food and sanitary treatment of fish species in relation to their characteristics<br>• use detection techniques data for monitoring and control of the state of health of the species fish breeds | • legislation on professional fishing and aquaculture<br>• principles, mechanisms and parameters of operation of the machines and the fishing and maintenance equipment of fish farms<br>• methods and techniques of preparation of tools and equipment<br>• fishing techniques and tools e aquaculture<br>• breeding techniques, reproduction and well-being of aquatic organisms<br>• types of feeding for the aquatic species during breeding<br>• characteristics of the various types of environments and techniques for aquaculture<br>• environmental protection, management and safeguard legislation<br>• common principles and applicative aspects of the current legislation on security<br>• safety at work: professional conduct, general and specific (safety and health of boarded workers) |

Table 4: There are four units of Competence for the Fishery and Aquaculture Operator for the 2Fish project. The table shows Unit 2 for Aquaculture at EQF Level 3.[4b]

## Industry roles within future VET development

Although, there is currently no formal VET in place in Italy leading to NQ, current VET that exists are implemented through initiatives by private and public organisations that have been mentioned in 1.2 and those mentioned above in section 4.0. These initiatives have been brought about with close collaboration, and support from the industry, and interested stakeholders from both pubic and private sectors.

FLAG[3c,3d] is predominant in these initiatives as aquaculture producers are present in many FLAG areas, both coastal and inland, and a number of FLAGs are already working with the sector. Strengthening linkages between aquaculture and its area, improving its acceptability by the society and addressing consumer concerns are amongst key aspects where FLAGs can make a contribution. They can also help develop synergies between aquaculture and other blue growth sectors (fisheries, processing, catering/restaurant industry, tourism, biotechnology etc.), facilitate ecosystem services provided by aquaculture as well as help address environmental and climate-change related concerns.

These linkages have led to development of projects focusing on education and training, otherwise VET, which addresses some of these concerns and needs of the aquaculture sector. These include programmes such as, the 2Fish project. The products of the project lead to the regional qualification at EQF level 3 implemented together with the Regional institutions to start the paths for young people (IeFP) in Emilia-Romagna region. These institutions are mentioned below:

**Cooperativa MARE**[5]

MARE, a cooperative was founded in 1995 on the initiative of a group of biologists, sharing a strong interest in the sea and a close link with fishermen, who had detected a job opportunity in the evolving fishing industry in technology and science fields. MARE is a research centre for technology innovation in fishery and aquaculture, and a service centre linked to government institutions, the cooperative world and public research institutes. MARE carries out training activities in their fields of investigation through:

- Organisation of courses, seminars and conferences
- Teaching and educational supervision
- Planning assistance
- Planning and implementation of informative and educational materials

**LEGACOOP AGROALIMENTARE - DIPARTIMENTO PESCA**[5a]

The Legacoop Fishing Department associates 300 cooperatives and 95 companies, for a turnover of 300 million (25% of the Italian GDP)Euros. The boats managed by Legacoop are over 3,100 (25% of the total Italian boats). The members are 8,600 (27% of Italian employees in fishing and aquaculture).

### Future VET needs

Up until now most of the 'knowledge is passed down' in a workplace environment.

ForMare[4a], is predominant in the southern part of the country, in Sardinia, where a lot of the fishing and aquaculture production takes place, as well as where higher unemployment rates exist. The 2Fish[4b] project was developed in more northern regions of Emilia-Romagna.

The '2Fish' Project was a training course was aimed at the service professions in the field of fisheries and aquaculture sector (directors and officers of fishing cooperatives, employees, managers, engineers and biologists, etc.). The program was put into effect in October 2013 at the Lavoratori del Mare Cooperative in Rimini.

What would benefit the industry, and those interested in developing education and training standards for their company, is to provide more avenues for them to express this need and listen to the challenges as well as solutions to these problems shared by others in similar positions.

At the regional level, these needs seem to be addressed by programmes that have already been implemented. These also rely on funding sources, a large portion from European Social Funds. Sustainable solutions need to be considered that don't rely on a continuous supply of funding from Europe and in turn, develop an effective cycle of VET that can be accessed by a wider population to have a better prepared workforce.

## Challenges facing the industry:

Overall, the industry suffers the same challenges with other sectors: company recruitment forecasts are focused on low qualified professionals. In fact, high-skilled occupation training takes place primarily for the demands of the work rather than for reasons of professional development and almost always during regular working hours.

Low-level qualification holders have less access to qualified jobs, and are also less likely to receive adequate training and improve their careers.

In Italy, the main aim for aquaculture is to promote environmentally sustainable aquaculture development, with a focus on organic production and the competitiveness and profitability of aquaculture enterprises through supporting product innovation and processes, as well as the creation of a hatcheries consortium.

Low levels of domestic aquaculture internationalization, limited diversification of domestic aquaculture products and activities and a lack of financial incentives for new investments are currently some of the main challenges.

One of the limiting factors regarding the growth of aquaculture training in some areas could be due to the mismanagement and the direction of people who are in top leading positions. Reduced technical and management capacities, regardless of any good intentions, may have prevented them from channelling the necessary financial and human resources to trigger the growth of aquaculture training in the cage farming sector and its development in their respective regions. This may have led to a greater focus in other types of aquaculture that bring more immediate attention to meeting the perception of sustainable aquaculture development goals.

In general, in Italy there is a wide mismatch between skills' supply and demand, as well as a risk of unemployment for high-skilled young people and a growing ageing of the workforce, which will in the coming years lead to an increasing deterioration of skills for low-skilled individuals, unless more effective and sustainable solutions are put into effect.

### National level initiatives

In communication with API, they perceive a need for collaboration at both the national and European levels with the different, supporting institutions including individual associations and companies for a continuous and constructive exchange.

Local action groups like FLAG in Sardegna[3a] and in Veneto[3b] region have been very active in promoting the need for introducing new projects and study programs focused on education and training in these prominent regions. This is an outcome of attempts to mitigate current high unemployment plus, create opportunities for the sector to rely on a better-informed and prepared local workforce.


Fig 4. Types of aquaculture in FLAG areas[3d]

Currently there is very little turnover in the renewal of workers and a lot of the knowledge and skills 'training' is through skills passed down the generations at the workplace.

This is a problem especially as many young people are leaving the regions to look for more economical solutions in other parts of Italy and farther afield, where they can find work and better living conditions.

The sector is particularly attentive to the training of operators as they enter the world of work but also as continuing education. Some of the issues regarding training are need for more focus on areas that are in need for development:

- Environmental and socio-economic sustainability of aquaculture activities
- Technological innovation in aquaculture in the many different production systems

- Technological and product innovation, traceability, food safety, quality and nutritional value
- Marketing related to new styles of consumption, to institutional / social catering (schools, hospitals, residences for the elderly)
- Worker safety
- Animal welfare and health (including biosafety, prevention and reduction of antibiotic resistance)
- Attention to new forms of aquaculture: Integrated Multi Trophic Aquaculture, algae farming, etc. but also to the more traditional ones: *vallicoltura* (fish farms in lagoons), production for sport fishing and restocking.

As a baseline, it is fundamental that there is a need to develop an integrated, more flexible approach to the whole fish-farming sector along with an openness to collaborate with very different professionals, entrepreneurs and training providers.

API's role in training is a priority; believes a lot in the collaboration at all national and European levels with the different institutions, but also between associations for a continuous and constructive exchange.

FLAG groups around the country are keeping an eye on the developments of the new school pre-VET program at Porto Tolle, as it will be a role model, if successful, for implementing similar secondary school VET options across the country.

### European level opportunities

There are many opportunities for future collaborative 'Erasmus+' innovative VET development activities. This could support the efforts of previous or current projects, that could create a more sustainable delivery of education and training in the sector. However, this should not be limited to cage fish farming in Italy, as the industry overall is relatively small and needs support at every level.

Discussing 'what works' and 'what doesn't' saves a lot of time and money and using examples of what's been tried and tested in other countries as well as providing more effective innovative solutions, could pave the way forward to providing more sustainable solutions, firstly at the local level and ultimately at the wider national economic scale.

Working with other countries that have more experience, would allow the exchange of knowledge and skills. The establishment of some form of 'standard' for particular skills and expertise, be it through a European occupational standard or an alternative mechanism, would create more transparency and better practices that workers can achieve. Providing training and certification would also create incentives that will boost work attitudes, performance and staff mobility – and economic performance for the companies.

API[6] has participated in projects promoted by Erasmus +, while FLAG groups rely on European funding to create programs for education and training. However, such reliance on limited external funding sources is not sustainable in the long term, and what is needed are programs that create interest in

people in the sector, and generate a better prepared workforce with long-term goals in driving the industry forward. This would be more efficient, increasing productivity in the broader sense.

