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Regional Report on the Energy and Blue Sectors

Hordaland County

WP3 – Mapping the Skills Gap / Building a Knowledge Base

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Content

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0.0 Acknowledgments

The completion of this report was possible thanks to the valuable input and collaboration from competent professionals within and outside the Hordaland County organization. This combined panel of experts represent a mix of stakeholders capable of extracting the necessary data and performing the relevant analyses in order to obtain the results needed as an input for RIGHT's next phase.

As the research methodology points out, a certain level of expertise is required to address the different sections of the research. These areas of expertise include, but are not limited to: statistics and analysis, workshop facilitation techniques, regional policy, regional economy and industry, regional education, regional innovation and entrepreneurship, regional clusters, and human resources/interview techniques.

In addition, the perspective from the industry on the different aspects of the research is central for the results. The input from collaborating companies and their competent representatives has been decisive for establishing patterns and for pointing direction.

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We expect this successful and productive collaboration to continue in the next phase of the RIGHT project – Bridging the skills gap with pilots (WP4).

1.0 Introduction

The Regional Report on the Energy and Blue Sectors for the Hordaland County in Norway represents the region's results for the first phase of the Interreg NSR project RIGHT skills for the RIGHT future (RIGHT). This phase, identified in the project as "WP3 - Mapping the skills gap – building a knowledge base", collects and summarizes regional data, which is used as an input for the project's second phase: "WP4 - Bridging the skills gaps with pilots".

Hordaland's regional report is one of seven parallel reports completed by each regional partner in the project's partnership. All these regional reports are collated in one single and final transnational report for the RIGHT project.

The scope of this report covers the Hordaland County in Norway. Through its different sections, it addresses the following topics about the region:

- Hordaland's socio-economic and R&D profile: based on unrestricted statistical information.
- Hordaland's innovation ecosystems described in the perspective of SWOT analyses: based on qualitative input provided by a selected panel of experts through SWOT workshops[1].
- Innovation capacity and needs of Hordaland's SMEs in the energy and blue sectors: based on qualitative interviews of six SMEs and one large company based in Hordaland.
- Expected employment shifts on SME level. Based on qualitative input from HR persons from two of the SMEs interviewed.

The University of Hanze, who is responsible for this phase of the project (WP3), provides the methodology and templates for addressing these topics.

The highlights of the different sections in the report are presented in section 2. These were established and quality assured through a workshop involving a panel of experts in the different aspects of the report. The highlights in the different sections resonate with each other and reveal key challenges for the future innovation capacity of the region's SMEs (blue/energy). These are presented in section 3:

- There is a clear skills gap in the areas of innovation and entrepreneurship, digitalization and ICT, and RAS (Recirculating Aquaculture Systems) and aquaculture technology. In addition, there is a need to develop mixed skills sets amongst employees. The research finds that companies need employees that can be adaptable and flexible so that they carry out different tasks in different parts of the organisation. This can also prepare the workforce for conjuncture changes.
- Funding for innovation is not easily accessible for SMEs with administrative limited capacity.
- The development of regulations within aquaculture and oil & gas sectors, as well as green transition related.
- SMEs have limited capacity during growth periods.
- There is a perceived ambivalent role of clusters from the perspective of SMEs.

Section 4 presents a discussion of the findings, highlighting both their value, as well as their limitations. Section 5 presents inputs for new strategy and policy for Skills Education and SME innovation with several

[1] A specific SWOT analysis was performed for the sub-region of Nord Hordaland. The highlights of this analysis are found in Appendix 6.2.

ideas for pilot projects in RIGHT's next phase: Bridging the skills gap with pilots (WP4). The Appendixes include the data gathered and processed from the different sections of the research.

2.0 Highlights of the analyses

2.1 Part 1A: Socioeconomic and R&D Profile

GENERAL INFORMATION OF THE REGION

Hordaland is situated in the Southwest of Norway and has direct access to the North Sea. It has a population of about 525.000 inhabitants (Sep 2018), and an area of 15.460 km2. It is currently divided into 33 municipalities with populations ranging from approximately 400 inhabitants (Modalen) to approximately 281.000 inhabitants (Bergen). Hordaland is a large county with a demanding topography. The population resides along the coastline and deep fjords, within inner valleys, and on islands close to the coast. Most of the population (79%) is concentrated around the Bergen area. The region is powered by nature (energy and blue) and owes its competitiveness mainly to the availability of natural resources: hydropower, hydrocarbons, the ocean, and unique landscapes that attract thousands of tourists yearly. The energy sector has been decisive for the development of the region during the past decades as large oil and gas fields are situated close to Hordaland's coast. The hydrocarbon value chain in Hordaland is dominated by a large operator (Equinor) and hundreds of supplier companies of different sizes (large and SMEs). The last oil crisis affected many companies dependent on oil and gas and caused a shift in focus to other sectors, such as the blue sector, including fish farming. The employed workforce, which makes up about 50% of the population, is concentrated in the Bergen area. A significant percentage (about 30%) the workforce is employed within the public sector (public administration, social security, defence, education, and human health).

INFRASTRUCTURE PROFILE

Communications technology is well developed, providing high-speed internet connection to about 90% of the population through both broadband and optic fibre. The leading communications company is in the process of phasing out 3G on a national level, expanding 4G and testing 5G for expected commercialization in 2020.

Hordaland is one of Norway's largest maritime counties and has 3 of the nation's 32 major ports. The Bergen airport is the second largest in Norway and was recently upgraded (2017) to handle a larger number of passengers (7.5 mill) and to include the infrastructure necessary to support increasing security standards. The road infrastructure is a challenge due to the difficult topography of the region. The road infrastructure is supplemented by ferries and is highly dependent on tunnels and bridges to solve these challenges. Some key road and railway sections are vulnerable to the elements (Bergen – Voss). The Bergen Railway is the long-distance train line stretching from Bergen to Oslo, the capital. About half of the goods transported between these two cities are freighted using the Bergen Railway. The railway is also an important public means of transport for commuters into Bergen and serves the tourist sector, especially in

spring and summer. Public transport consists mainly of bus (80%), railway (18%), and boat (under 2 %). The use of taxi is very limited and declining.

EMPLOYMENT PROFILE

The employed workforce consists of about 260.000 workers evenly distributed between males and females. The public sector is the largest employer in the region contributing with 22% of the regional GDP and employing about 30% of the employed workforce. The Blue and Energy sectors contribute together with about 20% of the regional GDP but employ together only about 6% of the employed workforce.

The wholesale, retail and repairs sector is the second largest employer in the region, employing 13% of the workforce. However, the contribution of this sector to the regional GDP is of 10%. Professional, scientific and technical services represent only 4% of the regional GDP and employ about 4% of the employed workforce. About 27% of the employed workforce has a higher education degree (1 – 4 years higher education) and about 11% has education on masters/PHD level (4+ year's higher education).

EDUCATION PROFILE

The actual number of young people under 25 completing upper secondary school is increasing. However, statistics show a recent trend amongst 25-39 year olds who merely have secondary school as their highest level completed. This is most probably due to immigration over the last 5 years and can create difficulties on the labour market for this section of the population. Since the mid-1990s, there has been a steady growth in the population between the ages of 30 and 39 who have completed higher education.

RESEARCH AND INNOVATION PROFILE

R&D expenditure within private companies in Hordaland is lower than R&D expenditure in other comparable counties such as Akershus, Oslo, Buskerud, Rogaland and Sør-Trøndelag. From 2015 to 2016, the business sector's spending on R&D decreased by 2.6 per cent. There is a trend that the industry commissions less research and conducts more research internally with own resources. At the same time, the university and college sector accounts for the majority of R&D expenditure in the county (almost 2.600 mill. NOK in 2016) and for this sector the region has third largest county expenditure in Norway.

2.2 Part 1B: SWOT Analyses of Regional Innovation Ecosystem

THEME – TECHNOLOGY ORIENTATION

How would you describe the technological orientation of the region?

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Several industries to rely on. • Transferable technologies between industries.	WEAKNESSES • Stakeholders in the region do not collaborate well enough, which limits the development of marketable technology.
EXTERNAL	OPPORTUNITIES • Increased focus on green solutions & sustainability. Green growth opportunity for all industries. • Explore technology crossovers between industries.	THREATS • Businesses prioritise operations rather than R&D activities, which can affect the region's innovation capacity in the long run.

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THEME – REGIONAL ATTRACTIVENESS

How attractive is the region to/for:

Investors

	HELPFUL	**HARMFUL**
INTERNAL	STRENGTHS • Well established investor environment in the region in the energy, marine and maritime sectors.	WEAKNESSES • Application processes for support and/or funding are perceived as complicated and bureaucratic, which can be detrimental for investors. • There is more access to risk capital in the east of Norway, which is detrimental for investors. • Few large companies based in Hordaland. These are in competition with the east of Norway making management and investment more challenging.
EXTERNAL	OPPORTUNITIES • Good investment opportunities within the energy, marine and maritime sectors. • Growth and green growth are expected in aquaculture, specifically in the production of farmed salmon.	THREATS • Regions in the East of Norway are more attractive for investors than Hordaland. • Losing investors to other regions reduces the potential number of start-ups in Hordaland.

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Researchers

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Strong research environments on both energy and blue sectors.	WEAKNESSES • Research environments and research infrastructure are concentrated in the Oslo-area. • Little connection between research and industry. Focus is on basic research. • Hordaland has few businesses with employees with doctorate degree.
EXTERNAL	OPPORTUNITIES • Opportunity to increase cooperation between business and research communities through catapult centres. • The Western Norway University of Applied Sciences' campus structure. The campus is spread throughout the region. The university is concentrated and centralised.	THREATS • The region may lose researchers to other more attractive environments/regions if the local environment is not nurtured and developed.

Innovators and inventors

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • There are support mechanisms and capital available for these stakeholders. Catapult and Makerspace are examples. • Training in the subject of patents and idea protection is available in the region. • Strong innovation ecosystem in Hordaland	WEAKNESSES • Information about available support mechanisms and funding is not well communicated in the region. • Many of these mechanisms are centralised in Bergen. • There are few inventors and patent applications in the region. • The fear of inventors in sharing their ideas with others. • Bergen is a city with 'old money', therefore it is difficult to find investors
EXTERNAL	OPPORTUNITIES • There is room for increasing the motivation of youth towards entrepreneurship. • Build trust among innovators and inventors. • More female innovators are wanted.	THREATS • Difficult to find investors to invest in invented products • Many ideas die quickly, reducing the long-term output of the region.

Entrepreneurs

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Good entrepreneurial environment at VIS and Marineholmen. • Good access to natural resources. • Availability of funding for start-ups. • Spread of incubators in the region.	WEAKNESSES • Protective attitude from entrepreneurs against external investors because they fear to lose control over their businesses. • Availability of funding outside Bergen is limited. The flow of information out of Bergen is not good. • Large distances makes it challenging to establish good environments throughout the region. • More difficult to get access to start-up support out in the region.
EXTERNAL	OPPORTUNITIES • A new Ocean View fund leads to more risk capital.	THREATS • Difficult to find risk capital.

Multinationals

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Strong multinationals are already well established in the region within energy and blue sectors. • Good access to other sectors in the region. • High living standard which is attractive for multinationals' workforce	WEAKNESSES • Invest in Bergen is responsible for international marketing, but they have limited funding.
EXTERNAL	OPPORTUNITIES • Increased marketing of the region to attract more multinationals.	THREATS • Little international knowledge about the possibilities in Hordaland. • Competing regions in Norway market themselves better internationally. Multinationals may establish in competing regions.

ICT Professionals

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • There are several large ICT related businesses in the region, as well as finance and media clusters, which can be attractive for ICT professionals. • Strong ICT environment with a strong ICT education.	WEAKNESSES • ICT skilled labour is hard to find in the local labour market.
EXTERNAL	OPPORTUNITIES • High demand in the region for ICT skills. • Utilise the strong educational institutions and networks even better.	THREATS • High demand worldwide for ICT skills creates competition for the workforce.

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THEME – POLICY

What is the basis of policy in the region for RTD, innovation, enterprise and entrepreneurship? What is the effectiveness of these policies?

Research and Technological Development (RTD), Innovation, Enterprise & Entrepreneurship

	HELPFUL	**HARMFUL**
INTERNAL	STRENGTHS • Increase over last few years in R&D spending in the region among public and private sectors. • Good cooperation between clusters and member businesses. The clusters in Hordaland are experienced. • The region has many well-developed programmes (MobiForsk, Regional Research Fund etc.) • Well-developed programmes for mobilisation in the region.	WEAKNESSES • Few businesses apply for RTD related funding. • Not enough R&D spending amongst businesses. • Application and reporting processes for funding are complex. • Difficult to find the right instrument for a specific challenge. • The clusters may overlap each other and seem similar. They may create negative competition (loss of members). • Support for entrepreneurship is jeopardised by a high threshold in Innovation Norway. • Payment of support funding is not necessarily timed to suit the entrepreneur's needs.
EXTERNAL	OPPORTUNITIES • Digitalization and ICT provide an opportunity for facilitating an overview of the solutions, as well as simplifying the application/reporting processes. • The mix of businesses in the regions opens for both incremental and radical innovation. • Increase cluster cooperation on a national level aiming at cooperation with international stakeholders.	THREATS • The business community may be reluctant to apply for funding due to complex application and reporting processes. • Businesses not connected to the system through clusters and collaboration may experience reduced innovation capacity in the future.

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THEME – TRIPLE HELIX

How would you define the level of engagement between the Triple (Quadruple) helix partners in the region?

Government ↔ Industry

	HELPFUL	**HARMFUL**
INTERNAL	STRENGTHS • Strong region capable of providing funding to all stakeholders in the helix, not only industry.	WEAKNESSES • The region needs better feedback and input from industry to be able to provide the right support mechanisms at the right time. • Industry does not optimise the use of the support mechanisms provided by the regional government. • The local/regional government has less influence than the national government.
EXTERNAL	OPPORTUNITIES • Arrange skills development programmes within innovation processes for the industry. • New and enhanced tax incentive programmes for research in SMEs.	THREATS • The funding instruments are not well enough adapted for SMEs. They do not always manage to meet the equity requirements.

Higher educational Institutions (HEI) ↔ INDUSTRY

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Good cooperation between HEIs and the industry (blue and energy sectors) through the clusters • Some new private funding programmes now available in the county (Kavli, Mohn).	WEAKNESSES • Lack of communication between industry and HEI early enough in development processes. • The educational system is slow to adapt to industry needs. • Several HEI projects do not have a connection to industry. • Goals and incentives for HEI and the industry are not aligned. The industry aims for profits, while HEIs aim for publications and recognition.
EXTERNAL	OPPORTUNITIES • Build skills among managers in SMEs. Those leading businesses are often skilled workers who have received more responsibility and lack knowledge about opportunities. • Have more industry/business-financed professors. • Better financing for further education programmes.	THREATS • A lack of funding for further education.