In conclusion, there is no qualification (NQ) or 'school' based established VET aquaculture programme in Italy . In recent report from CEDEFOP, a qualification in 'sea and fresh water operator' was identified, but information was hard to find on the location of any current provider.

There seems to be regional opportunities based on economic need: reducing youth unemployment, supporting SMEs and expanding the local pool of skilled workers, such as initiatives driven by ForMare and 2Fish projects.

These regional efforts in Italy support the objectives of the new EU Common Fishery Policy, specifically:

- Promote the competitiveness of the aquaculture sector
- Support its development and innovation -
- Ensure equal and fair conditions to the aquaculture companies

The efforts towards supporting the objectives of '*Fostering growth in Blue Economy'*, include a recognised and accredited VET system. It is hoped with new developments taking place in the school in Porto Tolle will lead the way to the development and introduction of innovative VET programs throughout Italy.

Recognition of the need for industry to develop and grow to satisfy a higher proportion of national demand will support initiatives in the realm of VET. However, meeting that need has so far been realized at 'local' level – the requirement for a substantive national level initiative is clear, preferably driven by industry.

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[4a]ForMare https://www.progettoformare.it/progetto/

[4b]2FishProject Outline and competences http://formazionelavoro.regione.emilia-romagna.it/qualifiche/schede/trasporto-marittimo-pesca-acquacoltura/operatore-pesca-acquacoltura

[5]MARE http://www.coopmare.com

[5b]LegaCoop https://www.dipartimentopesca.it

[6]Associazione Piscicoltori Italiani (API) communication by email and telephone http://www.api-online.it/index.cfm/en/home/

# Spain

**BlueEDU WP 6 VET demand Spain**
Pamela Ernstberger
NTNU

## 1 Description of industry

Spain, with a coastline of almost 8,000 km, is home to the biggest fishing industry in the EU. The majority of fisheries activities are carried out in the coastal regions of Spain. The country benefits from entry points into both the Atlantic Ocean and the Mediterranean Sea, and offers good conditions for marine and freshwater aquaculture. Because of its geography and different aquatic environments it supports, there is a wide range of aquaculture systems that exist. The aquaculture systems are designed and built to meet the needs of the species produced and adapted to suit the conditions of the physical environment. [7]

Aquaculture in Spain has a significant role in the economic and social development in certain regional areas. The aquaculture harvest in Spain in 2016 contributed a total of 283,831 tons. This production reached a value of 449.4 million euros. The main species produced is the mussel (215,855 t), which dominates the EU shellfish sector; producing 50% of the EU farmed mussel production. This is followed by sea bass (23,445 t), rainbow trout (17,732 t) and sea bream (13,740 t). For 2017 the figures of aquaculture harvest in Spain reached a total of 345,635 tons and value of 452.6 million euros. This production consisted of mussel (273,517 t), sea bass (21,269 t), rainbow trout (17,948 t) and gilthead sea bream (13,643 t) as the main species.

In 2016 there were a total of 5,105 production systems in operation, in Spain. Out of these, only 41 (MAPA) are for cage fish farming production. These cage fish farms produce mostly sea bream and sea bass. In 2015, there were 96 farms producing sea bass and sea bream, so notably, the number has gone down. As a comparison, over 4800 mussel farms are in production. The main technique for shellfish farming is with ropes hanging below rafts deployed in sheltered areas (mussel rafts or *rias* of Galicia). [4]

During recent years, the aquaculture industry has invested in diversification in new species, focusing on high added-valued species. Meagre, tuna, and yellowtail are considered to be potential species of interest in the Spanish aquaculture sector going forward.

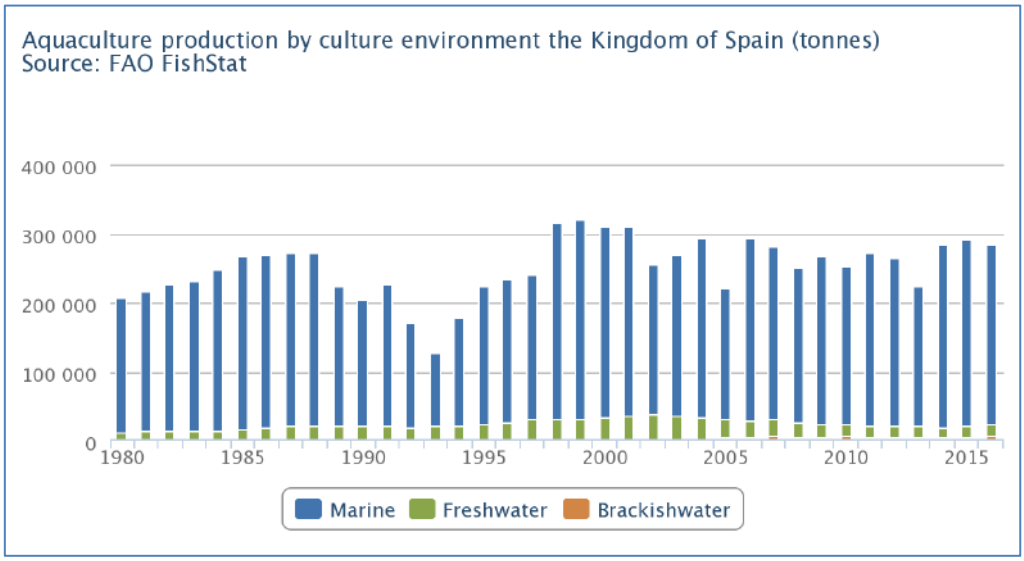


Table 1: FAO Data Aquaculture production in Spain[1]

1.1 Fish production

Sea bass (*Dicentrarchus labrax)* and sea bream (*Sparus aurata)* are the main species in the Spanish aquaculture in terms of value. The industry also specialises in: turbot (*Psetta maxima* ), European eel (*Anguilla anguilla* ), blackspot sea bream (*Pagellus bogaraveo*), meagre (*Argyrosomus regius* ), common sole (*Solea vulgaris*) and tilapia. Other species that are on R&D are the red sea bream or snapper, the common sea bream (*Pagrus pagrus*), red mullet (*Mullus* spp.), octopus (*Octopus vulgaris*) and other marine finfish farmed in cages, the Atlantic Bluefin tuna are fattened in cages, which with a production of 3,000 tonnes annually, employing 169 people with higher qualifications than in other subsectors and a higher retention of employees during the year. [2]

Locations of Production


Fig. 1 Locations of Production of aquaculture species[6]

Overall, the cage fish-farming sector is Spain is relatively small in comparison to other northern European countries, in terms of production and fish farm sites. In Galicia, where visits took place, the region produces the highest volume of mussel, approximately 60% of the total production in Spain. The reason for this is attributed to the temperature variations: most common fish species grown in cages in Spain are sea bream and sea bass. Although, the only company there, Isidro de la Cal produces sea bream, it grows a lot slower, compared to more southern parts of the country and neighbouring countries. This is due to lower sea temperatures. The growth rate is not determined by feed type. The company is looking into producing other fish species and currently investigating the growth rates of grouper *sp*. as well as focusing on producing added-value products, like sushi with their sea bream.

Throughout the coastal communities in Spain, production is limited to the cultivation of a few species. In regions such as, Andalucía, Galicia and Cataluña they have made more progress through R&D to further diversify their production. [7]

## 1.2 Industry representation regarding VET and Skills

The aquaculture industry needs highly trained and skilled personnel with specific, though varying, skill sets, some of which can be obtained only in the workplace. The industry is in favour of the current VET programs that exist at the regional level. Organisations such as the Ministry of Agriculture, Fisheries and Marine Aquaculture (MAPA- *Ministerio de Agricultura, Pesca y Alimentación*) work together with the Ministry of Education and Vocational Training (*Ministerio de Educación y Formación Profesional*), to develop and promote these. This is a collaborative effort, at autonomous regional level, recognising the need of the sector, including the wider fish farming industry and the region's economic needs.

1.2.1 Association and organisations representing the industry

Various professional associations and cooperatives represent Spanish aquaculture sector.

- SEA- *Asociación Española de Acuicultura* -Spanish Aquaculture Association
- *APROMAR Asociación de Productores de Cultivos Marinos* APROMAR- Association of Marine Cultivation Producers
- OPAC- Association of Inland Aquaculture Producers.
- OPMEGA- *Organización de Productores de Mejillón de Galicia*- Galician Organisation of Mussel Producers
- AROGA- *Asociación de Productores de Rodaballo Gallego* Galician Association of Flatfish Producers
- *Organización Nacional de Productores de Ostra y Almeja*- National Organisation of Oyster and Clams Producers
- *Organización Interprofesional de Acuicultura Continental Española* AQUAPISCIS- Spanish Interprofessional Organization of Inland Aquaculture

Only APROMAR and OPAC above, belong to the Federation of European Aquaculture Producers (FEAP).

The Ministry of Agriculture, Fisheries and Marine Aquaculture (MAPA), is responsible for the development and promotion of aquaculture in Spain. Its main tasks are to promote consumption of fisheries products and to provide technical or financial assistance to associations, cooperatives and enterprises within the sector.[4]

Aquaculture Marine Experimentation Network (Rema) for aquaculture development in the country established in 2015 and made up of a few companies. The aim of the organization is to provide solutions for scientific and technological challenges of the Spanish aquaculture industry.

APROMAR[2] represents all farming companies producing animal or plant species through mariculture in Spain. APROMAR's members produce finfish, shellfish and crustaceans, as well as algae. APROMAR as the main association of producers in Spain, is interested in the improvement of the sector and staff. It recognises the importance to professionalize the sector through the professional training to qualify their needed skills adequately. APROMAR works closely with the industry and interested stakeholders to identify the needs in the skills and training. More recently, APROMAR led a consortium in developing a new training programme called HealthyFish[10], a Standardized Training Program at European level for the aquaculture sector, which includes the training modules for the qualification of the professionals. It also includes the training content required to train the staff in Health and Welfare skills and on the Physical-Chemical Control of fish. APROMAR has also developed new short courses provided online already mentioned (see 3.5).

1.3 Staff recruitment

Despite the demand for graduated professionals to occupy different posts in aquaculture businesses, there are no university *degrees* in Aquaculture in Spain. One of the reasons is that Aquaculture is still

not officially recognised as a knowledge-based discipline within academic and university cycles. Those individuals, who have acquired the necessary or required knowledge to fulfil posts, are generally graduates in Biological Sciences, Veterinary or Engineering, who have studied general courses on zoology or animal production. Degrees in Marine Sciences have been created in the last years, and some aquaculture courses are taught as part of their curricula. However, many universities offer specialisation, or *Master* courses related to aquaculture focusing more on research.

Although staff recruitment does not require any type of formal education or certification, most companies prefer workers with relevant experience and good understanding of the industry and that preferably, show high levels of autonomy and responsibility. At present, there are Professional Certification schemes that recognise work-competence learning. This can be obtained when candidates successfully complete a written exam that assesses their prior knowledge, as well as passing a section of practical assessment. Candidates must first go through an online registration system found in the Public Services of Employment (SEPE)[11] that allows workers to insert their information that checks if they have any previous formal learning, *or* work experience that meets the competencies that are aligned to the current VET in aquaculture studies program. See appendix

Within non-regulated training, there are courses offered for Continuous Professional Development (CPD). Some of them are organised and taught by the autonomous government administration and others by different entities (unions, trade associations, producers' organisations, such as APROMAR and company themselves, etc.).

The statistics prepared annually by the Ministry of Agriculture and Fisheries, Food and Environment (MAPA) indicate that the number of people working in aquaculture in Spain in 2016 was 6,534, although this figure was distributed between 17,811 people. Most of these, 10,359, were self-employed, mainly from the mussel industry. The small family run businesses, with less than 5 employees, dominate the Spanish aquaculture sector with the 74% of the total.

It was followed by 3,512 unskilled workers, 2,972 workers under the category of 'specialized operators, 688 senior technicians or mid-level graduates, 217 administrative and 64 people with other professional categories.[8]

The evolution of employment in aquaculture in Spain shows over the years a decreasing trend in regarding the number of people employed.

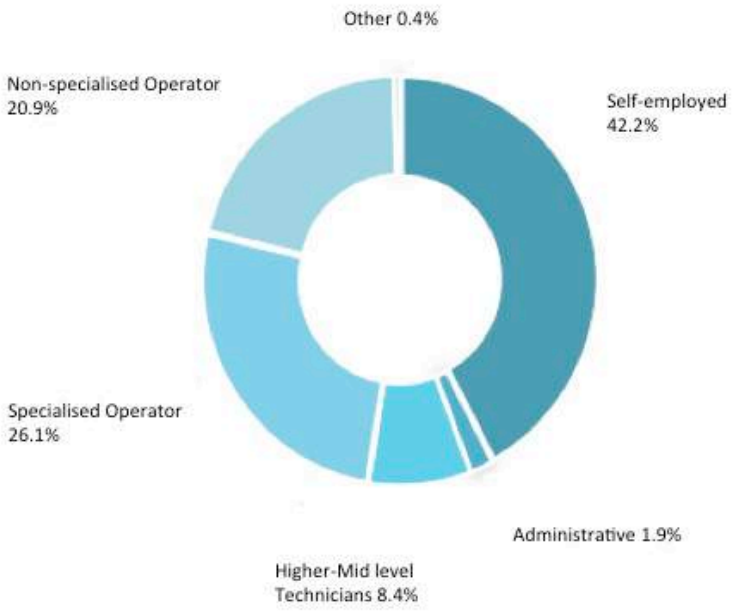


Fig. 2 Distribution of Employment in aquaculture in Spain (MAPAMA, 2016)[4]

Nowadays, there are less employees but a higher proportion of employees, have a higher-level qualification, including Higher VET qualifications. This change in the work force structure is driven by the changes in the industry 's development, where more and more, extensively and semi-intensively aquaculture activities are substituted by intensive productions that requires more qualified and skilled workers and sometimes, depending on the production cycles, only required on a seasonal basis. These skilled workers are working under better and more advanced technological conditions.

In 2018, The Public Employment Services registered a total of 580 contracts during the last twelve months of the year, compared to a total of 219 people seeking employment with the Higher Aquaculture Technician qualification.[8]

In November 2018, the figures recorded were 55 contracts to 41 people, of which: 52 contracts were temporary; 28 contracts full-time.

### 1.3.3 School engagement

Fisheries Local Action Groups, FLAG or *GAC* (*Grupos de Acción Costeira*)[12] are very active in coastal regions. It is FLAG that creates opportunities for school engagement in collaboration with the wider fisheries and aquaculture sector in close association with institutions that provide VET in the area. The efforts are to create more interest and awareness of the industry as well as opportunities that exist to younger generations. There is great concern that many more traditional or artisanal practices may be lost due to young people moving away from areas. Many choose to follow other career interests especially if there's very little incentive to keep them in coastal zone, where opportunities may be more limiting and unemployment levels high.

## 2 The investigative process

2.1 Overview and evaluation of investigative methods and processes

Information was gathered from a company visit to, Isidro de la Cal, which is the only company that produces fish in sea cages (mainly sea bream *sp*) in Galicia. In Spain there are very good research aquaculture groups, mostly based at Universities. The Institute of Oceanography (IEO) in Vigo was also visited, as they are currently doing some research and development with the industry, including the main company in the region, Isidro de la Cal and using facilities also based at IGAFA to introduce new species for sea cage farming.

Contact was made with partners involved in the new HealthyFish[10] project, which was released online in 2017 and led by APROMAR. Direct contact with APROMAR, provided a list of all current companies in production in all of Spain and organisations interested in investing in Spain's aquaculture development goals, such as Innovation Norway[6].

By contacting the various stakeholders, a network of individuals was established and communication followed up via email, Skype and phone calls. This seemed to be effective on the onset, but also required time as feedback coincided with holidays, work scheduling and limited availability by the direct contacts that could provide more accurate information.

2.2 Quantitative survey results

No feedback obtained from survey questions.

Other surveys:
Spain has two surveys directed to the aquaculture sector. In 1999 the Activity Survey started in order to get information about the activity of the aquaculture establishments, especially the species production with all the different techniques and the employment of the sector. This survey contains economic information and has been collected since 2008.

Data obtained for the aquaculture sector is published once a year in Fisheries Statistics in Ministry of Agriculture, Food and Environment`s website.[4]

2.3 Qualitative survey results

A wealth of qualitative information was obtained directly from contacts through the extended network, which included people from companies and organizations, visits and meetings held. This gave not only a 'regional' view, but also a better understanding of where the cage fish-farming sector stands today.

Overall, there is a lot of relevant information that can be obtained from the different stakeholders. Most of the communication was done via emails and social networks: LinkedIn proved to be very effective as it is easier to source a company and organization and then get more direct contacts. Through communications, a network of contacts was established, and these were followed up with direct 'messaging' via LinkedIn and Facebook.

The limiting factor to obtaining additional and more accurate information was the timing. At the start of this investigation, sending surveys sent out coincided with national summer holidays. This caused a lot of delay in getting feedback in a timely manner. In fact, no feedback was ever received!