Government ↔ Higher Educational Institutions (HEI)

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Regional level has responsibility for skills policy and regional authorities coordinate the competence policy in the region.	WEAKNESSES • The research direction of HEIs does not take into account in a significant degree the interests of other stakeholders in the helix.
EXTERNAL	OPPORTUNITIES • Hordaland County Council could influence the research direction of the HEIs to a higher degree. • Create incentives so that HEIs are motivated to promote and commercialise research results. • The government can take a more visible role as a commissioner of the role of universities in the triple helix environment • Ensure a balance in the number of students in relation to future educational needs, especially within higher education programmes	THREATS • Too much intervention from the state in the university environment can affect the creative processes in universities.

Government ↔ Higher education institutions (HEI) ↔ Industry

	HELPFUL	**HARMFUL**
INTERNAL	STRENGTHS • Partnerships and cooperation between these three stakeholders is formalised. • The effectiveness of this cooperation is enhanced through cluster programmes. • Businesses are well organised with good relations between employees and employers.	WEAKNESSES • Too many clusters and contact points affect the cooperation as well as the motivation of the stakeholders. The effectiveness of this cooperation can be weakened by the existence of too many clusters and contact points.
EXTERNAL	OPPORTUNITIES • The region can act as a unifier of interests between HEIs and the industry. • The triple/quadruple helix model leaves out two important stakeholders: entrepreneurs and risk capital investors. There is an opportunity to see the region from this perspective (5 stakeholder model) https://reap.mit.edu/about/	THREATS • Not including SMEs in the cooperation model. • Too many arenas. The SMEs do not have enough capacity to participate, hence their opinion is not heard and they are not represented .

Government ↔ HEI ↔ Industry ↔ Civil Society

	HELPFUL	**HARMFUL**
INTERNAL	STRENGTHS • In local communities it is easier to maintain good cooperation between industry/SMEs and local authorities.	WEAKNESSES • The relationship between these stakeholders is less clear when the civil society is included. • This relationship is not formalized, such as with the triple helix.
EXTERNAL	OPPORTUNITIES • Closer dialogue between these stakeholders including the civil society to a higher degree.	THREATS • The opinion of the civil society is not taken into account seriously enough. • Not clarifying sources of disagreement with regards to industry development. • The facts on which the public bases its opinion needs to be correct and spread accordingly.

THEME – ENTREPRENEURIAL ENVIRONMENT

Describe the region's entrepreneurial environment.

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • The entrepreneurial environment is supported by a strong array of mechanisms covering the aspects of education, financing, funding, growth and internationalisation among others. These offers are provided by the public, academic, and private sectors.	WEAKNESSES • The offer is overwhelming, complex and entrepreneurs get confused. It is difficult to find the instrument that fits the entrepreneur's needs best. • The timing when the support is actually provided is not timely with regards to the entrepreneurship's phase in its life cycle. • Entrepreneurship has a relative small role in the different educational programmes through all levels. • A culture of fear of failure affects especially the young. • Most support mechanisms are centralised in Bergen.
EXTERNAL	OPPORTUNITIES • Increase focus on building entrepreneurial skills at all educational levels. These programmes should also address the psychological part of it (fear of failure).	THREATS • Entrepreneurs giving up on the support mechanisms. • Entrepreneurs that use the instruments and receive too much funding may feel shielded and underperform when the support is gone, and/or under more competitive environments. • Stronger investor environments (Oslo) that are more attractive for entrepreneurs.

THEME – INNOVATION ECOSYSTEM

How would you describe the region's innovation ecosystem?

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Strong innovation ecosystem, with strong R&D environments and mechanisms. Access to national and international R&D programmes. • 2 of 5 national catapult centres are located in Hordaland and are easily available. • The process for the industry to engage with research centres is relatively easy, through the clusters.	WEAKNESSES • The industry is not involved in R&D processes early enough. • Only a fraction of R&D environments are open to industry. • R&D environments are centralised in Bergen.
EXTERNAL	OPPORTUNITIES • Better cooperation between the R&D environment and the industry can improve the ecosystem. It can then also improve the rate of success of ideas becoming products. • Create arenas where the industry can discuss its challenges with R&D environments.	THREATS • Very strong R&D environments in competing regions may seem more attractive for the industry than Hordaland. • R&D environments do not consider industry needs as a priority.

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THEME – CLUSTERS AND NETWORKS

Describe the clusters and specifically energy/blue sector/maritime clusters in the region

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Clusters are available for both large companies and SMEs. • Whole value chains are represented in the clusters. • Networks are characterised by diversity and integration. They have strong members (banks) that provide some funding for the local industries.	WEAKNESSES • Too many clusters on a national level cause destructive competition among them and confuses the industry. • Clusters are government funded but expected to act as commercial stakeholders by many members. • Many similar overlapping clusters is confusing for the industry. • The region's cluster environment seems fragmented from an international perspective. • Some networks are limited to a local geographical area and neighbouring networks compete rather than collaborate.
EXTERNAL	OPPORTUNITIES • Better cooperation among clusters at national level. • Clusters could provide a better overview of help mechanisms and relevant projects for the industry. • Networks can have more focus on innovation and be more effective (intention – action). • Networks have the possibility to unite the public and the industry sectors in their local areas.	THREATS • Funding for the cluster program will run out in 2025. It is not clear what will happen after that regarding these programmes. • Companies leave the clusters because they find them unnecessary, expensive and/or confusing. • The credibility and effectiveness of networks. • The way the system is set up means that the flow of information out of the cluster is poor, because they are member based. Hence, the information does not reach companies outside of the clusters.

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THEME – RESEARCH AND TECHNOLOGICAL DEVELOPMENT (RTD) / INNOVATION FUNDING

Describe the funding measures that support RTD in the region

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Plenty of funding available through regional, national and European mechanisms. • Tax incentives are also available.	WEAKNESSES • Funding potential is sub-utilized due to complex application processes for SMEs. • Funding potential is sub-utilized due to lack of capacity in businesses running daily operations. • Unclear overview of available funding programmes. Difficult to choose the right instrument for a specific need. Many businesses choose to apply for the wrong programme. • Funding is available for starting phases and difficult to access during the rest of the life cycle of a business. • High innovation threshold from Innovation Norway. Some ideas, especially within ICT, do not get funding. • Bureaucracy in application processes makes it difficult for SMEs to apply, but not for large firms with resources.
EXTERNAL	OPPORTUNITIES • Organize the funding instruments on the national level – followed up regionally. • Use the existing instruments in different contexts and make connections so that they become clearer for the businesses • Use the evaluation of "MobiForsk" when evaluating other programmes and services.	THREATS • SME conjuncture dependency creates fluctuations and difficulties with planning. • Businesses do not have knowledge or capacity to apply for funding. • Businesses apply for the wrong instrument, which reduces their innovation capacity.

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THEME – SMART SPECIALISATIONS

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Existing specialisations have been identified for the region. The current data collection process will provide further insight/confirmation. • Existing cluster policy.	WEAKNESSES • There is no current smart specialisation strategy for the region.
EXTERNAL	OPPORTUNITIES • Cross-overs between industry sectors • Possibilities will arise from the fusion between Hordaland and Sogn og Fjordane.	THREATS • The skills gap. • The fast pace of digitalization. • SME conjuncture dependency creates fluctuations and difficulties with planning.

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2.3 Part 2: SME innovation capacity and needs

TOPIC – DEFINING COMPANIES

Six of the seven companies interviewed are SMEs and one company is a large aquaculture company. It was surprising to find that there were no SMEs within aquaculture that were members of the Sea Food cluster. Five of the companies are part of different levels in the value chains of both, energy and blue sectors, while two of the companies are purely related to the blue sector (aquaculture).

Geographic scope

All interviewed companies operate at local, regional and international levels to some degree.

Type of innovation

Most companies conduct process, product and service types of innovation.

Details of innovation

- 3D scanning and printing are relevant for some SMEs in Nord Hordaland.
- Some marginal and some radical innovation.
- Drivers for innovation
    - Customer driven innovation.
    - Trends in the market.
    - In some cases suppliers.

Who is involved in innovation?

Most of the interviewed companies involve all of their staff to some degree in their innovation processes due to their size and short communication structure.

All staff are equally important in small SMEs. Large companies and larger SMEs have a more structured innovation process.

Suppliers and customers are the main drivers for innovation among interviewed companies. Inventors or students that approach the companies with new ideas or proposals and other external factors drive innovation to some degree.

TOPIC – DEFINING URGENT CHALLENGES

What urgent challenges are the companies facing, and what are possible solutions for the challenges?

URGENT CHALLENGES	SOLUTIONS
Changes and fluctuations in the markets are difficult to predict.	Keep being flexible and open for new markets where similar products/technologies can be transferred and applied. Especially changes related to the green transition.
Supplier SMEs experience a lack of skills within aquaculture (for example RAS).	No clear specific solution came out from the interviews, but the challenge points to skills development.
New and stricter regulations related to the green transition, as well as the lack of effective regulations for approving new technologies/equipment.	More involvement from authorities as well as neutral third-party regulators for ensuring the quality and safety of new technologies related to the green transition.
SMEs find it difficult to compete against large stakeholders within the same product segment. Large customers prefer the low risk of well-established suppliers to a small innovative SME.	No clear specific solution came out form the interviews, but the challenge points to larger actors involving smaller ones without taking ownership.

TOPIC – DEFINING PATH DEPENDENCY

Which factors are important for the businesses, and which factors are limiting?

IMPORTANT FACTORS	LIMITING FACTORS
Geographic: the access to the North Sea is decisive. This is relevant for both Energy and Blue sectors.	Market fluctuations make it difficult to prepare for the future especially when it comes to staff needs and order book.
Cultural: Most companies interviewed rely on local workforce and strive to preserve these jobs.	For production businesses, it is difficult and expensive to increase production capacity due to their geographical location (nature barriers).
Historic: Some companies are cornerstone businesses in their local communities. They were founded and grew around the local society.	
Good and well-established working environment has contributed to the success of several of the interviewed SMEs.	

TOPIC – DEFINING FUTURE STRATEGIES

How are the businesses preparing for the future?

TWO MAIN STRATEGIES TO DRAW FROM THE INTERVIEWS

1. Keep up with the green transition. This means moving towards electric driven production and sustainability.

2. Keep being adaptable and open to introduction of existing technologies and products into new sectors. Most businesses interviewed have increased, or are intending to increase their activities towards the aquaculture sector

What is needed for the businesses to be competitive for the future?

New competencies/training	Research & Innovation	Additional Finance	New networks & collaboration
Aquaculture (marine biologists, fish health/welfare, water quality)	Software developments that help companies to keep competitive	Financial support from Innovation Norway and other forms of funding to support companies.	Being a part of international clusters and networks is important. However, due to their size, SMEs cannot be members of too many networks/clusters
Underwater inspection not only for oil and gas, but aquaculture as well	New alternative materials		
Material technology	Aquaculture		
ICT for analysing and using data	Automation of certain work tasks		
RAS production in aquaculture including SMEs	Market innovation		
Skills within innovation processes			
Battery driven production/operations			
Personnel with mixed skills (electronics, mechanics, automation, ICT, etc)			

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TOPIC – DEFINING DIRECTION

Promising Developments	Inevitable Developments
Significant growth in the aquaculture sector	It is very different from company to company. However, keeping up with the pace of emerging technologies in their different areas will be decisive. This includes materials, electrification, big data, green transition, etc. This also applies to regulations, as the businesses expect stricter regulations
Electrification of drift/processes	

TOPIC – LEVERAGING INNOVATION POTENTIAL

Are you considering exploiting new ventures?	
New markets:	Yes. 6 out of 7 companies.
New technologies:	Yes. 6 out of 7 companies.
New products:	Yes. 7 out of 7 companies.
New partners:	Yes. 6 out of 7 companies.
New geographical markets:	Yes. 3 out of 7 companies.

TOPIC – DEFINING INNOVATION STEERING

Who is driving or pushing innovation?
For most SMEs, customers, R&D and policy-making (regulations) drive innovation.

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TOPIC – DEFINING EMERGENT PATTERNS

Significant changes in the last three years	
New partnerships	Yes, but no common changes among businesses.
Scope	Little change during the last three years, but all interviewed businesses are gradually shifting focus to aquaculture and international markets.
New communications	Increased use of digital communications, virtual meetings, etc.
Knowledge sources and sharing	No common changes among businesses.
Innovation processes and solutions	A mix of emerging formal and non-formal innovation structures among the companies.

2.4 Part 3: Job Forecasting and Skills Gaps

None of the seven companies interviewed during the research can be categorized as exclusively iconic for either of the categories specified in the methodology (new/old). The interviews reflect an awareness among the companies about the green transition and the need to implement solutions in their business models to address it. However, none of the companies' current activities reflects exclusively the new type of business.

The project has therefore chosen two companies, each with activities in both, blue and energy sectors. One of them provides mainly services and is knowledge-based, while the other one provides mainly hardware/equipment and is production-based.

These are relatively small SMEs (max. 50 employees) with no exclusive HR department or responsible person for this function.

The labour turnover for the knowledge-based SME is significantly lower than the turnover for the production-based SME. The reason for this is that the knowledge-based SME was recently founded (2018) and has not yet been exposed to the market variations that affected older companies during the last decade, as for example the oil crisis. These older companies had to adjust the size of their workforce to the fluctuations of the market. In addition, the production-based SME, which was founded more than 50 years ago is experiencing ageing work force.

The results of the JOEs for these relatively small SMEs is more based on the subjective view (based on experience and education) of the person filling out the forms, than on a structured analysis attempting to forecast the future.

The job structural challenges identified by the younger knowledge-based company are related to the continuous development of rules and standards, to the improvements in specific educational fields, and to capacity issues. As the green transition slowly replaces the old non-renewable model; rules, standards and educational packages need to be improved. The shift of focus in the local economy from oil & gas to aquaculture is also a factor affecting rules, standards and education. This SME is not forecasting any new positions/titles in their job structure, but rather an increase in the number of employees in current positions, and keeping these updated with educational and regulation related developments.

The job structural challenges identified by the more traditional production-based company are also related to capacity and the improvement of the educational background required for existing positions. This SME forecasts three new positions related more to capacity and company structure than to the green transition.

Both SMEs show in their forecasts the will to improve current positons by expanding the skills requirements for their current workforce through the combination of jobs and/or disciplines.

3.0 Key Conclusions of Parts 1-3

We are able to draw several key conclusions from the findings in the different sections of the report, which we summarise below and which are relevant for further developments within the project.

1) Skills:
    a. Businesses have a clear need for skills updates within the areas of
    - Innovation and entrepreneurship
    - Digitalization and ICT
    - RAS and aquaculture technology for cross sector transfer

    b. There is a need for employees who can master a combination of skills required by the companies. This has been defined as a need for a cross-over of skills between companies and within the same company. The challenge is especially apparent in the regions outside of Bergen.
    c. There is a potential to close parts of the skills gap through the sharing of knowledge and experiences within the clusters. A suggestion is to build partnerships for sharing knowledge and for sharing employees amongst with different skills sets.

2) Funding for innovation:
Most SMEs lack structured innovation processes. Innovation happens internally and informally. There is a lack of existing knowledge amongst companies with regards to available funding instruments for development and innovation. Companies do not have sufficient capacity and knowledge to be able to use existing instruments correctly and they are unable to find the right instrument for their current development phase. There is also a need for better communication between the Norwegian Research Council and the industry when announcing call-based innovation project funding.

3) Regulations:
There is a need for increased knowledge regarding existing rules and regulations, especially for SMEs within aquaculture and oil & gas sectors. Tighter rules are expected under the green transition and SMEs need to be kept up to date and informed.

4) Capacity:
    a. SMEs lack capacity to send employees on courses for further education and therefore need module based courses either with an industry-wide approach or with a specific subject/field approach.
    b. SMEs are vulnerable when facing conjuncture swings and should be more proactive in order to increase their innovation capacity and develop new markets, also during growth periods.

5) Clusters:

The clusters have an ambivalent role within the innovation ecosystem. For some the relevance and advantage of membership is confusing both from a geographical and sector perspective while for others there is a clear benefit in participating with courses, conventions, networks etc.

4.0 Discussion of the Findings

The attractiveness of the region is closely connected to the abundance of natural resources, which generate value for the nation and for the region through strong export businesses across the value chain – specifically within oil and gas, aquaculture and hydropower.

As a region in a non-member state, Hordaland does not have a smart specialisation strategy. However, the region does have a regional innovation strategy, a regional research strategy and other relevant plans with regional goals for example for greening the economy, lowering emissions and increasing energy effectiveness. This gives direction and focus on specific priorities where the regional government puts in resources and drivers. The findings from the SWOT analyses show that the priorities for the region are relevant for the energy and blue sectors.

Experts in the working panels and participating SMEs in general agree when discussing the challenges the region faces and the areas of specialisation the region needs to focus on.

The JOEs reveal an immediate need to increase capacity but there are no plans to embark on path development pointing to a path dependency in these particular companies. This is not necessarily the trend for the region as a whole. JOE samples from two SMEs out of hundreds within the blue and energy sectors in the region is not representative and interpretations based on this source need to be supported by additional studies. The same limitation is applicable to the seven interviews performed. However, in this case, the resonance amongst the interviews and between the interviews and the SWOT analyses is much clearer. Nevertheless, an additional study has been commissioned by the Hordaland County Council, which analyses the region's industrial structure in the light of employment patterns and company patterns between 2000 and 2016. The study will supplement the findings of this research and will be used as part of the input for WP4.

The skills gaps that have been identified on a regional basis correspond with the future plans of regions' SMEs. Digitalisation and ICT skills are often cited as lacking in the current and future workforce and amongst school leavers. The challenge is to be able to educate the workforce and school leavers quickly enough and in the right numbers in order to meet the immediate and future challenges industry is facing.

In addition there is a need to develop mixed skills sets amongst employees. The research finds that companies need employees that can be adaptable and flexible so that they carry out different tasks in different parts of the organisation. This can also prepare the workforce for conjuncture changes.

The lack of culture for entrepreneurship is also seen as a barrier for future regional growth. This kind of culture building needs to be nurtured and introduced at early education phases with continued focus throughout schooling. There is also currently a specific need for certain technological services and skills connected to fast-moving innovation within aquaculture.

In addition, there is a need to keep a continuous focus on innovation and technological development even when the order books are full in order to ensure a robust position in case of conjuncture changes and new competition in the market. The region has recent experience with the need to turn around its industrial focus and create technology cross-overs during the recent swings in the oil price which had a negative effect on the industry base in Hordaland. It is important to use this experience and to examine which mechanisms have worked best and how they can be adjusted to the current climate, in order to build a robust industrial base. The Norwegian cluster policy has given support and strengthened many industry players.

However, the research has also uncovered that the jungle of support mechanisms is confusing, bureaucratic and complicated. Many SMEs are either not aware of the opportunities and miss out, or do not apply due to capacity constraints and cannot spend time in understanding the rules and filling out applications. SMEs lack knowledge about how to apply for the correct support at the correct growth phase.

The research has also revealed a latent need for SMEs to be better informed and updated regarding new and pending regulations in relation to greener requirements for products and processes.

SMEs confirm that they see the need for more international cooperation for example through cross border cluster organisations. This is an area where the North Sea cooperation could play a role. There are existing projects, which examine how to create trans-national connections between clusters in order to supplement value chains and create competitive sectors. A certain culture among SMEs for keeping information in-house regarding products and techniques could be a barrier to this kind of cooperation.

We also see that there is a need to discuss and be aware of both the threat and the opportunities a high growth sector in the region can offer. Many companies are discovering the sudden growth opportunities connected to the aquaculture sector. They have been approached for services and products and are readily focusing on the potential. The danger is that these small companies specialise themselves in a certain sector and are not robust when the market suddenly changes again.

At this stage, it is too early to discuss future research recommendations. However, the research does point to a need to ensure continued innovation capacity amongst SMEs and to increase the role of education institutions as a support network for SMEs in their innovation work.

We wish to first define and carry out the pilots, compare experiences and findings with other partners in the project and discuss results and further plans under WPs 4 and 5. The work in this WP3 and the process for creating this report has given us interesting new insights and direction to build further on.

5.0 Inputs for new strategy and policy for Skills Education and SME innovation

- It is important to be aware of the difference between courses relevant for SMEs and full education at degree level on a personal level.
- Students and SMEs:
    a. Instruments to get students to carry out their main project with an SME. Offers to students so that they can get knowledge about the companies' needs. Connect the companies' challenges with the students' main project.
    b. Create digital "connection box" between students and SMEs (Transfer and adjust best practice from Norwegian Business School and NTNU)
- Fast-track:
    a. Fast skills update to raise aquaculture skills in businesses that shift focus to this industry (including RAS). Find a formalised and structured solution. Use the current regional Skills Forum network to help in this this work.
- Digital solutions for different levels (ICT):
    b. Online or e-learning to solve specific SME challenges for those who do not have capacity to join courses in person.
    c. Set up digital learning platforms such as edx.org (https://www.edx.org/) and coursera.org (https://www.coursera.org/) for higher education
    d. Easy access guidance for finding and using available funding
- Use existing infrastructure:
    a. There are two catapult centres for demonstration projects in Hordaland. Exploit any free capacity they might have for training and testing. Set up relevant courses or visits.
- Courses and pilots need to be carefully designed in order to ensure the right level of input and motivation for SME participation.
- Create a culture for entrepreneurship. Increase knowledge about entrepreneurship and innovation processes from an early age and throughout all schooling. Students need to be more aware of the possibilities of starting their own company.
- A new type of employee in the future who is able to master several types of skills according to the needs of the company / employer (mixed skills).

6.0 Appendix

6.1 Part 1A: Socioeconomic and R&D Profile

Region's Socio-economic and R&D Profile

General information of region

Geographic location of region: **Hordaland county**, in Western Norway, between 59.3N - 61N/4.4E - 7.4E

Population: **524 823** (30.09.18) Area of region: **15 460** km2

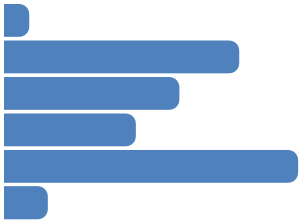
Governance of region: **57 member County Council** (CC), elected in General Election by PR from 9 lists. **15 member County Executive Board** (CEB) elected by CC by PR from 8 lists. CEB headed by **County Mayor Anne Gine Hestetun** from Labour Party, **Dept. County Mayor Pål Kårbø** from Christian Democratic Party.

Structure of region

Hordaland is currently divided in 33 municipalities with ranging populations from approximately 400 inhabitants (Modalen) to approximately 281.000 inhabitants (Bergen). Hordaland is a large county with a demanding geography. The population resides along the coastline and deep fjords, within inner valleys and on islands close to the coastline. Most of the population (79%) is concentrated around the Bergen area.

Employees by residence: **260 677** (week 47, 2017)
Employees by place of work: **254 293** (week 47, 2017)

- SIC(*) A: **4 802** (2 %)
- B, C, D, E, F: **52 272** (21 %)
- G, H, I: **53 938** (21 %)
- J, K, L, M, N: **39 650** (16 %)
- O, P, Q: **92 816** (36 %)
- R, S, T, U: **10 815** (4 %)



(* Standard Industrial Classification)

Municipalities covering the **Bergen Area** (Statistikk i Vest, 2017):
- Area: 2 938 km2 (19 % of county)
- Population: 413 322 (79 % of county)
- Employees by residence: 206 058 (79 % of county)
- Employees by place of work: 205 399 (81 % of county)

Municipality of **Bergen** (Statistikk i Vest, 2017):
- Area: 465 km2 (3 % of county)
- Population: 281 445 (54 % of county)
- Employees by residence: 142 543 (55 % of county)
- Employees by place of work: 161 948 (64 % of county)

Infrastructure profile

	Size/type/quantity	Comment
Broadband	88% of households in Hordaland (and 95% in Bergen) have 100 Mbit/s downstream capacity (Nkom, 2018)	Internet is free in many public places such as airport, main seaports, shopping malls, etc.
Other ICT infrastructure	World's fastest 4G network (Telenor) measured by Speedtest/Ookla during the whole year 2018. Very good coverage except for extremely rural areas (the Hardanger Plateau for ex.) 4G network expanding and there is a plan to close the 3G network in 2 years time.	5G technology was tested for the first time in Norway by Telenor and will give speeds 20 times faster than 4G, opening for significant technological developments in many industries. Pilots starting in 2018 and expected commercialization in 2020..
Seaports	90 seaports, of which 58 are private 10 are public and 22 are unclassified. These ports serve the shipping industry, fish farming, oil and gas, tourism, public transport, and leisure activities for the locals. Hordaland has 3 of the nation's 32 ports classified as backbone ports: Bergen, Sture, Mongstad. (Kystverket, 2018)	Hordaland is one of Norway's largest boat counties. Its seaports are distributed mainly along the coastline and deep in the fjords
Airports	BGO (Bergen) medium international (6 000 000 pax, in 2017) SRP (Stord) small domestic (35 000 pax, 2017) (Avinor)	Bergen airport is the second largest airport in Norway and the main airport for the west coast. The terminal was significantly upgraded in 2017 and has a capacity of 7,5 mill pax. was opened in 2017. The new terminal fulfils the increasing security requirements within air transport.
Roads Motorways	779 km National/European roads 1 021 km county roads w/60+ km/h	Roads are supplemented by 18 ferry connections due to

		the demanding geography of the region (fjords and islands) and the lack of sufficient bridges and/or tunnels. Some key sections are still quite vulnerable to the elements (Bergen – Voss).
Roads Secondary	1 941 km county roads w/50- km/h 3 071 km municipal roads	
Public transport - railways	Bergen Railway: Electric powered 371 km Remote operated between Hønefoss and Bergen. Seat capacity of 350 seats, which can be extended to 480 seats. Stations with people traffic: 33 Double tracks currently being developed on key sections (NSB)	The Bergen Railway is the long-distance train section in Norway with the largest traffic. Freight traffic is also large and about half of all goods between the country's two largest cities are sent through the Bergen Railway. Passenger traffic is characterized by tourist traffic and by weekend traffic to and from tourism destinations in the mountains and fjords. At Vossebanen (Bergen - Arna - Voss) there is an extensive commuter traffic into Bergen. As with the roads, some key sections are vulnerable to the elements.
Public transport – bus	Total boardings in Hordaland 70 million. In the Bergen area 61,5 million where 12,5 millon are on the Public transport in Hordaland was distributed like this: Bus: 80% Railways: 18% Boat: Almost 2% Use of taxi has a negative trend and is under 1%	The public regional strategy for public transport is connected to the national strategy, which aims to cut all non-environmental friendly transport from urban areas, limiting it to collective transport, walking, and bi-cycles.

Household and age distribution profile

Household expenditure as % of national average: **100.5 %** (572 000 / 569 000, NOK, consumption per household, SSB, 2016)

Household income as % of national average: **104 %** (517 000/498 000, NOK after taxes, SSB, 2016)

Age distribution	< 15	16-25	26-45	46-65	>65
Male	52 180 (10 %)	35 871 (7 %)	75 634 (14 %)	64 670 (12 %)	36 191 (7 %)
Female	49 629 (9 %)	34 295 (7 %)	69 835 (13 %)	61 074 (12 %)	43 160 (8 %)

Employment profile

Total population in employment: **260 677** (SSB, 2017)

Participation rates in employment (SSB, 2017):

Male: **68,5 %** (of pop 15-74) Female: **65,1 %** (of pop 15-74)

Employment by sector (PANDA, 2016)

Sector	% Regional GDP	% of total employment	Comment, e.g. targeted growth sector (S3)
Public	22 %	30 %	Incl. public health care
Energy – traditional	7 %	3 %	Extraction, mining, transport, storage, services and refining of oil, gas and minerals (not incl offshore GDP)
Energy – new	3 %	1 %	Production and distribution of electricity, heating and gas
Maritime	6 %	1 %	
Manufacturing	5 %	7 %	
Agriculture	4 %	2 %	Incl. aquaculture, fisheries & forestry
Agri. Food	1 %	1 %	Processing and manufacturing of fish and other foods
Healthcare	3 %	6 %	Only private health care. Public health care included in "Public" above
Tourism	3 %	6 %	Land & air transport, hotels & restaurants, tourism
Services – Financial	5 %	2 %	

Services – Creative industry	5 %	6 %	Publishing, ICT, R&D, art, culture, sports & organizations
Other (specify)	13 %	6 %	Property management, security, rentals and temporary employment activities
Other (specify)	9 %	13 %	Wholesale and retail trade, repairs
Other (specify)	8 %	9 %	Water, sanitation, construction
Other (specify)	4 %	4 %	Professional, scientific & technical services
Other (specify)	2 %	2 %	Postal & courier activities, warehousing and support activities for transportation
Blue	4 %	2%	Fish processing, seafaring, fish and fisheries, aquaculture

Numbers employed by qualification level (SSB, 2016):

Degree	**Masters + PhD***	**PhD***	**Professional Qualifications**
69 860 (1-4 yrs higher education)	**28 938** (4+ yrs higher education, incl. PhD)	**2600-2900**	**N/A**

* Published longer education figures for counties include PhDs. National PhD-Masters ratio is 1:9. Our estimate for Hordaland is a ratio between 1:10 and 1:9.