Planning meetings and visits was difficult to organize as this requires planning well ahead of time, to allow for some flexibility in scheduling that is convenient for all.

# 3 Industry opinion of current VET supply

Overall, the industry does not require formal certification for workers entering the industry but they do prefer candidates that have gone through a VET track. The main VET center in Galicia, *Instituto Galego de Formación En Acuicultura*, otherwise known as IGAFA has a high profile with respect to the program and training it delivers. It also has many company partners worldwide. Currently organisations like APROMAR do not perceive any training problem on aquaculture in Spain as they feel VET providers, such as IGAFA offer high quality programmes, that fulfil that role in preparing candidates with the skills and knowledge they need to enter the workforce. Due to the small size of this industry in Spain, and its current stagnation condition, what's in place, seems sufficient. APROMAR does what it can to meet the needs of the industry, without there being too much demand to supply this need.

## 3.1 Available VET summary

| VET description | Qualification | Delivery mode |
|---|---|---|
| NQ Formación basica (Foundation VET) mainly in Fisheries related courses | EQF Level 3 | College-based |
| Mid-Diploma in Aquaculture | EQF Level 4 | College-based |
| Higher-Diploma in Aquaculture | EQF Level 5 | College-based |

Table 2: Summary of Available VET in Spain

## 3.2 Occupational standards

In Spain there are no occupational standards for cage farming. What is in place, are the current VET teaching and training standards for non-university studies. These set a benchmark for competence, skills and knowledge by which Vocational Education and Training (VET) providers can measure their qualifications and training courses to demonstrate that they are producing individuals with the right minimum competence to enter, or succeed in the labor market. These also provide a benchmark for companies that do not have occupational standards in place.

Each region operates independently although there are minimum common standards. The competencies for VET in aquaculture (which can be applied cage farming production) are outlined in the INCUAL website (National Institute of Qualifications). [9a,9b]

| Qualification level Description | Competence |
|---|---|
| **Level 1** | Tasks involving simple work activities corresponding to standardized processes, with the theoretical knowledge and limited practical skills to be applied |

| | |
|---|---|
| **Level 2** | Well-defined professional activities with the ability to use own instruments and techniques, which mainly concerns an execution work that can be autonomous at the limit of these techniques. Requires basic knowledge of the technical and scientific skills for activity and capabilities of transferring understanding to practical level |
| **Level 3** | Professional activities that require mastery of various techniques and can be executed autonomously, involves responsibility for coordination and supervision of technical and specialized work. It requires an understanding of the technical and basic scientific principles of the activities and the evaluation of the factors of the process and their economic value |
| **Level 4** | In a wide range of complex professional activities carried out in a wide variety of contexts that require a combination of technical, scientific, economic or organizational skills to plan set of actions, define or develop projects, processes, products or services |
| **Level 5** | In a wide range of highly complex professional activities carried out in diverse contexts that are often unpredictable, involving planning actions or creating products, processes or services. Great personal autonomy. Frequent responsibility in the allocation of resources, in the analysis, diagnosis, design, planning, execution and evaluation |

Table 3: INCUAL Competence Guide for Professional Workers. Used as a benchmark by companies, including aquaculture companies.[14]

Company staff indicated that observing their workers was critical in determining their competency, proving their ability to perform a predetermined range of skills or functions to a standard recognised by the company and to some extent, aligned to the competences, skills and knowledge acquired through VET qualifications. Although company staff have expressed that certification is not a requirement for entering the industry (at husbandry level), they do prefer candidates that have a higher level of autonomy and responsibility (Level 3 and up), performing tasks more efficiently using their own professional initiative.

### 3.3 Formal VET leading to NQ

The NQ in Spain is recognised by completing a VET program and obtaining certification for Aquaculture Technician and Higher Aquaculture Technician at the EQF Level 4 and 5, respectively.

(see WP5)

### 3.4 Mandatory training and certification

There is currently no mandatory training and certification requirement to enter the industry and husbandry or operator level. Although, company employees do favour workers that have had experience in a related sector, such as fisheries or have transferable skills that can apply to the work.

### 3.5 Non-formal VET

### 3.5.1 In company training schemes

In discussion with some company staff, they provide training to the staff performing most basic tasks and also training for technicians in the company. From time to time, they outsource courses that can fit into their program, such as how to apply biocide, operating lift truck, food handler or animal welfare, as well as transport of live animals.

In in-company training they do not obtain a certificate since we are not approved, but in the subsidized courses, recognition of achievement or participation can be obtained.

Many of these courses are subsidized by public funds and their human resources department is responsible for managing these.

### 3.5.2 Short courses

| Provider | Course Title | Duration | Delivery Mode | Certification |
|---|---|---|---|---|
| APROMAR | Specific concepts of aquaculture feeding | 40 Hours | Online | APROMAR/APLICACIONES |
| APROMAR | Prevention of occupational risks aquaculture sector | 30 Hours | Online | APROMAR/APLICACIONES |
| APROMAR | English + vocabulary terms aquaculture | 6 Months | Online | APLICACIONES-MY OXFORD ENGLISH |
| APROMAR | HealthyFish | 11 Modules (flexible) | Moodle Online | Cetification and Digital Badges |

Table 4: External courses offered for aquaculture sector Ref. to Training courses offered by APROMAR http://cenp.davinchi.es/2018/Formacion_APROMAR/areasFormativas.html

# 4 Aquaculture learners

## 4.1 Learner profiles and characteristics

Most learners recruited come from recognized institutions, for example, IGAFA and other VET centers in Spain. The companies recognize the high level of the VET program these learners are coming from and more than too often, after leaners have completed their work experience, will secure a job once graduated from the program. The VET program in IGAFA has over 60 company partners globally, which provides learners with the opportunity to acquire additional, essential skills that are not obtained via more traditional routes. Hence on completing their work experience, they come away with skills such as problem solving, communication, teamwork and work habits that industry most want to improve, at the cross-cultural level.

Widening their horizons, so to speak, definitely puts them at an added advantage when it comes to applying a broad set of transversal skills acquired at the international level. Most learners will work with companies for a few years, before moving on to continue higher education or higher positions within the industry.

## 4.2 Learner confidence and learning difficulties

Not discussed

## 4.3 Learning style preferences

In speaking to company staff, there seemed to be a preference for in-classroom instruction with supporting practical application in the field. In terms of any distance learning solutions, such a online, the company visited did not see ‘distance’ or remoteness of the sites as a limiting factor, as they are easily reached and accessed, as compared to companies and farm site locations in Scotland.

## 5 Skills gaps identified

While this was not fully discussed, it was pointed out that the majority of ‘mature’ fish farm workers have no formal prior-education or background knowledge of the fish farming industry. Through the years, they have acquired this knowledge together with skills, through in-company training schemes and directly from the work place.

## 6 Future VET needs

In general, there are VET courses offered in the various centers in Spain leading to a mid-and higher-level certification for title of Professional Technician. Graduates from these VET programs can progress to enter more academic type programs at various universities. There is a need for VET leading to management roles that focus developing skills and knowledge for a more holistic management approach. This was indicated by a member of staff at one of the local companies in the region. Job satisfaction in any field of work depends on how conducive the work environment is.

While companies do not require VET certification from their workers to enter the industry, they do support certification schemes that offer their workers additional CPD. The Professional Certificate offers the workers certified recognition of their work abilities and skills, as well as providing them with a recognised qualification. These extrinsic and intrinsic motivating factors drive them forward and company staff, support these initiatives. It is important to them that workers stay loyal to company, plus creates a better rapport between management and farm workers.

# 7 Industry roles within future VET development

## 7.1 National level initiatives

There has been some initiative put in place for workers in the industry to obtain certification for years they've worked in the industry or if they have completed any previous training. This is for the Professional Certificate.

Workers can have their prior-knowledge, including practical experience in the work environment validated and accredited by the Department of Employment Agency (INCUAL-SEPE)[13]. This will allow them to obtain a Professional Certificate on completing an exam that assesses their skills and knowledge aligned to the competences required by the industry. The Professional Certificate indicates the level achieved and this can be referenced to the information in Table 3 above.

## 7.2 European level opportunities

Company staff indicated that observing their workers was critical in determining their competency, as well as how 'happy' or satisfied they were with their work. In discussions, this proposed another option to consider would be the introduction of a *skill-based* training system. To formalise this in the work environment, it would need a different approach to curricula, methods of teaching, assessment and certification to those traditionally used in a classroom setting. A skill-based training approach focuses on the ability of a person to perform skilled tasks and the practical application of knowledge in a range of variable operational situations. Competency is determined when the worker can prove his/her ability to perform a range of skills or functions to an agreed standard. This could also be set to a European Standard.