Retention rates of graduates in region**: N/A**

Education profile

Total population in education (SSB, 2017):

- Minimum *(on assumption that all individuals in training for immigrants, online courses and adult learning associations are included in other populations/and/or not counted)*: **157 247**
- Maximum *(on assumption that all individuals in training for immigrants, online courses and adult learning associations are counted only once, and not included in other populations)*: **209 009**
- Both assumptions are unrealistic, but true value lies somewhere between **30% and 40%** of population total for 2017.

- Certified day-care/kindergarten/pre-school: **29 604**
- Primary and lower secondary: **63 421**
- Upper secondary: **25 095**

- Post-secondary non-tertiary: **1 636**
- Folk high schools, long courses, students *from* Hordaland: **772**
- Tertiary, students *from* Hordaland: **26 573** (59% female)/students *in* Hordaland: **36 719** (59% female)
- Norwegian language training and social science for adult immigrants *(individuals may be included in other populations)*: **4 052**
- Online courses *(individuals may be counted more than once and be included in other populations)*: **815**
- Adult learning associations *(individuals may be counted more than once and be included in other populations)*: **50 947**

Percentage Full-time: **N/A** Part-Time: **N/A**

Participation rates in education: **N/A** (can't be calculated – age of students not available)

Between 16 and 25 years old - Not completed and not in tertiary (Hordaland, 2017).
Male: 16,3 % Female: 12 %

Number of students by level (SSB, 2017):

Primary	**Secondary**	**Tertiary**	**Vocational**	**Further education**
63 421	25 095	36 719	1 636 (post-secondary)	55 814 (not unique inds)

Dropout rates by level (NSD DBH, 2017):

Primary	**Secondary**	**Tertiary**	**Vocational**	**Further education**
1,6 % (w/o transfer to secondary)	11,1 % (quit) + 5,9 % (finished without passing), counted five years after start	13 % (based upon planned study points from all institutions present in county, except one business school)	N/A	N/A

Number of Higher Education Institutions (including institutions w/main campus elsewhere):

University		Institute of Technology		Technological University		Business Schools		Specialized universities & colleges	
Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
1	0	0	0	0	0	1	1	1	4

Vocational education:

Number of vocational schools: 10

Students attending vocational school: 1636 (SSB, 2017)

Number of active students in vocational school: 3305 (NSD DBH, 2018)

Male: 2395 (72,5%) Female: 910 (27,4%)

Age distribution (NSD DBH, 2018)				
<20	20-29	30-39	40-49	>50
100	2145	680	275	105

Research and innovation profile

Number of Research Centres:

Public	**Private**
11*	1**

*In high degree funded by public sector
**Public and private funding – but close to being private

Number of Incubation Centres:

Public	**Private**
3	1

Industry stock (SSB, 2018 Q1):

Large (250+ employees)	**SMEs** (10-249 employees)	**Micro** (1-9 employees)	**0 employees** (incl. sole proprietors w/o other employees)
89	5 560	12 254	32 255

Industry stock by sector (SSB, 2018):

Sector	**250+**	**SME**	**Micro**	**0 emp**	**Comment**
Energy (traditional & new?)	7	59	56	184	Extraction, mining, transport, storage, services and refining of oil & gas, production and distribution of electricity, heating and gas
Maritime	2	55	70	335	
Manufacturing – heavy engineering	10	183	205	377	Lumber, paper, chemical & pharmaceutical, rubber, minerals & metals, machines & transport equipment
Manufacturing – light engineering	4	108	230	563	
Agriculture	0	78	433	3 881	Incl. aquaculture, fisheries & forestry
Agri. Food	1	84	70	117	Processing and manufacturing of fish and other foods
ICT	2	136	420	1 237	Including publishing
Healthcare/Pharmed	19	1 200	1 118	2 691	
Tourism	5	440	1 177	1 382	Land & air transport, hotels & restaurants
Services – Financial	17	604	2 748	10 100	Including business-, property- and employment services

Services - Creative industry	9	635	638	3 407	R&D, education, art, culture, sports & organizations
Other (specify)	7	201	124	26	Public administration and defence; compulsory social security
Other (specify)	2	1 055	2 608	2 443	Wholesale and retail trade, motor repairs
Other (specify)	2	596	1 798	4 049	Construction, water & sanitation
Other (specify)	2	69	126	395	Postal & courier activities, warehousing and support activities for transportation
Other (specify)	0	57	433	1 068	Small repairs, other personal service activities, activities of households as employers, other non-descript
Blue	2	124	181	829	Seafaring and fish, fisheries and aquaculture

R&D Investment:

Source of R&D funding	**2017**	**2016**	**2015**	**2014**	**2013**
Total Government spend on R&D in region	N/A	N/A	4 394 mill. NOK	N/A	5 431 mill. NOK
% of national R&D spend*	N/A	N/A	7,3 %	N/A	10,7 %
Private sector spend on R&D in region	N/A	N/A	1 691 mill. NOK	N/A	1 319 mill. NOK
% of national R&D spend	N/A	N/A	2,8 %	N/A	2,6 %
Foreign funding	N/A	N/A	381 mill. NOK	N/A	391 mill. NOK
Other sources (private funds, gifts etc.)	N/A	N/A	304 mill. NOK	N/A	224 mill. NOK
Total EU R&D funding coming into the region	N/A	N/A	N/A	N/A	N/A
EU R&D funding as % of EU funding nationally	N/A	N/A	N/A	N/A	N/A

*National R&D spend = Private + public + foreign funding and other sources.

Total R&D expenditure*	2017	2016	2015	2014	2013
Total expenditure (industrial sector, institute sector and higher education sector) in region	N/A	6,878 mill. NOK	6,784.3 mill. NOK	5,922 mill. NOK	5,448.7 mill. NOK
% of national total expenditure	N/A	10,8 %	11,1 %	10,9 %	10,7%
Industrial sector expenditure in region	N/A	1,822 mill. NOK	1,820 mill. NOK	1,684 mill. NOK	1,367 mill. NOK
% of national total expenditure	N/A	2,8 %	3 %	3,1 %	2,7 %

*A widely used measure in the Norwegian statistics.

6.2 Part 1B: SWOT analyses on Regional Innovation Ecosystems

THEME: TECHNOLOGY ORIENTATION

How would you describe the technological orientation of the region?

Overview:	Technology development and its profitability has been dominated by oil and gas industry. The oil crisis open the doors for change and new opportunities. Technology and from the oil and gas industry is now being transferred to other industries. Within the oil and gas industry efficiency measures have been introduced. The focus on sustainability and green solutions has increased.
Strengths - Capacities & capabilities	Even though technology related to oil/gas has been dominating, there are also other strong technological industries, for example in Odda, and the emerging land based aquaculture facilities. The region has several industries to lean on. The region has an adaptable industry and is willing to change. There is consciousness about the necessity to collaborate across industry branches to achieve new technological advances that are useful for the region.
Weaknesses - Issues that need to be addressed	Businesses lack the willingness to invest in new technology early enough. The industry sector is doing well and has more than enough to deal with production. Then priorities are not necessarily innovation and/or development. There is lack of entrepreneurship internally in the businesses because they are prioritizing daily production.
Opportunities - Potential for innovation/S3 focus	Opportunity to use more of the resources in the region within energy and blue sector (natural and technological resources) Explore technology-crossing paths between branches. Large companies can start new business, due to downsizing and reorganization, particularly in the energy sector.
Threats - Constraints to be addressed	'Silo phenomenon' – that one does not collaborate well enough across different industries due to prejudices and attitudes. This limits technology development and innovation significantly. The industry sector is doing well and has more than enough to deal with production. Innovation and technological development are not a priority. This makes it more challenging when times are bad and one does not have the resources to innovate. Lose the innovative power.

General comments/Observations *(Technology Orientation): NA*

THEME: REGIONAL ATTRACTIVENESS

How attractive is the region to/for:

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Investors	There is a well-established investor environment in the region (Connect Vest, amongst others) The region has energy, maritime, marine (aquaculture) and several other industries. There is easy access to the sea. Potential for growth especially in Blue sector. Good infrastructure, enough residences, roads etc. It is an attractive area for settlement for investors. Labour market integration, between districts and Bergen. Flow of expertise and access to work.	We need more investors. The Oslo area is still far more attractive than Hordaland for investors. Some sectors have very few investors. Insufficient road infrastructure: Mobility of the workforce and logistics for potential companies. Some districts are "isolated" with narrow and over trafficked roads not suitable for effective industrial logistics. Digital coverage in some municipalities could be better. Access to human capital. Fragmented labour market. Labour market integration might be negative for the local environment	New VC (Venture Capital) initiative is about to be started (Ocean View). Investment environment Blue. Infrastructure: Sea transport can be exploited more efficiently. Opportunity for more effective transport.	Without investors even more start-ups will die. The investment environment is strongest in Oslo. This can be seen as a threat in Hordaland. Entrepreneurs can be leave the region to other more attractive investor environments. Katapult Ocean is based in Oslo. Takes investors away from Hordaland. Reputation with regards to the processing of applications (difficult and bureaucratic). Can scare away investors.
Researchers	Strong research environments on both blue and energy sectors (old and new). Norway's Research Council has an industry PhD, which connects researchers with the industry.	The connection between researchers and the business community could be better.	Linking research and business communities. Digitalisation is increasing in work processes, which creates data that can be used in research – big data and digitalization. KABIS (Capacity boost for sustainable and innovative seafood	Not managing risks and challenges to maintain and develop the research environments is a threat. International competition for researchers in other regions and countries.

			production) will contribute to new knowledge and innovation in closed production technology for the aquaculture industry, in order to achieve an environmentally friendly and cost-effective production of salmon. Two catapult centres open up the possibility for the industry to cooperate with researchers The university of Bergen will aim to include innovation and entrepreneurship in all their programmes. Increased focus on good SFI applications. The purpose of the Centres for Research-based Innovation (SFI) is to build up and strengthen Norwegian research groups that work in close collaboration with partners from innovative industry and public enterprises.	
Innovators : (Get the idea. Solve a problem with a goal)	There are three incubators that can help develop an idea to a business. Instruments and capital are available A 3D printing lab called makerspace is available to everyone for 480kr a month. Catapult centre, an offer to everyone and a possibility for all innovators There is cooperation between regional educational institutions and businesses to find innovative solutions.	Information about mechanisms is not widely spread through the region There is a culture barrier in Norway. One is not supposed to stand out from the crowd. Innovators are not good enough to market their ideas. There are few innovators in the region. Many are not aware of programs such as 'makerspace'. A workshop for those who like to explore, learn, create, create,	Catapult and makerspace are possibilities to increase the number of innovators in the region. Innovation and entrepreneurship are included in schools, on all levels, for example "Ungt entrepeneurskap" – Young entrepreneurship. There is room for increasing the motivation of youth towards entrepreneurship.	The cultural barrier, can be a threat. "Afraid of showing off". Unmotivated youth. Geography is a threat. Many solutions such as makerspace are centralised in Bergen. Competition from other regions and countries. Too much focus on oil and gas during the last years. Low capacity for development and innovation due to

		play, develop, share ideas, build, test, and fix their prototypes.		intensive oil and gas production. Expensive solutions and labour force.
Inventors (Invent a specific product Not necessarily a goal)	Access to patent related knowledge exists: BTO has extensive knowledge here. Oppfinnerprisen (the inventor price), by BTO.	Not many inventors in the region. Few patent applications from the region. Businesses fear for losing their ideas to others if they apply for a patent. It is expensive to apply for patent. BTO is limited to the innovation environment. The support is limited and one has to be in the environment. Weak reputation for inventors.	Expand and develop the support mechanisms for inventors. Makerspace. This can be expanded and used more widely. Oppfinnerprisen (The inventor price) Give better access to patent knowledge and competence – for example through BTO.	Difficult to find investors to invest in invented products. Fear for losing their ideas to others makes the idea die before they are born.
Entrepreneurs (Start a company)	Access to start-up funding and education. There is a good environment at BTO and Marineholmen in Bergen Young entrepreneurship Low interest rates in the financial market. Good access to natural resources. Innovation Norway funding.	Difficulty in finding risk capital. Minicipality funds are not evenly distributed in the county. Culture. Many actors are protective against external investors. Afraid to lose control. Access to proper industry and office locations is limited	Horizon 2020: Instrument for entrepreneurs, more money and marketing capacity Grunderhus: possibility to find an arena to discuss innovation between different actors. Access to industry/office locations could improve. Start-up program for refugees.	Access to inventors – little access? Access to industry/office locations could hinder new business establishments.
Multinationals	Strong industries especially within Energy and Blue. Infrastructure (harbours, airport, transport).	The region still has a way to go to be known for our industries. The multinationals don't know about the region and which industries we are strong in.	Smart marketing of the region. Access to industry/office locations. Facilitate more areas. Not all municipal area plans are equally good.	Access to industry/office locations Competing regions market themselves better than Hordaland.

	Access to knowledge resources. Competitive compared to other nations (USA, UK) . Good access to other businesses in the value chain. Access to raw materials and natural resources. The region has a high standard of living, culture, good childhood conditions, good education system, family-friendly etc.	Access to industry/office locations	Right skills for the right future. Capacity and competence according to region's current strengths and future needs. Education offers for children and youths. Labour from abroad Make use of specialised workers which multinationals might need. Cheaper power supply. Closeness to the market. Access to raw materials, natural resources	Non-renewable resources as a basis for establishment. Need to diversify. Large actors are often centralized or internationalized. Headquarters normally not in Bergen, but rather in Oslo. Leads to fewer actors establishing their headquarters in the region. Closeness to customers. Breadth in the customer base. Low diversity in industries, mostly energy, sea, aquaculture Sustainability.
Indigenous enterprises	N/A	N/A	N/A	N/A
ICT Professionals	Media City Bergen Finance cluster Several large ICT businesses High standard of living		More focus on this type of education. Everyone is looking for IT professionals.	Difficult to find this skills in the labour market.

General comments/Observations *(Regional Attractiveness:*

It is not clear as to what distinguishes Hordaland from other counties concerning regional attractiveness. All other regions in the country share the same attractive features such high standard of living, free and high quality education for young and adults, closeness to nature, clean air, etc.