Since competence training is based more on skills than on knowledge it also needs a different form of examination. Teachers, or even 'site supervisors or assessors' have to be able to analyse the behaviour of students when performing a task. The new system therefore also requires new skills and training for them.

While these are views discussed with individuals from companies, it is not a general view and this would need to be looked into further.

Creating opportunities for exchanging knowledge and skills in the sector has been a suggestion, both by VET institutions, company staff and investors in the industry. The idea was put forward to have an exchange of professionals between some leading countries, such as Norway to share practices with Spain at the same time provide more mobility opportunities for VET students and their teachers of VET centres.

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[4]Aquaculture Farms Stats https://www.mapa.gob.es/es/estadistica/temas/estadisticas-pesqueras/acuicultura/encuesta-establecimientos-acuicultura/default.aspx

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[6]Innovation Norway including notes from personal communication via Skype
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[8]Employment information on VET qualified workers Nov 2018: TITULACIÓN: TÉCNICO SUPERIOR EN ACUICULTURA http://www.todofp.es/dam/jcr:50c756f2-d75f-4c64-911c-435becc039cb/ts%20acuicultura.pdf

[9a]Appendix 1aTécnico Superior en Acuicultura EQF Level 4 Competences
http://www.todofp.es/dam/jcr:25cdf8d8-8a1a-4398-8ffd-7f6ff538656b/tcultivosacuicolasen-pdf.pdf

[9b]Appendix 1bTécnico Superior en Acuicultura EQF Level 5 Competences
http://www.todofp.es/dam/jcr:7c6f45bc-88d2-4907-a355-544a87f5244d/tsacuiculturaen-pdf.pdf

[10]HealthFish http://healthyfish.apromar.es/

[11]Certify your work experience
http://www.sepe.es/contenidos/personas/formacion/certificados_de_profesionalidad/certifica_tu_experiencia_laboral.html

[12]FLAG/GAC- Pontevedra https://webgate.ec.europa.eu/fpfis/cms/farnet2/on-the-ground/flag-factsheets/pontevedra-flag_en

[13]SEPE Professional Certificate
http://www.sepe.es/contenidos/personas/formacion/certificados_de_profesionalidad/pdf/especialidades/MAPU0209.pdf

[14]Professional Certificate https://incual.mecd.es/certificados-de-profesionalidad

# Finland

WP 6 VET demand Finland
Author: Martyn Haines

## History of aquaculture in Finland

Aquaculture in Finland has been active for a number of years with the first fish farms developed in the late 19th century. This was mainly hatcheries created alongside salmon rivers to restock the rivers and assist the natural fish stocks. Commercial aquaculture started during 1950-60's using ponds to culture salmonid fish. As production methods and knowledge improved the industry started to grow, and production saw a shift from mainly pond production to larger production sites in coastal areas. The industry saw a boom in growth which peaked in the 1980's after experiencing a period of rapid growth (Fig 1), which in turn led to increased growth in the domestic fish processing and market industries. This rapid growth was viewed as unsustainable due to environmental concerns and so environmental permit applications where introduced, which included stricter regulation. The improved regulation was introduced to protect the environment and wild fish stocks and is still in place ensuring aquaculture facilities comply with all permits/licences and are subject to routine inspections. The environmental permits detail regulations on the areas where fish farming activities can be carried out, production volumes and production methods to be used. The introduction of stricter regulations on obtaining environmental permits for aquaculture enterprises slowed down the industry growth and closed down some aquaculture enterprises. (1)

## Description of the industry

The aquaculture industry in Finland is dominated by Rainbow trout (Oncorhynchus mykiss) culture, although there are a range of other species farmed in smaller quantities. Total aquaculture production in 2014 was 11722 tones of which 10681 tones was large Rainbow trout. There are other species (brown trout, arctic char, sturgeon, pike perch and eel) farmed, but in much smaller quantities. The Finnish aquaculture industry had a production value of €54 million in 2014 with responsibility for 50% of the total production attributed to the 10 largest aquaculture companies in Finland. There were 170 aquaculture enterprises active in 2014 with 152 of those companies employing five staff or less. A total of 515 staff (FTE 329) were employed in the Finnish aquaculture industry in 2014. All data sourced from STECF (2). In common with all other countries in the EU, Finland has set a sustainable growth target for its aquaculture sector. The statistical figures from the Natural Resource Institute Finland (3), indicate that the industry is starting to show steady growth and to 2017 had grown in both production tonnage and economic value. The total aquaculture production in 2017 was 14 587 tonnes with a value of 79.8 million Euros. This equated to over 20% growth on the 2014 production tonnage total, and over 40% on the value of the 2014 production. The bulk of this production was attributed to rainbow trout which totalled 13 580 tonnes, valued at 70.3 million Euros. The majority of the 2017 rainbow trout production was in a marine environment with 11 752 tonnes produced.

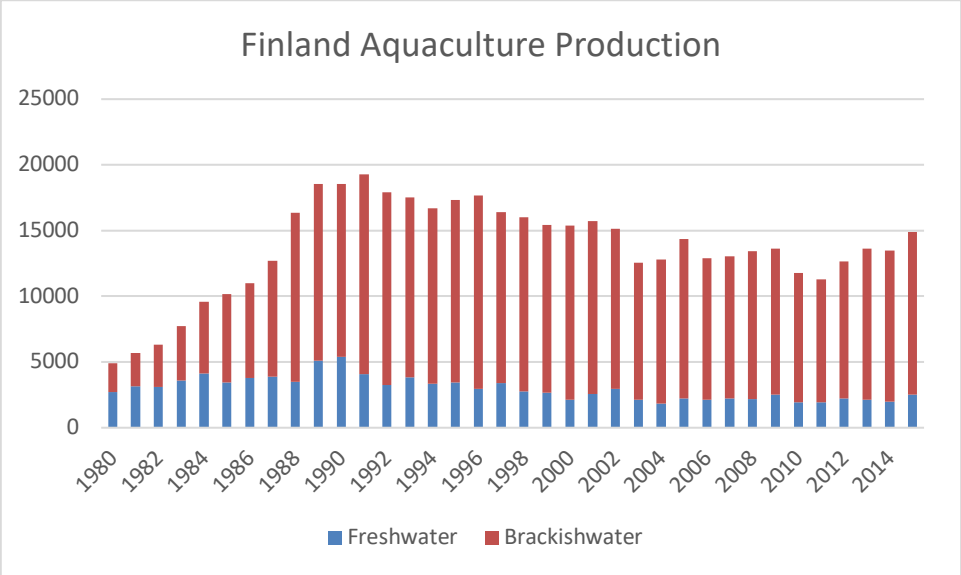


Fig 1. Adapted from FAO data. (4)

The aquaculture industry makes a reasonable contribution to the Finnish economy and is predicted to grow by >40% by 2020 (5). The growth of aquaculture will be vital to the local and the national economies, but any growth must be compatible with Finland's environmental objectives. In Finland there is a national spatial planning program for aquaculture. This program identifies the most suitable and productive areas for aquaculture production in marine areas. Technological improvements may make it feasible to consider siting marine units further offshore or increased use of water treatment technology and Recirculation Aquaculture Systems (RAS) may be utilised to boost production, which in turn may in-crease demand for staff training/qualifications. The use of RAS may be viewed as a potential solution to the slow growth of the industry in Finland as they are the only aquaculture enterprises, in the continental area, which are currently granted new permits (6).

The Nordic countries have identified a need for a collaboration on RAS and any associated education and training. The collaboration includes various industry and educational organisations in the following countries; Norway, Denmark, Finland, Sweden and Iceland. The partners have proposed that all information on any aquaculture and RAS training should be made available on one website e.g. the Nordic Network on RAS http://www.nordicras.net. In Finland there is a proposal to organize a RAS summer school in the University of Jyväskylä in the summers of 2018 and 2020. It is not clear at this stage whether the training will be vocational, and who the target audience is academics, university students or aquaculture employees (6).

## Industry representation

**Finnish Fish Farmers Association (FFFA)**

The Finnish Fish Farmers Association may be essential for any progression of aquaculture VET in Finland. The Association organises seminars and lectures for members on topical issues such as fish health. It also updates members on the latest reforms, education and employment vacancies. The

Association represents Finnish fish farmers on the aquaculture development group, appointed by the Ministry of Agriculture and Forestry. The aquaculture development group deals with the bureaucracy concerning environmental licensing, marketing, disease control and finances. The Association also arranges training for members where required. An example of training currently underway is a management training for entrepreneur's programme which is aimed at fish farmers and fishers. This programme is offered in co-operation with an independent organisation (Työtehoseura), which specialises in management training and will run from January 2017 – November 2018 (7).