Perhaps the attractiveness in the region originates in its closeness to the natural resources that in the end generate value for national and international business through the value chain: oil and gas, aquaculture, production of power (hydraulic).

World leading technology within subsea and aquaculture is well established in the region.

Definitions:

Ocean View (Venture Capital) - Investing in pioneering technology companies that power a more sustainable ocean economy.

Bergen Teknologioverføring (BTO) - BTO works to develop innovation and commercialisation of research in the Bergen region. We are the regional centre of expertise for innovation and commercialisation of research results.

KABIS - The aquaculture industry, research and education are gathered in the large-scale project "Capacity lift for sustainable and innovative seafood production". KABIS addresses business-related issues. Led by NORCE.

Sentre for forksningdrevet innovasjon (SFI) – The goal is to contribute to enhanced innovation capacity and increased value creation in Norwegian business and industry through long-term research.

Oppfinnerprisen – is a price that focuses on businesses in Hordaland with a great growth potential, led by BTO, Innovation Norway and Hordaland County Council.

THEME: POLICY

What is the basis of policy in the region? Where does the policy come from?

	Regional	National	European
RTD	Hordaland's Regional Action Plan for Industry and Societal Development 2018-2019 (HNH): Prepared by the county with support from a resource group consisting of several public, private and academic entities. It contains main strategies for entrepreneurship and innovation, relevant expertise, community development, as well as industries with special focus, such as blue and energy. MobiFORSK: A 3-year project (2017-2019) aiming to mobilize for research-based innovation in the companies. The goal growth and a more innovative business environment. Priorities are: -Sustainable growth within the bioeconomy - sustainable production of seafood and agricultural products and other utilization of biological resources such as new use of waste, bioenergy and new ingredients. -Technology development through industry-intensive connections. Help existing technology and expertise in the region benefit from new and smart ways which ensure a robust growth in existing and new industries RFF – Regional Research Fond West is an initiative that aims to strengthen development and innovation in the western part of Norway by supporting regionally prioritized research topics.	The individual development strategies from the different ministries in the government The Research Council of Norway. A Norwegian government agency responsible for awarding grants for research as well as promoting research and science. It also advises the Government in matters related to research, and is subordinate to the Norwegian Ministry of Education and Research The implementation of Agenda21 for Norway (RTD). Agenda 21 is a non-binding action plan of the United Nations with regard to sustainable development. Innovation Norway: Innovation Norway is the Norwegian Government's most important instrument for innovation and development of Norwegian enterprises and industry	Horizon 2020: Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness.
Innovation	Hordaland's Regional Action Plan for Industry and Societal Development 2018-2019 (HNH). See above. MobiFORSK: See above The Norwegian Innovation Clusters programme with the levels Arena, NCE and GCE is a collaboration between Innovation Norway (State-owned company promoting industrial development), the Industrial	SIVA: The Industrial Development Corporation of Norway or SIVA is a Norwegian state enterprise responsible for government investment in incubators, science parks, industrial parks and real estate through partial ownership of other companies.	Horizon 2020: see above

	Development Corporation of Norway (SIVA) and the Research Council of Norway.: -Arena: The clusters in the Arena programme spark increased innovation and collaboration between businesses, research and educational environments, and the public sector. -NCE: The Norwegian Centres of Expertise (NCE) help to target, improve and accelerate ongoing development processes in Norwegian clusters. -GCE: The Global Centres of Expertise (GCE) are world-leading clusters with potential for growth in international markets.	Innovation Norway: See above The Research Council of Norway: See above. Kompetansereformen for continued education and technical schools aims to no one become outdated and being able to remain in the workforce longer. The individual development strategies from the different ministries in the government	
Enterprise	Hordaland's Regional Action Plan for Industry and Societal Development 2018-2019 (HNH). See above Hordaland's funding to Innovation Norway with prioritized industry areas The cluster program/Norwegian innovation clusters. Arena, NCE and GCE clusters. RFF – Regional Research Fond West is also applicable for enterprises.	Innovation Norway. See above Norwegian Innovation Clusters. See above Katapult Ocean Accelerator: Invests in, and scales startups with positive impact on the ocean through the Katapult Ocean Accelerator fund. Builds a global ecosystem of startups, corporations, organizations, research institutions and thought leaders. Ocean Innovation Norwegian Catapult (OINC): a national test, simulation and visualization centre for efficient prototype development and verification of new solutions for blue growth and green transition in the sea industries. The Research Council of Norway. See above The individual development strategies from the different ministries in the government.	
Entrepreneurship	Hordaland's Regional Action Plan for Industry and Societal Development 2018-2019 (HNH). See above Etablerarsenteret: The establishment center offers entrepreneurship courses and advice to entrepreneurs, start-ups and contractors. It is a public offer to entrepreneurs.	Innovation Norway SIVA: The Industrial Development Corporation of Norway or SIVA is a Norwegian state enterprise responsible for government investment in incubators, science parks, industrial	

	financed through a splicing team between Hordaland county municipality and 22 other municipalities in Hordaland. Incubators and business parks.	parks and real estate through partial ownership of other companies The individual development strategies from the different ministries in the government.	

What are your views on the effectiveness of these policies?

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
RTD	Provide access to programs and support functions on different levels. Such as Horizon2020 helpdesk, Clusters with support functions and MobiForsk. Provide control over funding and priorities based on the regional development. Provide knowledge about the region's development potential. Positive development through the years in R&D spending in private and public sectors	Statistics show that not enough businesses make use of opportunities to apply for RTD funding for development. Too much bureaucracy, and because of that, there is too much paperwork. For example: reporting. There are too many schemes/programs to choose from, and it's difficult to get an overview and to choose the right scheme for the business. The schemes are too long and complicated, which is frustrating for the businesses. R&D industry spending in Vestland is one of the weakest in the country.	More businesses can benefit from using systematic RTD. More effective and digital ways regarding reporting. A process is currently taking place for reviewing the application process for funds. The goal is to make the process simpler and more organized. The possibilities arising from the fusion with Sogn og Fjordane.	If the business community does not participate in development programs or projects, they might not keep up with the development, especially concerning innovation and skills. There are less projects because of poor user-friendly application processes/systems Indoor projects lack the involvement of external actors and can miss out on certain technological developments.
Innovation	There are many offers available, it is important to use them. There is networking and partnerships of different sorts, for example between clusters. There has been established many clusters in the region which have individual businesses as members.	It is difficult to find the right instruments for specific challenges. Limited information regarding the different incentives. Many businesses and workers lack the right skills concerning future challenges, which can weaken innovation.	Innovation happens in all industries and for all types of businesses, both public and private. It must be arranged for incremental and radical innovation. There is a lot of potential in existing businesses, which	See RTD above.

	Different organisations working together in partnerships. Focus on what problems we need to solve on a regional, national and European level. Positive development through the years in R&D spending in private and public sectors.	R&D industry spending in Vestland is one of the weakest in the country.	needs to be addressed. Similar to what has been written about opportunities in RTD. See above. The possibilities arising from the fusion with Sogn og Fjordane.	
Enterprise	Innovation Norway's system works. It has the ability to unite different companies which will create synergies within an industry. Hordaland has experience with cluster programs and catapults.	Innovation Norway does not finance all businesses. They require a specific level of innovation which is not always attainable by many enterprises/ entrepreneurs. This leads to some businesses not fulfilling the requirements and falling out. Many different programs available. Confusing for the users. Similar clusters on a national level can create negative competition between them and lead to loss of members. There is need for coordination. Clusters seem fragmented abroad, as they are stationed in different parts of Norway. The effort is fragmented	Increased cooperation across clusters. Gather similar cluster environments in Norway in order to facilitate cooperation with international clusters. Increase international cooperation. The possibilities arising from the fusion with Sogn og Fjordane.	Some good ideas might become undeveloped because they do not manage to convey IN's required degree of innovation. Too many NCE, GCE and arena projects.
Entrepreneurship	Innovation Norway's system works. There are other alternatives to Innovation Norway that help those who do not meet their requirements, such as establishment support from Hordaland County Council. Etablerersenteret (see above) is available in counties and municipalities.	Many programs cover the same entrepreneurial needs. It is difficult to go through the different actors and instruments. The services need to be organized, gathered and concretized. There is a tendency to centralization in Bergen. Different views how negative this might be. Small municipalities might not get the same benefits as centralized entrepreneurs.	Spin-offs from established businesses, perhaps along with existing employers. The possibilities arising from the fusion with Sogn og Fjordane.	Some good ideas might become undeveloped because they do not manage to convey IN's required degree of innovation. Service providing ideas are more prone to not meeting IN's requirements. Skills as a barrier for further development of entrepreneur businesses.

	Incubators SIVA (see above) There is a lot of capital available for start-ups.			The support from Innovation Norway might not be sufficient throughout the life of a company.

General comments/Observations *(Policy)*:

Hordaland's Regional Action Plan for Industry and Societal Development 2018-2019 (HNH) provides the basis for the future development of the county. It is anchored in other longer-term plans and involves in its creation stakeholders from private, public and academic sectors. HNH includes among others, the region's main strategies for innovation and entrepreneurship, and skills and competence. Projects in the county are prioritized according to their relevance for HNH.

The next plan will include the region Sogn og Fjordane which will fuse with Hordaland from January 2019.

THEME: TRIPLE HELIX

How would you define the level of engagement between the Triple (Quadruple) helix partners in the region?

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Government → Industry	The government is capable of supporting the industry with funding, competence and education. There is a good connection between the government and the industry. There are working groups where the two stakeholders can meet, such as the restructuring committee (omstillingsutvalget).	The government needs better input and feedback from the industry for establishing the right support mechanisms at the right timing. The role the industry takes is vague. It is difficult to make them commit to anything without the use of laws. This is not ideal for developing mutual cooperation.	The government can arrange skill development programmes before the industry asks for them through instruments such as: -Kapasitetsløft (Capacity Boost): 80 million NOK distributed to seven long-term projects (National level -25 mill. Vestland) that will strengthen research capacity through education in areas that are of particular importance for the business sector in these regions. -SFI (The Research Council of Norway): strengthens innovation and develops expertise at a high international level through investing in long-term research in close cooperation between R&D-active companies and prominent research environments.	If the industry often refrains from using the offers they themselves have asked for, it can undermine the motivation and willingness of other stakeholders.
University (HEI) → Industry	There is a tight collaboration between HEI and the industry within Blue and Energy sectors.. The marine cluster at Marineholmen brings together ground-breaking marine research and business environment. The ambition is to kick-start the blue shift. The university of Bergen is partner in all sea clusters	Slowness in the system to meet educational needs. It takes time to get new programmes approved. Even though there are good connections between the two stakeholders, the industry is often introduced late in the process of developing new educational programs.	Expand the collaboration to new disciplines to increase the spectrum of possible innovations. There should be incentives for promoting the creation of spin-offs and/or start-ups originated by the partnership between HEI and industry	The available funding is used for different purposes by the two stakeholders: HEI wants publications, while the industry wants market oriented innovations. There are no incentives for synergic collaboration.

	(blue clusters) in the region. The Royal Norwegian Naval Academy, Vestlands The following HEI have bachelors and masters degrees within Ocean Technolgy: - The Royal Norwegian Naval Academy. -The Western Norway University of Applied Sciences. -The University of Bergen	Projects that are developed based on pure research and that are not necessarily rooted in the business sector.		
Government →University (HEI)	The government has begun to make new demands to the HEIs	The connection between the government and higher education institutions varies on some areas. It is good on some areas and worse on other areas.	Despite universities being large and powerful, the government needs to take a visible role as a commissioner (according to regional needs) and as a facilitator. The government has competence that can be used in these processes. Government incentives and measures for HEIs for promoting the commercialisation of research results.	Too much intervention and influence from the state in the university environment can affect the creative processes in the universities.
Government →University (HEI) →Industry	The cluster program (GCE; NCE and Arena). It is a strength to have these programs, it opens for plenty of opportunities. The Competence Forum Hordland (Kompetanseforum): The plan will create a better balance between supply and demand when it comes to competence and labor. This will be done through a binding cooperation between the business sector, the public sector and the educational actors. Collaborations and partnerships between these stakeholders are formalized	Too many clusters and arenas to choose from. Confusing for stakeholders. Difficult to have a comprehensible overview. There are too many contact points too. The large quantity of arenas diminishes the effectiveness of the solutions and the quality of the results.	There is a possibility to gather and group different types of stakeholders together in order to reduce the level of confusion. The government may help the universities with involving SMEs in a better way, not just large businesses with own R&D and financial power.	Lack of collaboration because of too many actors. Consequently they give up. Lack of motivation

Government→University (HEI) → Industry → Civil Society	The government can commission special missions to the clusters to coordinate R&D industrial commercial plans that provide a benefit, not only to the industry but to society as well.	The civil society opinion should be better taken into account by the other stakeholders. These are signals that reflect the reality and needs of the region (ex. Movements against salmon farming contaminating the fjords seabed)	A closer dialogue between these stakeholders can provide a basis for market-oriented innovations. Mulighet som sterkere samarbeid med «folkebevegelser» slik som bærekraftig liv. Applying the MIT 5 Stakeholder Model (Helix) in order to separate the industry in corporations and smaller actors (entrepreneurs) and include risk capital (investors). This will provide a better picture and analysis tool for the environment in the region.	The negative public opinion related to farmed salmon and new energy (windmills) may affect developments. Misleading points of view in the information material available to the public (oil & gas debate, salmon debate, windmill debate) Important that the real facts are established and spread.

General comments/Observations *(Triple (Quadruple) Helix):*

The government is strong and capable of providing funding and support to all other stakeholders in the helix. Each organizational helix stakeholder (Government, HEI and industry) is highly competent within their corresponding area of influence. Unfortunately the goals between HEI and industry is not necessarily aligned, which undermines the general growth and innovation results for the region. The clusters, as well as incentives from the government can be a factor to unite goals and final purposes. The opinion of the public must be taken into account more seriously, as it affects policy. However the facts on which the public builds its opinion need to be scrutinized, clarified and spread.

Applying the MIT 5 Stakeholder Model (Helix) in order to separate the industry in corporations and smaller actors (entrepreneurs) and include risk capital (investors). This will provide a better picture and analysis tool for the environment in the region.