**Survey results**

A number of organizations in Finland were contacted with information requests for the BlueEDU project. The contacts established were mainly with educational organizations and the Finnish Fish Farmers Association (FFFA). The initial correspondence provided useful information on the Finnish education system and aquaculture qualifications currently available, most of which are at the graduate and post graduate university level. The educational information helped the development of the WP3 section when describing aquaculture education in Finland. There were however difficulties in establishing further contacts with the aquaculture industry in Finland. The FFFA was contacted to ask if they or any of their members could assist in completing the industry qualitative and quantitative surveys, but no response was received. The aquaculture industry in Finland is small when compared to other countries in Europe, with a number of smaller scale producers, but their input would have been useful to get a complete representation of aquaculture across Northern Europe. As surveys could not be carried out information and data could not be gathered that would allow an evaluation of the Finnish aquaculture industry as it stands and any vocational training they may require or skills gaps to be addressed. This may have been useful to the Finnish aquaculture industry as they move forward and achieve their 2020 growth aspirations.

## References Finland

(1)- Fish Farming in Finland, published by the Finnish Fish Farmers Association

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(3)-Natural Resource Institute Finland (Luonnonvarakeskus) accessible from: (https://stat.luke.fi/en/)

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(5)- Finland: Multiannual national plan for the development of sustainable aquaculture an overview, accessible from; https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/summary-aquaculture-strategic-plan-finland_en.pdf

(6)- An overview of aquaculture education in the Nordic countries, with special emphasis on recirculating aquaculture systems (RAS) Prepared by Hanna Ahonen and Juhani Pirhonen, 2017, accessible from: https://www.luke.fi/wp-content/uploads/2018/03/uaculture_education_Nordic_countries.pdf

(7)-TTS Workers Association, accessible from: http://www.tts.fi/kouluttaudu/koulutustarjontamme/johtaminen_ja_yrittajyys

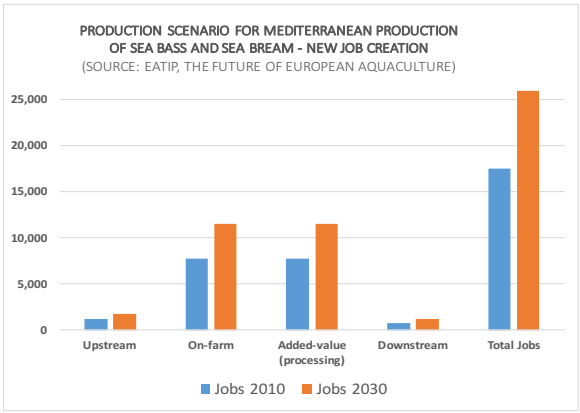
# Greece

**BlueEDU WP 6 VET demand**
Douglas McLeod, FEAP
Martyn Haines, PLI

## 1 Description of industry

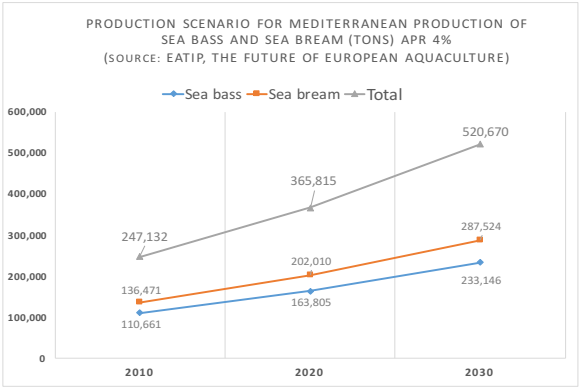
Greece has a very long coastline of 15.000 km and ideal environmental conditions for marine aquaculture. Greek Mariculture ranks today as 1st in Greek food exports and has a market share of 42% of global production of Sea bass and Se bream, however is a relatively young but vibrant sector with 34 years of experience. Sixty five (65) companies produce 113,000T of mainly sea bass and sea bream providing 450 million meals annually of ex-farm value €0,6 bn. Eighty percent (80%) of the production is exported in more than 30 countries within 48 hours post harvest (€0,5 bn value - 93% in Europe, 4% in US and 3% in Other countries).

The Greek Mariculture Sector employs directly or indirectly 13.000 people in coastal and remote areas of which 6,500 are on-site, farm employees. More than 9,500 jobs indirectly in related industries like feed production, cage and net manufacturing, processing and services and support. FGM data (2008) indicate employment in the fisheries sector declines by -5.1% per year on average since 1997 with an average age of 54-64 years and is predominately part-time combined with other seasonal and part-time employment. In contrast maricultural workforce grows by 4.5% per year on average since 1997, employs younger people of average age 32-42 years, it is predominately full-time with 10% more women employed in mariculture and up to 50% more women employed in processing.




In the European Aquaculture Technology and Innovation Platform vision document, Mediterranean mariculture was expected to grow with an ARP of 4% to double production to more that 520 thousand tons by 2030 increasing it's value by 111%.

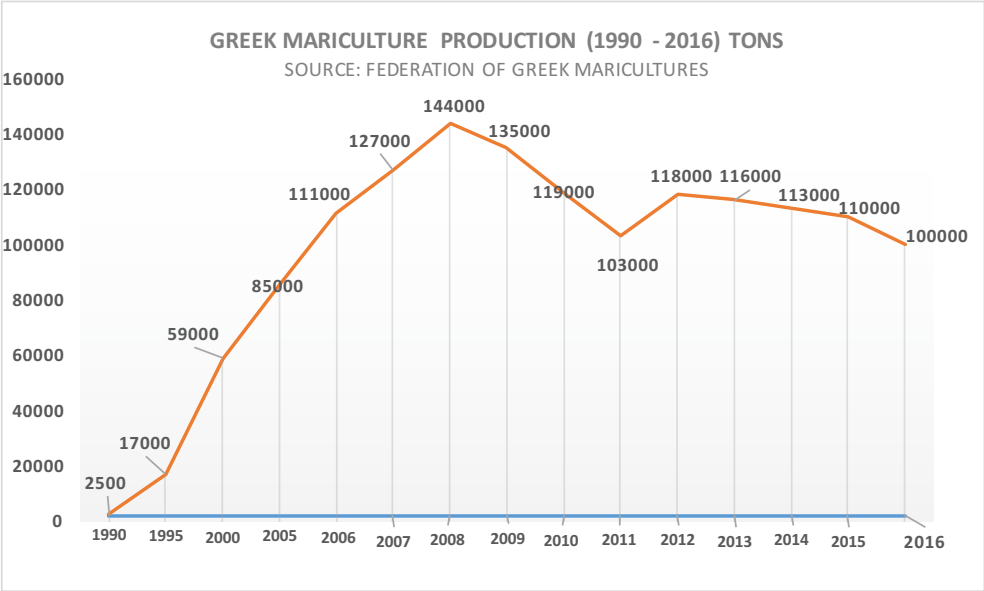
In order to achieve this growth the EATiP scenario taking into account future technologies and automations indicated that the industry would require



at least 15,000 additional jobs created upstream and downstream but mainly on the farm and in added value creation (processing).

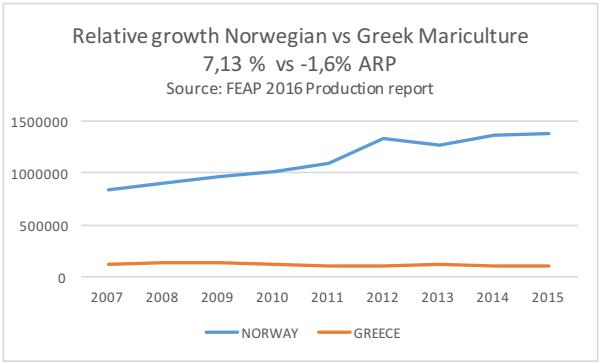
The main marine cage farm species are Sea Bream and Sea Bass, with significantly differing trends in production experiences in recent years, as illustrated in the Table and Graph overleaf.

In Greece there are 3 large companies at national level and approximately 250 family owned businesses. Since 2008 the production has dropped from 140,000 tonnes down to approximately 100,000 tonnes. There is an acute shortage of capital limiting access to modern equipment due to the low rates of investment, and growth. Competition with tourism is inhibiting the expansion of farm sites and a similar situation exists to that found in the Croatian coastal zone.




Greek mariculture is in a crossroads to turn to the next period of sustainable growth following the Norwegian model. The two biggest companies in Greece Nireus group and Selonda Group with combined turnover of more than €365m that belong to the banks (79,62% and 75,93% respectively) have recently entered the last phase of due-diligence to be acquired by new investors among which some Norwegian funds.