THEME: ENTREPRENEURIAL ENVIRONMENT (1 OF 3)

Describes the region's entrepreneurial environment

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Overview	There are few barriers for starting a business in Hordaland and numerous public and private mechanisms to support entrepreneurial initiatives through the different development cycles. These include: -The start-up process -Development of entrepreneurial skills -Funding and financing -Growth -Internationalisation Since 2009 the number of start-up has increased every year (Vestlandet). The number of start-up has been the highest in history during the last 3 years.	Too many mechanisms appear confusing to users. It is difficult for users to choose the right mechanism for the right stage in their specific entrepreneurial process. Benefits from the large offer of mechanisms is not optimised. The investor environment in other regions is more attractive. These leads to reduced investment in the region and hence reduced entrepreneurial initiatives. Although entrepreneurship is included in many educational programs at different levels, it is not a priority. The main focus is to be able to get a job, not to become an entrepreneur.	A better organization and overview of the different mechanisms at different phases and aspects of the entrepreneurial process would clearly yield better end results. This will also enable the optimised use of resources which will opening for even better support and final results. Entrepreneurship specifically related to new aquaculture production methods has been raised as an evident opportunity for the coming years.	The fall out of investors and entrepreneurs in the region due to the weaknesses explained here. The lack of drive from some entrepreneurs that get "comfortable" with excessive support makes them less competitive in environments outside Hordaland and/or Norway. Cultural habits and the lack of entrepreneurial focus to the young population can limit the regions entrepreneurial output in the future.
Ease of starting a business in the region	Relatively easy to start a business in Hordaland. There are numerous available mechanisms that provide some sort of support: coursing, grants, loans, and guidance. These mechanisms are inexpensive. The whole system is rigged to ease the process of starting a business in Hordaland.	There are too many support mechanisms available, covering different aspects of entrepreneurship. This makes the task of finding the right solution seem complex for many entrepreneurs: -Too many programs -Too many courses (start-ups) -Competition between public and private sector.	Better coordination to the users about support mechanisms from the different suppliers. Better information regarding the "first line support" mechanisms that show the way forward in the process of starting a business in the region.	Some entrepreneurs give up easily because they cannot find the right support mechanism for their needs; even it exists. The apparent complexity due many available support mechanisms stamps the system as "difficult". Some entrepreneurs use more resources by hiring consultants to do conduct the establishment process for them.

Enterprise supports available for start-ups	At least 20 different establishments in the region anchored in both private and public sectors. Some of them include: -Etablerersenteret -Bergen Technology Transfer (BTO / VIS) -Industriutvikling Vest -NCE Seafood Innovation -GCE Ocean Technology -Innovation Norway -Impact Hub Bergen -Support from private companies (BKK, DNB,SPV) -Ungt Entreprenørskap -Atheno -Gründerparken Vest -Bjørnafjorden gründerpark -Bjørnafjorden næringspark -Bergen næringsråd -Vest næringsråd -Bjørnafjorden næringsråd -NAV -Skatteetaten -Marineholmen Makerspace -Connect Vest-Norge	It is time consuming for entrepreneurs to find the right instrument that covers their specific needs. Difficult to group and keep a useful overview of these mechanisms updated.	Group, classify, and update these instruments for easy access and understanding by users. There is clear need for grouping and classifying all these programs and instruments. Having a first line service with the right overview will easy the task of finding the right mechanism for start-ups.	Time consuming for entrepreneurs to find the right instrument. Entrepreneurs might give up because they do not know where to go or what to look for. Reduced number of start-ups / successful start-ups.
Enterprise supports available for growth	Several effective support mechanisms for growth. Many of them public. Organized overview easy to understand by the users. Examples include: -Connect Vest-Norge -Sector clusters -Katapult Ocean (Accel.) – from Oslo but many clusters in Hordaland collaborate with them. -Ocean Industries (Accel.) -Start-up lab (Accel.) -Accel.no (supported by Hfk). Free training for businesses within growth. -Innovation Norway (Global and international growth)	Some of these mechanism to support growth are very expensive. Especially from the clusters (private) and from Innovation Norway (public)	There is room for improving the coordination of these instruments so that users understand them better and use them more effectively. There is healthy competition among providers, so that the quality of the services improves for the users.	The price can scare away potential risk averse entrepreneurs and hinder growth.

THEME: ENTREPRENEURIAL ENVIRONMENT (2 OF 3)

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Enterprise support available for internatio-nalisation	Several private and public effective support mechanisms for internationalisation. Examples include: -Innovation Norway -Clusters (travel support) -GIEK (Export Credit Norway) -Bergen Technology Transfer (BTO / VIS) – Patents -DNB Ocean Industries The offers are good for SMEs. Larger enterprises do not get as much money. This improves the SMEs chances for internationalization.	Timing of the support provided related to the life cycle phase of the actual companies is not addressed per today, to the best of our knowledge. Coordination of the delegations promoting international investment (Invest in Bergen) is not clear.	Timing of the support provided related to the life cycle phase of the actual companies is not addressed per today, to the best of our knowledge. Addressing this issue will optimize the use of resources increasing its availability to other users and the chances for successful internationalisation.	Un-balanced benefit from the different possibilities Too much financing and support affects the effectiveness of ideas/companies. Norwegian businesses have "pillows under their arms", because they get a lot of support and funding. This is perceived as excessively self-confident firms. Too much funding keeps businesses artificially alive and comfortable. When they reach the international market they are not well prepared and may fail. Lack of insight into international environments and markets.
Availabili ty of finance for start-ups	As in other regions in Norway, it is relatively easy to have access to capital at a relatively low interest rate. This includes banks, but also other mechanisms such as: -Etablererfond Bergen region (50.000 NOK) -Innovation Norway -Hatch Blue Accelerator (technology for seafood). Based in Bergen because this is the capital of seafood. -DNB Ocean Industries (specific loans to blue sector)	Not a strong investor environment as in other Norwegian regions. Weak investor environments compared to Oslo.	The BlueTech investment fund is being built (OceanView.VC). It will make between 300-500 million NOK available to invest in the blue sector. DNB (bank) – gathers together actors in Blue sector.	Start-ups choose to try other regions with larger investor environments. Especially the Oslo region is a magnet for start-ups.
Availability of finance for growth	As in other regions in Norway, it is relatively easy to have access to capital at a relatively low interest rate. This includes banks, but also other mechanisms such as: -Etablererfond Bergen region (50.000 NOK) -Innovation Norway	Timing of the support provided related to the life cycle phase of the actual companies is not addressed per today, to the best of our knowledge.	Timing of the support provided related to the life cycle phase of the actual companies is not addressed per today, to the best of our knowledge. Addressing this issue will optimize the use of resources increasing its	Relatively small investor environment can limit growth, or force companies to move to other regions.

	-Hatch Blue Accelerator (technology for seafood). Based in Bergen because this is the capital of seafood. -DNB Ocean Industries (specific loans to blue sector)		availability to other users and the chances for growth.	
Availability of finance for internationalisation	Several private and public effective support mechanisms for internationalisation. Examples include: -Innovation Norway -Clusters (travel support) -GIEK (Export Credit Norway) -Bergen Technology Transfer (BTO / VIS) – Patents -DNB Ocean Industries	Timing of the support provided related to the life cycle phase of the actual companies is not addressed per today, to the best of our knowledge.	Timing of the support provided related to the life cycle phase of the actual companies is not addressed per today, to the best of our knowledge. Addressing this issue will optimize the use of resources increasing its availability to other users and the chances for successful internationalisation.	Too much financing and support affects the effectiveness of ideas/companies. Norwegian businesses have "pillows under their arms", because they get a lot of support and funding. This is perceived as excessively self-confident firms. Too much funding keeps businesses artificially alive and comfortable. When they reach the international market they are not well prepared and may fail. Lack of insight into international environments and markets.

THEME: ENTREPRENEURIAL ENVIRONMENT (3 OF 3)

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Entrepre-neurship education at primary level	Ungt Entrepenørskap Hordaland: Public administrated organization that provides the development of skills within value creation and entrepreneurship among the young. Regional focus. Puts together the youth, the academics, and the industry. Dale Oen Experience: A private organization that aims to provide real life experiences to youth and industries. Creates	Not all schools and not all students get access to these few alternatives. Entrepreneurship education is limited as in most cases it incorporated into other subjects, not a subject of its own. The educational focus at this stage is more on working for a company rather than starting your own company.	Increase focus and mind set on start-ups earlier in the education path. Work with the cultural barriers. Failure should not be seen as a bad thing, but rather a necessary part of the process. Learn to accept failure and use it as learning experience. Keep going. Education about the understanding of failure should be in the	Mind set of starting own company/idea is not developed early enough. Most young people prepare for working for someone, not for starting their own businesses. Not addressing the cultural failure issue will limit the entrepreneurial output of the region in the future.

	expertise through special designed activities.		program for all educational levels. How to choose an educational path should also be a part of school curriculums at this level.	
Entrepre-neurship education at second level	Ungt Entrepenørskap Hordaland: Public administrated organization that provides the development of skills within value creation and entrepreneurship among the young. Regional focus. Puts together the youth, the academics, and the industry. Dale Oen Experience: A private organization that aims to provide real life experiences to youth and industries. Creates expertise through special designed activities.	Not all schools and not all students get access to these few alternatives. Entrepreneurship education is limited as in most cases it incorporated into other subjects, not a subject of its own. The educational focus at this stage is more on working for a company rather than starting your own company.	Make entrepreneurship less intimidating Important to show youths that it is okay to fail, and be willing to try again – culture. Establish an apparatus that helps the businesses that fail. Help them understand how they failed and how to keep going. UDV (utdanningsvalg) is a curriculum subject that helps youth in choosing a carrier path. There is room for increasing the entrepreneurship content in this subject.	Janteloven (Law of Jante): a code of conduct known in Nordic countries, that portrays doing things out of the ordinary, being overtly personally ambitious, or not conforming, as unworthy and inappropriate. This affects especially young people and poses a cultural barrier for entrepreneurship, innovation and creativity.
Entrepre-neurship education at higher level	Master programs as well as single courses are offered by different higher education institutions in the region: -NHH (Norwegian School of Economics): -HVL (Western Norway University of Applied Sciences) -UiB (University of Bergen) -BI (Norwegian Business School)	The entrepreneurship related and courses are not compulsory in all business related study programs. It is up to the student to incorporate them voluntarily.	UiB is now working towards including entrepreneurship in all their programmes.	All those students who per today are finished with their degrees and did not receive entrepreneurship skills.
Entrepre-neurship education for Entrepre-neurs	There are several support mechanisms that offer courses within entrepreneurship: -Etablerersenteret -Atheno -Business parks -Incubators (programs not courses) -Innovation Norway	If you are not part of an entrepreneurial environment you don't have knowledge, nor access to these instruments. This is a weakness as the entrepreneurs from the districts have a clear disadvantage compared to the ones from Bergen.	More funding for this sort of education may attract more entrepreneurs who will be better prepared for the challenges that entrepreneurship brings.	Time is a constraint for entrepreneurs. Going to courses in not their priority and the miss out on important entrepreneurial skills which may be relevant for the success of their businesses/start-ups. The coverage of region is not balanced. There are many entrepreneurs out in

	-Continued education programmes from universities (BI and NHH) -Accel Energy (accelerator and growth)	Entrepreneurs have challenging time constraints. The offer is there, but not used enough.		the districts which are not included in the same way as those based in Bergen.

General comments/Observations (*Entrepreneurial environment:*

The entrepreneurial environment in Hordaland is supported by a strong array of diverse support mechanisms within the aspects of education, financing, funding, growth and internationalisation among others. These offers come from private, public and academic sectors. However, the offer is so overwhelming that entrepreneurs often get confused and/or don't have the time to select and use the solution that fits their needs best. Herby, the potential output of the support mechanisms is not optimised.

The abundance of support may create a false sense of security for some entrepreneurs. Problems can start when the support is no longer there, or the entrepreneurship moves to more competitive environments. The entrepreneur has been shielded by the support and is not competitive on its own, or in other environments.

Entrepreneurship is offered as part of the education of youth from primary to higher education. However there is room for giving entrepreneurship a bigger role in the different educational programmes.

From a cultural point view, the region is affected by the fear of failure and the Law of Jante. This affects especially the young population who are less keen to start an enterprise.

THEME: INNOVATION ECOSYSTEM

How would you describe the region's innovation ecosystem?

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Overview	The innovation ecosystem is strong with competent R&D institutions, strong and organized support from the government and regional tailor made programmes that address regional needs.	The R&D environment has different goals than the industrial environment. The efforts are not coordinated.	Coordination of efforts between R&D and industry environments will lead to better outcomes for the region.	Not addressing the lack of common goals and interests between the R&D and industry environments may lead to further separation of ideals and goals.
What is/are the mechanisms for doing research in the region?	Many strong R&D environments. Access to regional, national and international R&D progammes. The mobilization program «MobiFORSK» will help bring the industry and R&D better together. A 3-year project (2017-2019) aiming to mobilize for research-based innovation in the companies. The goal is growth and a more innovative business environment. Priorities are: -Sustainable growth within the bioeconomy - sustainable production of seafood and agricultural products and other utilization of biological resources such as new use of waste, bioenergy and new ingredients. -Technology development through industry-intensive connections. Help existing technology and expertise in the region benefit from new and smart ways which ensure a robust growth in existing and new industries The Research Council of Norway (NFR) government agency responsible for awarding grants for research as well as promoting research and science. It also advises the Government in matters related to research. The council is very active. The clusters (NCE and GCE) have R&D coordinators or innovation mediators.	There is contact between R&D and he industry, but R&D are not always good enough at bringing the industry into the R&D process early enough.	Better connections between the different stakeholders: R&D (universities) and industry, innovation mediators and MobiForsk, NFR's regional representatives.	Other national environments outside of Hordaland are very strong. These may seem more attractive to the region's businesses and industry (SINTEF and NTNU).

	There is a strong business environment compared to other regions.			
What is the commercialisation process for research in the region?	We have two catapult centres in Hordaland which is unique advantage compared to other regions. They are national, but both are stationed in Hordaland (Stord Sustainable Energy + Bergen Ocean Innovation). Easy to utilize for those in the region. These are 2 of a total of 5 national centres. Vis Innovation: (VIS/BTO) contributes to solve societal challenges efficiently, making sure that knowledge and ideas quickly turns into benefits. Researchers, entrepreneurs and established businesses contact VIS with challenges and ideas that we further develop together.	Weak connection between R&D, industry and the academia.	Many research results could be commercialized if there had been a better connection between R&D and industry.	Weak connection between R&D, industry and the academia. The success rate from idea to commercialization is reduced and further affects this.
How easy is it for industry to engage with research centres?	The clusters are connection points between industry and research centres. It works relatively well. The clusters have the industry contact and it works well. Relatively easy process.	The level of interest that R&D institutions have in industry's issues varies. Only a fraction of the R&D environments is available for industry.	Create common arenas between industry and R&D, where the industries can tell about their challenges.	The R&D environment focuses on how «good» they are and what they are capable of doing. They do not consider the industry's needs as a priority.
How easy is it for HEIs to engage with research in industry?	Same as above	Same as above	Same as above	Same as above

General comments/Observations (*Innovation ecosystem:*

The innovation ecosystem in the region is strong but not the strongest perceived in the country. The commercialization process is favoured by the fact that 2 of 5 national catapult centres are located in the region, benefiting innovative companies in the region. Better solutions and commercialization of ideas could be reached if the R&D environment and the industry could find common goals and improve their cooperation practices.