Source: https://www.undercurrentnews.com/2017/07/07/lazard-to-run-sale-process-for-selonda-nireus/



## 1.1 Marine Production:

While Sea Bass production has remained reasonably stable over the period 2008 – 2016 at around 45 Thousand Tones (KT), Sea Bream output has declined from close to 100 KT to around 60 KT. The trends in production are in large part a reflection of the competitive market for Mediterranean Sea Bass and Sea Bream. The rapid expansion of Turkish production, from Sea Bass 49 KT to 72 KT and Sea Bream from 32 KT to 68 KT, a combined increase of 60KT at extremely competitive prices, led to reduced output of Sea Bass from France (4 KT to 2 KT), Sea Bream from Spain (24 KT to 14 KT), and for both species from Greece (144 KT to 105 KT) and Italy (both species, from 19KT to 14 KT). These figures indicate that the industry in Greece suffered the greatest 'hit', of some 40 KT or around 27% of 2008 capacity.

As a result of the economic pain, the fin fish production industry in Greece has experienced a major restructuring which is expected (monopolies/competition authorities willing) to be achieved in early 2019. A US investment fund (Amerra), backed by the sovereign wealth fund of Abu Dhabi (Mubadala), which already owns the third largest Greek aquaculture company, Andromeda Group, has confirmed a deal to acquire the two largest producers, Nireus and Selonda. The precarious position of these latter two companies is shown by the degree of ownership by banks, 74.8% of Nireus and 82.6% of Selonda.

It should also be remembered that 2008 was the year of the Global Financial Crisis, which impacted on seafood markets around the planet. And, as always, when economic difficulties occur, staff training is one of the first expenses to be cut – unless it can be shown to be a particular priority.

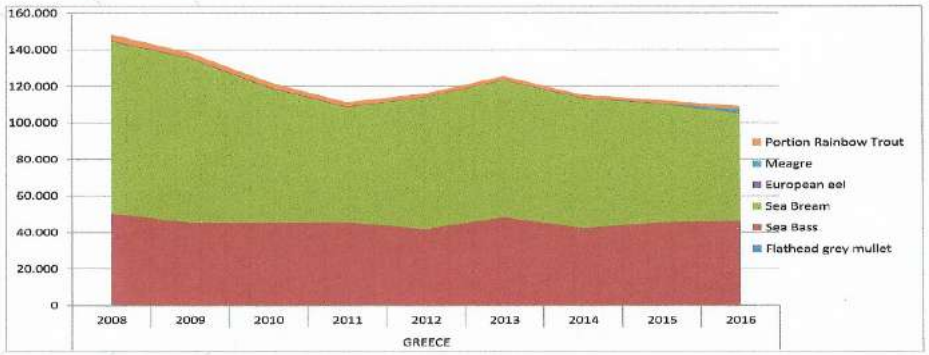
It has taken almost a decade for the Mediterranean Sea Bass/Sea Bream market to achieve a better degree of balance in supply and demand, and for prices to stabilise for all producers.

Other fin fish species farmed are of marginal significance.

# GREECE

| PRODUCTION (tons) | | YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| COUNTRY | SPECIES | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| GREECE | Sea Bream | 94.000 | 90.000 | 74.000 | 63.000 | 72.000 | 75.000 | 71.000 | 65.000 | 59.000 |
| | Sea Bass | 50.000 | 45.000 | 45.000 | 45.000 | 41.500 | 48.000 | 42.000 | 45.000 | 46.000 |
| | Portion Rainbow Trout | 3.420 | 2.588 | 2.712 | 2.389 | 1.967 | 2.014 | 1.611 | 1.611 | 1.611 |
| | European eel | 489 | 428 | 372 | 304 | 322 | 250 | 285 | 285 | 285 |
| | Flathead grey mullet | 395 | 276 | 276 | 390 | 245 | 275 | 263 | 263 | 263 |
| | Meagre | | | | | | | | | 1.800 |
| Total GREECE | | 148.304 | 138.292 | 122.360 | 111.083 | 116.034 | 125.539 | 115.159 | 112.159 | 108.959 |

Note: No current data available



## 1.2 Industry representation regarding VET and Skills

Greece lacks an aquaculture VET supply and the larger companies have developed internal proprietary systems to train and prepare their new recruits. Some aquaculture industry support companies are showing an interest in the development of a formalized VET supply that can utilize mobile ICT devices for learning content delivery. This hand-held technology is currently used for farm record keeping and fish production management but could be further developed to support flexible and accessible farm based learning.

The current limited provision of VET for aquaculture producers has not gone un-noticed, and in mid-2018 there was a significant industry-led initiative to improve the situation. Industry representatives have identified the prime areas of lack of workforce skills – namely feeding, fish handling/husbandry and harvesting/packing – and jointly with VET providers from regional colleges and schools have designed an 18 month course for operational staff. This course is expected to be workplace based, and to be available in 10 out of 12 regions of Greece – and therefore, even if not a formally Nationally Recognised Qualification, will represent a ***national industry recognised*** common qualification. See Annex 1 for details of the qualification.

The delivery of the qualification will include workplace-based practical instruction and assessment, college-based classes and on-line e-learning. Accredited organisations in each region (colleges) will be the certifying bodies for the Diplomas and also for accrediting the qualifications of instructors and teachers.

The development of the course has been funded (€1.5 million) by the European Commission (Structural Funds):

The Federation of Greek Mariculture (FGM), the representative trade association for the sector, has taken a leading role in this initiative, and estimates there are around 1,250 potential trainees nation-wide who would qualify for undertaking the training and receiving a Diploma at the conclusion.

A second application (for €1.5 million) has been submitted to the European Commission programme (5th November 2018) for the development of a second qualification, covering other aquaculture skills not included in the first project.

During an interview with the CEO of an large aquaculture company in Greece, they mentioned that corruption was a concern in Greek society. They alleged that it is challenging for the aquaculture industry to take any kind of VET qualifications seriously, as it is too easy to buy them. To overcome this problem, it was suggested that an aquaculture VET system in Greece could be based up on a reputable quality assured awarding body, outside Greece. That would, according to the CEO, be the only realistic way of establishing and organizing an aquaculture VET system that aquaculture industry in Greece could trust.

#### 1.2.1 Federation of Greek Mariculture (FGM):

The FGM acts on behalf of fin fish and shellfish aquaculture operators in Greece, with the former sector generating the largest economic contribution and employing the majority of staff.

FGM is a member of FEAP and participates in a number of collaborative projects and has been a major source of information for this report.

FGM represents the industry in negotiations with government Departments, including the Ministry of Education and Religious affairs when VET issues are being discussed and in discussions with EOPPEP on qualifications and accreditation issues.

#### 1.2.2 Marketing:

As noted above, there has been significant restructuring of corporate ownership across the Greek industry, with essentially a merger of the three largest producers, thereby creating significant economies of scale, particularly with reference to marketing and market development.

Exports of Sea Bas and Sea Bream have been affected by the price competition from Turkish products, however volumes have been maintained to the main markets for Greek exports of Italy (50%) and France, where the Greek products are preferred by consumers over Turkish fish. Cost reductions/economies of scale for the corporate merger should improve margins both in the domestic market and exports.

It is reasonable to expect that the corporate consolidation will also lead to improvements in the provision and quality of VET across the sector, if such an objective can be supported by European partners with experience in designing, delivering and quality assurance of qualifications.

### 1.3 Staff recruitment and development policies:

The industry (Sea Bass and Sea Bream production) is located widely across the Aegean and Ionian Seas, including many remote and isolated islands. The Kefalonia Fisheries SA company was the first aquaculture operation set up in Europe to farm Sea Bass and Sea Bream (1981), so there is a significant history of these species being cultivated in Greece.

Most operators 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. There has been a range of responses to the qualifications of husbandry and managerial recruits, with one company

reporting only 2% as matching their 'ideal entry requirements' while a second operator claimed 40% in husbandry staff and 70% for site managers, and a third claimed 70% overall.

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, hence the initiative to create a new course and qualification for pen workers and other mentioned above (Paragraph 1.2 and Annex I below).

Although as this is intended to be focused on employees, it will be unlikely to improve the skill levels of recruits.

Companies have reported difficulties with recruiting site managers, with initial selection based largely on experience at company sites although a technical qualification from a technical institute was highlighted as a good aspect of a CV. Experience in administration and management and an extensive knowledge of fish biology, production processes, engineering equipment and public safety and security was also identified as essential.

For all staff, a willingness to work in isolated locations and to work under pressure was identified as a major 'qualification'.