THEME: CLUSTERS AND NETWORKS (1 OF 3)

Describes clusters and specifically energy and blue clusters in the region

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Overview	There are two government funded well organized clusters in the region that cover the regions blue and energy sectors. They are considered centres of expertise within Ocean Technology and Seafood Innovation. They combine industrial players, educational institutions, and public innovation institutions.	Too many clusters competing with each other instead of cooperating. Members may get confused.	Increase collaboration and coordination between clusters to optimize the use of available resources and the support provided to the industry. Cluster funding will stop in 2025. Start planning how to go ahead having in mind the shift to greener production alternatives.	The role of NCE and GCE clusters which are government funded but have a commercial role. The risk of companies leaving clusters because they find the cluster environment expensive, confusing and unnecessary.
Support from government (clusters)	The GCE programme is owned by Innovation Norway, the Industrial Development Corporation of Norway (Siva) and the Research Council of Norway. The programme has a ten-year perspective and is financed by the Norwegian government. The government funded NCE cluster program supports activities that will contribute to sustainable innovation by releasing and reinforcing collaborative development activities in the cluster, to increase the cluster´s	The program supports too many similar clusters. Many work with the same things (for example the GCE clusters) and compete against each other for members. Difficult for businesses to recognize whom they can approach. Expensive membership if businesses are part of many clusters. The programmes have a limited funding life from the government: 10 years (2015-2025)	Need to start planning on the next phase for the GCE and NCE programmes. «Sea strategy», meaning to «live from the ocean». This is strategically rooted and the future seems optimistic for blue and energy in the region. Industrimeldingen: outlines the opportunities and challenges Norwegian industry is facing, and describes the government's policy for meeting this. Topics in the report are restructuring within sustainable frameworks, meanings of access to capital and access to expertise and the importance of research, innovation	What to do when funding stops. Resources are limited to a time frame for the different clusters. The way forward needs to be addressed. Difficult for GCE to be commercial actors with support from the government. The programmes have a limited funding life from the government: 10 years (2015-2025)

	dynamic and attractiveness, and to increase each individual company's ability		and technology development. That the financial funding is anchored in political strategies. Innovative and green public procurement. (for example electric ferries, hydrogen vehicles and BIR – garbage disposal in Bergen) Advantages for electric cars. Regulations to move to cleaner production (Bergen harbour) Public regulations that lead to the industry stepping up and delivering what the government needs	
Nature of cluster participants	Good networking for participating companies. The whole value chain in blue and energy is represented. Not geographically excluding. There are possibilities for all businesses, small and large.	Many similar clusters, which creates confusion among businesses. Expensive memberships.	Similar clusters could join together / merge, to provide a better alternative to industry. Innovation Norway is reviewing this opportunity now, focusing on "superclusters", such as those in Canada. (this allows for SMEs to come closer to larger businesses, make it cheaper for smaller businesses) There is possibility for better collaboration.	Risk of losing partners due to many similar clusters (confusing). Expensive memberships. The mandate is the same for all clusters, however they way to solve problems is not the same. Administrative burden for businesses to be members in several clusters. Businesses can opt out of clusters if they feel that the clusters are too similar Different rules for different clusters, e.g some have to pay tax whilst others do not.

THEME: CLUSTERS AND NETWORKS (2 OF 3)

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Level of cooperation between cluster participants	Long experience with clusters in Hordaland, the businesses have learned to cooperate and know each other well. They have built trust. It takes time for the system to work All businesses are dependent on each other in the value chain. The Norwegian business model has a flat structure, making it easy to collaborate. It allows the businesses to come close to the decision-makers, accessibility. Hordaland is ahead when it comes to technology within aquaculture and sub-sea. Example to the industry	Competition for funding projects is tough. Many applicants will not receive funding. Competition for contracts is tough too. There are a lot of competitors, many good projects are lost due to competition. Businesses might want to keep their ideas to themselves	That the cluster takes a helicopter view to provide insight into the industry to partners. The cluster administration can take more control and provide an overview, which allows the partners to see what happens in the future and give insight – e.g. "fyrtårn prosjekt" (digitalisation and blue). Potential for competitors to work together –opens up many possibilities Big stakeholders can bring SMEs as partners in projects/contracts. Build easier/less complicated cooperation systems. This is currently under development.	Loss of members because the message/strategy from the clusters is not properly communicated. Spreading of rumours, due to misunderstandings. Change of names. Proper communication strategy required.
Level of Internationalisation of cluster participants	Large multinationals are part of the clusters. SMEs are included as part of the value chain. Can use the multinational's instruments Innovation Norway Global Growth available for	Difficult for SMEs alone to come into international markets. They depend on Innovation Norway, the cluster, and on big stakeholders.	Sharing of international experiences from participants has a positive effect on other companies. Increased focus on having seminars e.g. about cultural understanding in an international setting.	Cultural differences (do's and don'ts). Level of integrity of stakeholders in/and from other countries. Risk of losing competitive advantages to international competitors due to outflow of ideas. Outsourcing of Norwegians companies

	businesses through the clusters.			
Level of integration of the cluster within the regional innovation system	Complete integration of the clusters in the innovation system. Cluster to cluster collaboration, collaboration with other regions.	Too much integration can lead to recirculation of the same ideas, a narrow mind-set.	Cluster to cluster collaboration is important to reduce the effect of too much integration. Big geographic network.	From an international perspective, we can be seen as nationally fragmented. Different ideas focus on different sectors and to outsiders we seem fragmented. Reduced innovation capacity due to re-circulation of the same ideas.
Influence of the cluster on R&D activities	Most important actors within R&D as partners (SINTEF, NTNU, UiB, HVL etc.) Those actors needed are already cooperating. NMU: The Norwegian Marine University Consortium (NMU) is an institutional cooperation agreement among universities in Norway with considerable marine and maritime profile. NMUC is Norway´s representant of the higher education sector to the European Marine Board.	Regional competition on initiatives.	Complementary partners (UiB, NTNU) can increase innovation capacity. Both are approaching blue. Alliance between universities and NMU (9 universities).	Different agendas and pace for the different actors is not synergic (Industry vs. Universities) The industry and the universities are fundamentally different, and somewhat not compatible. The reward system for universities are through publications, and is not in line/pace with the industry (results).

THEME: CLUSTERS AND NETWORKS (3 OF 3)

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Overview	Diversity and affiliation make networks strong within their own geographical locality. Banks are normally members and provide some funding.	Entirely private funded. Their effect is limited to the local geographical area. Neighbouring networks compete with each other.	Collaboration between networks. Measure the effects. Involve the public sector more	Credibility of the effectiveness of networks is at stake. Need to document positive results.
Support from government (networks)	Can apply for project support from government in some cases.	No financial funding.	Public entities could be more involved (Municipalities)	Without public involvement the main purpose of these networks may change through time benefiting only some companies.
Network participants	Diversity in member companies. All sub regions have their network which is relevant for their industries: Ex: -Bergen Chamber of Commerce and Industry -West Chamber of commerce (Island of Sotra) Can apply for project support from government.	Payed membership required Funded only by industry (members) Too many networks, cause confusion Networks compete with each other. They do the same in parallel ways.	The networks have potential for focusing more on innovation and need to go from intention to action. They have the potential to unite public and industry sectors in their respective localities. Fusion of geographically close networks may increase effect on industry. Collaboration vs. competition.	Networks seem to have lost their original purpose through the years. There is a slight reputation that these networks are becoming more a social society where the certain member companies are favoured according to the status of their owners.
Internationalisation of the networks in the region	Networks bring businesses on trips abroad.; They get to know each other and meet potential international partners. The regional banks are part of the networks. They are very active and provide funding to businesses in the form of prices and grants.	Internationalization activities are expensive, normally not funded, and the goals/results are normally not measured. The businesses have to pay themselves for participating	Funding from financially strong actors, such as banks could be higher. Establishment of big international corporations can affect SMEs in the networks. International businesses can make	Establishment of big international corporations can affect SMEs in the networks by outcompeting them.

			smaller businesses subcontractors	

General comments/Observations *(Clusters and Networks):*

There are two main clusters in the region both funded by the national government and both considered centres of expertise within their respective sectors (GCE Ocean Technology and NCE Seafood). The effects of these clusters in the region are far more significant in industrial innovation and development than the effects from the networks. The networks are more local private initiatives with little focus on innovation.
Too many clusters on a national level may be causing destructive competition among them and confusing the industry. There is room for better cooperation and coordination among clusters.
Funding will run out in 2025 and a new phase for this programmes needs to be planned.

THEME: REGIONAL TECHNOLOGICAL DEVELOPMENT (RTD)/INNOVATION FUNDING

Describes the funding measures that support RTD in the region

	Strengths - Capacities & capabilities	**Weaknesses** - Issues that need to be addressed	**Opportunities** - Potential for innovation/S3 focus	**Threats** - Constraints to be addressed
Overview				
Funding Instruments available for entrepreneurs	Etablererfond funded by Hordaland County Council. 50.000 NOK easily available. The target group is entrepreneurs and new businesses that fall outside Innovation Norway's scheme of "establishment grants to entrepreneurial companies with growth ambitions and a business idea that represents something significantly new in the market". Innovation Norway has funding for some more high technology (high-tech) ideas. Grunderhub: Gründerhub Bergen is facilitated by Bergen Teknologioverføring (BTO), one of Norway's largest entrepreneurial environments with more than 100 active companies co-located at Marineholmen and Media City Bergen. BTO has various offers for entrepreneurs in start-up and growth phases. Annually 15 different programs are run adapted to type of industry and phase. StartupLab: typically invests in the first equity round, in the range of $ 100-300K. We ask for 10-15% equity in return. Provide support, but entrepreneur remains in charge of his business, All the legal stuff is taken care of by them. GCE Ocean Technology	Innovation Norway has funding for some more high technology topics with a certain degree of innovation. Coordination and overview in order to be able to choose the right instrument.	Increased coordination and overview in order to choose the right instrument There is funding and capital, and there is potential for it to be used	Coordination and overview in order to choose the right instrument. The funding instruments are perhaps not sufficient enough. There is not enough funding for the whole life cycle for a business.

Funding Instruments available to support ICT businesses	Innovation Norway The Media Cube (incubator): NCE Finance Innovation incubator (Fintech room): is the national Norwegian fintech cluster. The goal is to make finance easy and to export enabling services and technologies to the world. It is an association and fintech innovation cluster of banks, financial companies, insurance companies, start-ups, investors, tech companies, academia and research institutions working on the financial services and solutions of tomorrow.	Only Innovation Norway to support companies Difficult to get resources from Innovation Norway.	The Research Council of Norway as national contact point. IBM: has a large ICT environment, with international cooperation, for example in Munich, where IBM pays and funds businesses. Something similar could be started in Hordland.	ICT related innovations and solutions don't come through.
Funding Instruments available to support incubators/accelerator programmes	Hordaland County Council: Partnership funds + project funding SIVA – business clusters, accelerators incubators and catapults. Private support/funding: applies to participants in some accelerator programs. DNB – Ocean Industries Accelerator: focuses on Bergen and entrepreneurial funds, such as NXT. MIT Reap: MIT REAP Framework consists of a series of mechanisms to translate, convene and educate teams of regional leaders through a full 5-stakeholder approach. 100ScaleUPs (BI): help technology companies to develop and enable execution of their scaling strategy. provide the necessary knowledge, frameworks, tools and feedback in order to develop, test and validate a strategy that is tailored to their businesses. Grunderhub: see above StartupLab Bergen: see above	National (SIVA) instruments are not calibrated to the situation in our region. It does not consider the regional situation properly. One needs to consider geography (cities vs. districts), as well as cultural factors.	It is important to work in cooperation with different actors so that we are able to mobilise when an opportunity arises: clusters, research, business sector, public sector, academic institutions, etc. Proactive mobilization.	One can miss opportunities to receive funds if one cannot mobilise one's network. Too many programs to choose from, can lead to incorrect choices and businesses falling into the wrong program.

	SR-bank: does not directly fund, but works with Nyskapingsparken, Grunderhub, etc. There are many and diverse funding instruments and programs to choose from			
Current tax incentives to support R&D, ICT R&D, other R&D…	"Skattefunn" – given without competition if certain requirements are met. 18-20% funding for R&D projects run by companies. "Skattefunn" is widely used. Differentiated social security contribution: The employer's contribution is paid by the employer as a share of the employee's salary. Differentiated social security contributions mean that the rates vary according to where the business is located. The rates are lower in the districts than in central areas. Electricity tax – the government wants to reduce the tax on electric power for businesses.	Many businesses are not aware of "Skattefunn", or do not want to use the opportunity. Need for mobilization and stimulation towards companies to engage in cooperation with R&D institutions. The number of applicants is relatively low. The program is not well-known. Don't need R&D partner. Small SMEs may lack the skilled personnel to evaluate the cost/benefit effect of applying Skattefunn and the resources to gather documentation requirements.	Large potential for more companies to get the benefits from "Skattefunn". Simplify application processes. Should be low threshold, and without the need of a R&D partner.	Relatively easy procedures to apply to "Skattefunn", but still complicated to implement for many SMEs due to formal requirements. More opportunities for training offered to companies. If possible work towards government to achieve less complicated procedures.
Describe the availability and accessibility to regional, national and European funding for RTD	Regional Research fund is an asset. Research Council of Norway. Most Horizon 2020 programs are available for Norwegian partners Innovation Norway Funding opportunities are many. There is plenty of availability. We have the instruments for applying for funding.	Potential is not met on either of the funding opportunities. The use of the available funding is sub-utilized. National and European funding are more rewarded in other parts of Norway as Oslo and the Trondheim area. Low % funding for businesses. Small businesses cannot fund the private contribution The bureaucracy around funding applications demands a certain size, and skills within the organization.	Attract more companies that want to get involved in R&D processes with such a quality that funding will be granted. The industry could make better use of these instruments.	The absence of the need for innovation and/or getting funding by companies that are doing well as they are. Companies that are satisfied with less innovative focus in their daily activities. Threat to loose innovative opportunities and market positions. Missing out on opportunities for development The rigour of programmes is a challenge for small companies.