Awareness of NRQs is limited, with the only Academic Diplomas at Level 6 and 7 from Higher Education institutes mentioned and combined with an apparent total absence of an apprenticeship framework there is an almost total reliance on in-house company training for husbandry operatives. Site managers develop expertise through participation at professional conferences and workshops. There were no employees noted as having enjoyed the opportunity or having successfully completed an NRQ, an unsurprising response given the lack of awareness of NRQs or of providers of qualifications at a vocational level.

The only 'qualifications' mentioned were generic skills such as boat handling, crane operation, equipment. However, there was 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 recognising 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 (such as digital and automated expertise) 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/manufacturer training was noted as preferred learning styles.

For site managers, the competences for improvement identified included management of fish health and welfare, management of feeding regimes, health and safety management, production/ harvesting planning, staff management and team leading and budgeting/financial management.

There was an almost total lack of awareness of staff issues around learning difficulties – to the extent it was acknowledged, the response was that they would be instructed to carry out routine tasks and therefore would not need any particular training.

Apprenticeships appear not to be recognized as a training route (with no differentiation over age), although courses at the Technological Institutes for younger staff were mentioned by one respondent.

Learning approaches for husbandry operatives favored 'One to one mentoring' and 'Short courses on technical subjects' and for site managers highlighted 'One to one mentoring', 'Peer discussion' and 'Short courses on technical subjects'.

In summary, there is an absence of NRQs, apprenticeships or general VET provision, resulting in a company focused approach to workplace training with in-house 'qualifications' supplemented by specialist external provision for specific skills such as digital expertise. There appears to be a recognition of the positive contribution that VET could provide to the industry, a view that should be supported by VET professionals in other European countries.

The 3 structured interviews covered companies employing almost 1,200 staff in total, including 870 husbandry staff and 87 site managers. In light of the FGM estimate of a potential total of 1,200 candidates for the innovative training courses under development, this survey appears to have covered a significant proportion of the Greek marine fin fish industry.

## Conclusions and Recommendations - Greece:

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.

The priority BlueEDU recommendation to the European Commission is that there should be a major drive to encourage a multilateral meeting of all stakeholders in the Greek VET arena – industry, EOPPEP, 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 Greek 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, leaving the industry in an unchanged situation (lack of expert staff, absence of career development pathways, inability to implement research findings and technical advances from elsewhere in the European aquaculture industry).

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 organisation – if this new dominating corporate entity can be encouraged to prioritise 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 labour 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.

## Croatia

Croatia's coastal areas and inland waters have good conditions for aquaculture development, including a sea surface of 31,067 km², 1,242 islands, islets, totaling 6,278 km of coastline. In 2015, the total number of aquaculture production centres was 420, including both marine (373 farms) and freshwater (47 farms). The farms are mostly represented by small and micro scale enterprises, particularly family-owned farms.

Croatia pioneered commercial marine aquaculture with one of the first and largest hatcheries for European Sea Bass in the early 1980s. Marine aquaculture includes farming of finfish and shellfish. Finfish farming involves a closed farming cycle (with of the exception Atlantic bluefin tuna), where the first phases take place in a hatchery, and then moves to floating cages at sea. The largest number of farms for white fish and tuna fish are in Zadar region.

Aquaculture is an economic activity that has a long tradition and it is playing an important role in Croatian fisheries. The share of aquaculture in the total fishery production exceeded 21 percent, which is higher than the EU average of 20.4 percent. It has significant social effect, especially at the local level. The aquaculture economic activity provides employment for local population during the whole year, and help reducing the trend of depopulation of rural area and sensitive island communities.

Based on the National Strategic Plan for Aquaculture Development 2014–2020 (ref1) the main challenges in the aquaculture sector are poor diversification of species and products, technological development of the sector, non-existence of marketing strategies, and the lack of product branding and licensing. The lack of processing capacities and production of products with a higher added value, together with market instability and high production price are additional challenges to be overcome. Sea Bass, Sea Bream and Atlantic Bluefin Tuna dominate the marine cage-based farming. The production of Sea Bass and Sea Bream exceeded 8 500 tons in 2015.

The educational system in Croatia lacks any formal aquaculture VET education, despite aquaculture being a major industry. Therefore, aquaculture companies need to train their staff themselves and entirely rely on this form of non-formal VET, currently.

## Cromaris

Cromaris is a Croatian aquaculture leader, specializing in the cultivation and processing of native species of white fish with specific emphasis on sea bass, sea bream and shellfish. In 2016 the company produced 6888 tons and they employed more than 300 persons.

The company is one out of two large companies in Croatia. Major investments have been done during the recent years, which will rank the company among the most technologically advanced entities in the sector of sea bass and sea bream growing and processing in the Mediterranean area. Those investments have been focused towards development of sustainable aquaculture with systematic care of our surrounding environment.

The company has seven farms, two of which are located in Istria (northern Adriatic), and five in Zadar's area (central Adriatic). Today Cromaris is the leading Croatian and the world's number ten sea bass and

bream producer. Italy is the most important market for sea bass and sea bream, which led to the establishment of an Italian Cromaris company in March 2013. Cromaris Italia srl is the exclusive importer of Cromaris product for the Italian market and is owned 100% by Cromaris.

## References Croatia:

Ref 1: Croatian National Strategic Plan for Aquaculture 2014-2020, online at

http://www.mps.hr/ribarstvo/UserDocsImages/akvakultura/NSPA%202014-2020_eng.pdf

## Malta

Malta is not currently a FEAP member, but has a small cage farming sector producing mainly Sea Bream and Sea Bass, but is reliant on the hatcheries of other Mediterranean countries for its fingerling supply. In addition, there is a Tuna fattening sector reliant on wild caught stock and experimental work ongoing with new emerging farmed species, including Amberjack and Meagre. The farmed output was a little under 6,000 tones in 2015.

There are some significant aquaculture companies based in Malta. This is exemplified by the Aqua Bio Tech Group, an aquaculture supply company

**The Aqua Bio Tech Group (ABT)**

The Aqua Bio Tech Group is an aquaculture supply company. It is strategically located in the center of the Mediterranean on the island of Malta, although operating globally with clients and projects in over fifty-five countries. The company undertakes a variety of aquaculture, fisheries and aquatic environmental projects through its regional offices and selected partners throughout the world. The vast majority of the company's work is related to the marine or aquatic environment, including aquaculture developments, project feasibility assessments, finance acquisition, project management, technology sourcing and technical support and training.

ABT Aquaculture is a leading aquaculture consulting and technical support company. The company has grown to become one of the largest dedicated independent aquaculture consulting companies operating on a truly global scale. They have clients and projects in over forty-five countries and forty qualified and experienced staff and personnel. The company has a wealth of experience and expertise covering all aspects of aquaculture planning, feasibility, development and operation.

The Technical Director, would like to draw special attention to VET in many of the EU countries in the southern part of Europe, mentioning in particular the following:

- Far too many schools and universities lack facilities for offering practical oriented aquaculture training, for instance in areas like fish welfare, fish health etc. which requires access to laboratories. They experience that there seem to be an assumption within such educational institutions, that practical training may be done remotely. This don't work out!
- In Malta there is close cooperation between ministries as decision makers and industry, thus securing policy support to industry. However, ABT experience that there is variation in policy support inside the countries in southern Europe, and between them.
- Malta lacks a vocational education and training (VET) system for marine industry, including aquaculture. There is not any marine college that offers such training today. There are discussions today to set up a private college system. Such a private college system may offer cooperation about VET in the Mediterranean region.
- The ABT Group experiences that aquaculture VET is not well paid in the Mediterranean area. People and staff that have a passion for what they do, often drive development of the aquaculture industry.

- In the south of Europe the typical attitude is to protect knowledge and skills, such that the competitors don't get access to it.
- In Malta they to some extent apply the US system for National Qualification Framework.

## Cyprus

Cyprus is in the Levantine Basin (Eastern Mediterranean) characterized by increased salinity and temperature when compared to the other basins of the Mediterranean Sea. Its waters are of a low - nutrient status and low in primary productivity, making them ideal for producing marine species. Although initiated many years ago, aquaculture has recently expanded through offshore cage farm installations.

In the 'Multi National Plan for the Sustainable production of Aquaculture' [8] there was a commitment made to modestly increase the national production of an annual harvest, composed mostly of Sea Bream and Sea Bass (99%), from 5,339 to 6,332 tones, between 2013 and 2023.

Cyprus has no specialized aquaculture VET schools or programs.

In a section of the 'Multi National Plan for the Sustainable production of Aquaculture' titled 'Response to the Strategic Guidelines' under the heading - 'enhancing competitiveness, there is no mention of workforce development, education or training. There is a reference made to 'reinforcement of personnel and networking activities' which may have some linkage to workforce development. This implies that aquaculture VET has not been recognized as important to aquaculture development at national level.

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