General comments/Observations (RTD/Innovation Funding)

There is plenty of funding available through regional, national and European mechanisms. The potential is sub-utilized partly due to complicated application processes which small companies find difficult to comply with and partly because many businesses have been doing very well lately. When business is going well many down prioritize research and development and oversee the possibilities of funding.

Definitions:

Gründerhub - a free four-month startup program for founders with great ideas and international perspective. Under the auspices of Sparebank 1 Sr-bank and BTO.

StartupLab – an incubator that offers entrepreneurs offices and help to establish and develop technology companies through networks, partnerships with established business and other activities.

GCE Subsea (GCE Ocean Technology) - GCE Subsea strengthens innovation and internationalisation of the Norwegian subsea cluster.

The Media Cube - The media cube is an incubation program for startup companies in media and technology startup companies.

Finance innovation incubator - Fintech room is an incubator for start-up companies in financial technology.

Ocean Industries Accelerator - An innovation environment for companies in the sea industry.

MIT Regional Entrepreneurship Acceleration Program (MIT REAP) - provides opportunities for communities around the world to engage with MIT in an evidence-based, practical approach to strengthening innovation-driven entrepreneurial (IDE) ecosystems

100ScaleUPs – an accelerator targeting Nordic technology companies. The programmes consist of action-learning modules with workshops, simulation labs, and lectures from professors, investors and entrepreneurs. Runned by BI.

THEME: SMART SPECIALIZATIONS

1. What are the region's Smart Specializations?

Hordaland does not have a smart specialisation strategy but has a corresponding business development plan (HNH – Handlingsprogram for nærings- og samfunnsutvikling i Hordaland) which includes an innovation strategy, a regional research strategy and a climate plan through 2050. The main sectors to be promoted on a regional basis are marine and maritime industries, media and culture, tourism, farming and local food production and energy.

2. How are these Smart Specializations developed?

The existing plan was developed in collaboration with the regional partners/triple helix stakeholders: public institutions, industry academia.

3. What is the sustainability of these Smart Specializations?

The plan emphasises on:

- The cross over nature of Hordaland's current industrial foundation.
- The ability of current industries to adapt using existing skills and competencies through collaboration with other sectors and disciplines.

In addition, an evaluation of the plan is performed every 4th year. Politicians, as well as the industry (through clusters) are involved in the definition and revisions of the Regional Plan Strategy.

4. What Smart Specializations should the region focus on in the future?

The current strategy focuses on green energy shift and digitalisation supported by a sound skills development policy, which is planned for 2019. This must be continued in the new region. Hordaland will merge with the region Sogn og Fjordane and they will together form the new region Vestlandet. Sogn og Fjordane will add a large geographical area which is thinly populated in some areas and more dependent on farming, food production and tourism. Scaling will therefore be a possible challenge.

A comprehensive data collection task is now being conducted which will be used as one of the inputs for the process of defining the region's future Smart Specialization Strategies.

The main focus will be on entrepreneurship and innovation. The region also strongly promotes a green shift and the industrial transformation from black energy production to green. Digitalisation will also be a key tool in future development. The demand for the right skills in the near future will be covered in the future S3 agenda by a new skills plan for the region.

5. Why these Smart Specializations?

Hordaland has been heavily dependent on the oil and gas industries and the service sector connected to offshore supply, and it hosts world-leading companies within engineering services and subsea technologies. The recent oil crisis forced some to think in a new direction and to form new markets and partnerships. Cross sectoral technology transfer became more usual. The region also hosts a maritime clean-tech cluster and has developed a market for clean technology for transport (electric ferries). The public buses will also be electrified. There is an abundance of clean power in the region produced through hydro-electricity.

6. What are the Strengths, Weaknesses, Opportunities and Threats for these Smart Specializations?

Strengths: Existing skills and specialisations are identified for the region. The data collection process currently being conducted will provide further insight and/or confirmation.

Weaknesses: The pace of demographic change and the addition of thinly populated areas from the merging of counties. The priorities for the current business development plan (NHN) in Hordaland does not take into account factors from the merging county Sogn og Fjordane.

Threats: The skills gap and the fast pace of digitalisation require swift measures. The increase of global competition with regards to both, skills and costs.

Opportunities: The capital of the county, Bergen, is a key driver for the region with several research and education institutions, strong export related industries, access to raw materials and clean energy sources.

The possibilities arising from the fusion with Sogn og Fjordane.

Overall/conclusions: Hordaland does not have a smart specializations strategy, instead the region has a corresponding business development plan, the Regional Action Plan for Industry and Societal Development (HNH). This plan includes an innovation strategy, a regional research strategy and a climate plan until 2050. The main sectors that ought to be promoted on a regional basis are marine and maritime industries, media and culture, farming and local food production and energy. The plan was developed by regional partners and triple helix stakeholders: public institutions, industry and higher education institutions. The current strategy focuses on a green energy shift and digitalisation, which also needs to be continued in the new Vestland region. When Sogn og Fjordane is merged into the region farming, food production and tourism will become even more important. Hordaland has been heavily dependent upon oil and gas industry and the service sector connected to offshore supply, however the recent oil crisis forces businesses to think in a new direction and focus on cross sectoral technology.

RIGHT
RIGHT SKILLS FOR THE RIGHT FUTURE

THEME: HIGHLIGHTS SWOT NORD HORDALAND – REGIONAL ATTRACTIVENESS FOR INVESTORS

	HELPFUL	HARMFUL

INTERNAL	STRENGTHS
	• Significant value creation within aquaculture and energy. Large companies and potential customers.
	• Close to Bergen
	• Regulated areas ready for industrial use.
	• The community has a positive attitude towards industry and development.
	• Concentration of technical school competencies.
		WEAKNESSES
		• Absence of risk capital. The available capital is used on low risk enterprises with little possibility of growth.
		• Absence of large investors.
		• Investment in the region is weak due to the two main types of companies in the region:
		  • Large corporations owned externally and not anchored locally do not re-invest their profits in the region.
		  • SMEs with limited funds and innovation capacity.

EXTERNAL	OPPORTUNITIES • Excellent access to biological resources and circular economy across industries. • Connect the concentration of technical school competencies with the academia.	THREATS • Too small SMEs which won't grow fast enough to become attractive for investors. • Local owned and traditional companies which are not interested in sharing ownership. Rejection of investors.

Interreg North Sea Region RIGHT European Regional Development Fund EUROPEAN UNION

THEME: HIGHLIGHTS SWOT NORD HORDALAND – REGIONAL ATTRACTIVENESS FOR RESEARCHERS / INNOVATORS / INVENTORS

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Suitable test locations for pilot projects due to geographical location, international access, and technical/practical oriented workforce.	WEAKNESSES • The region is fragmented and the internal cooperation is not good enough for discussing R&D projects. • R&D is concentrated in the large international corporations, not on local based SMEs.
EXTERNAL	OPPORTUNITIES • Use the region's strengths and better internal cooperation to attract projects related to the sustainable development of the industry in the region. • Choose a few project initiatives to concentrate on.	THREATS • Pilot projects are centralized in Bergen. • Nord Hordaland appears fragmented when it comes to applications for funding of R&D projects. • The application processes for funding are challenging for SMEs.

THEME: HIGHLIGHTS SWOT NORD HORDALAND – REGIONAL ATTRACTIVENESS FOR ENTREPRENEURS

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Entrepreneurs in the region highlight the local identity. There is a culture for entrepreneurship in Nord Hordaland.	WEAKNESSES • The existing support mechanisms for entrepreneurs are confusing. They consist of many organizations which use a good portion of the available resources on themselves.
EXTERNAL	OPPORTUNITIES • Establish best practice of use of support mechanisms when the municipality merges into the larger Alver municipality.	THREATS • Demotivating and challenging for entrepreneurs to apply for support.

RIGHT
RIGHT SKILLS FOR THE RIGHT FUTURE

THEME: HIGHLIGHTS SWOT NORD HORDALAND – REGIONAL ATTRACTIVENESS FOR MULTINATIONALS

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Several well established multinational corporations in the region (Equinor, Marine Harvest, Lerøy). • Access to natural resources and closeness to Bergen. • The industrial environment is English speaking. • Regulated industry and housing terrains.	WEAKNESSES • The region appears fragmented to international stakeholders. It is not easy for international stakeholders to make contact with the right entity/person in Nord Hordaland.
EXTERNAL	OPPORTUNITIES • The larger municipality Alver will enable the reorganization of support mechanisms. • Choose 4 main projects for the municipality to concentrate on together with multinationals (Data storage, BKK,).	THREATS • Intra- and interregional competition. Some regions are better at selling their assets and ideas than Nord Hordaland.

Interreg North Sea Region RIGHT European Regional Development Fund EUROPEAN UNION

THEME: HIGHLIGHTS SWOT NORD HORDALAND – REGIONAL ATTRACTIVENESS FOR ICT PROFESSIONALS

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • CNC machining at Frank Mohn.	WEAKNESSES • Lack of ICT professionals in the region. Lack of ICT environment. No culture for ICT businesses.
EXTERNAL	OPPORTUNITIES • Large regulated terrains for the establishment of a large ICT stakeholder/multinational.	THREATS • If the ICT environment is not built up in the region, it will remain unattractive for ICT related professionals and companies.

RIGHT
RIGHT SKILLS FOR THE RIGHT FUTURE

THEME: HIGHLIGHTS SWOT NORD HORDALAND – TECHNOLOGY ORIENTATION

	HELPFUL	HARMFUL
INTERNAL	STRENGTHS • Strong operations and process skills in the region. • Strong and effective logistics infrastructure. • Adaptable SMEs • CNC skills (Frank Mohn) • TAF school (combines the academy and the industry) • Society welfare technology.	WEAKNESSES • A stronger engineering environment is necessary • The region is fragmented • Few engineering companies and few ICT companies.
EXTERNAL	OPPORTUNITIES • Create an ICT environment to attract more ICT and engineering companies. • Use CNC possibilities for innovation purposes • Bring the 3D printer in Bergen to Nord Hordaland. • RAS technology and its innovation possibilities within aquaculture.	THREATS • Bergen is a tough competitor. • To appear fragmented and not managing to communicate the main technological goals for the region. • SMEs are not being connected to the technological development.

Interreg North Sea Region RIGHT European Regional Development Fund EUROPEAN UNION

6.3 Part 2: SME Analysis format

Companies:

[1] Synfaring AS

[2] Frekhaug Stål AS

[3] Bremnes Seashore AS

[4] SubC Solutions AS

[5] HydPro AS

[6] Nagell D AS

[7] Salmo Breed AS

Format SME innovation capacity and needs:

Format: Compilation of SME interviews			
Topic	**Question**	**Sub-question/detail**	**Answers**
Defining who you are	What is your core activity in energy/blue innovation?	• Details of business	Types of Business: 71.129 Other technical consultancy activities. [1], [4] 25.990 Manufacture of metal products not mentioned elsewhere. [2] 10.202 Freezing of fish, fish fillets, shellfish and molluscs. 03.211 Production of fish, molluscs, crustaceans and echinoderms in sea and costal aquaculture. 03.212 Production of fry and hatchery in sea and coastal aquaculture. [3] 46.693 Wholesale of other machinery and equipment for industry [5] 62.020 Consulting business in relation to information technology [6] 03.213 Services related to marine and coastal aquaculture [7]
			Size of staff: 20 [1] 51 [2] 413 [3] 5 [4]

			7 [5], [6] 49 [7]
			Other: founded in May 2018 [1] founded in August 1955 [2] founded in September 1984 [3] founded in march 2007 [4] founded in October 2017 [5] founded in August 2011 [6] founded in May 2001 [7]
		• Geographic Scope	Local: …. [1], [2], [3], [4], [5], [6], [7]
			Regional: … [1], [2], [3], [4], [5], [6], [7]
			International: … [1], [2], [3], [4], [5], [6], [7]
		• Type of energy/blue innovation	Product innovation: … [2], [3], [4], [5], [6], [7]
			Process innovation: … [1], [2], [3], [6], [7]
			Service innovation: … [1], [2], [4], [5], [6]
			Other: Technical innovation [3]
		Details of energy/blue innovation	1. 1) Offer customers a total package, to both small and large companies, where they customize the services for the recipients. For example 3D scanning and assisting vessel owners with risk assessments. 2) New technology. Apply new technology (drones) and improve services. [1] 2. 3D printing. New product development. Innovation is pushed both by costumers and internally in the company. Advisors/consultants to customers. [2] 3. Focus on quality, 1-2 tailor made units a year, which are unique. The company designs and draws, and has ownership rights to all the products, while the production itself goes to other companies. [4] 4. Product innovation – Customer specific solutions. HPU has adapted to different industries including blue and energy: helicopters, wind power, aquaculture and wave power. Service innovation – alternative ways to provide services to customers in order to keep costs down. [5] 5. Product innovation – uses new technology within digital presentation and builds new products. Delivers technology from HP. Produces digital content to energy/aquaculture customers. The company finds the correct technology platforms and

			assembles it to a total package that they later can sell. Hardware and software. Process innovation – works internally to find the best way to get the content up on the technology platforms. Creates a workflow and new processes. Works with the simplification of processes and quality assurance. Service innovation – creates services, e.g. implements VR for the customer combined with advice on how to use the product. Has a HoloDeck. Has training and courses [6] 6. Product innovation - Salmon roe and its genetic properties are the main product innovation. They research brood and tests properties. Researching to find methods for measuring. Genomic tools are important for product innovation. Process innovation – entails the actual production of the roe and ensures that the process is good. Have just completed a land-based facility in Salten. Biosafety and fish health are important elements in this research [7]
	Who is involved in energy/blue innovation?	• Inside company	1. The company has a short reporting structure. Manager, department managers and each area has its own manager. Everyone in the company is involved in innovation. Ideas can come from any of the employees, but it is management that puts the idea into practice. The company tries to involve everyone in the innovation process. [1] 2. 1) Management and Technical Responsible staff. 2) The development department. 3) The operators [2]. 3. 1) The R&D department has a manager. The R&D involves other departments in the company. 2) Employees in technical positions. 3) Production manager and those with responsibility over the production lines. 4) Line managers are involved in projects [3] 4. Everyone in the company is involved in the innovation [4] 5. 1) Design engineer, product manager. 2) Mechanic with practical and extensive experience. 3) The rest of the staff, due to short communication structure and small company. [5] 6. 1) Everyone in the company [6] 7. The company has its own group of employees from various departments who work on innovation. Everything from researchers, geneticists, people with fish health expertise, market, sales etc. is involved. [7]
		• Outside company	1. The board of directors consists of external members with industry experience and two employees. They are key people not directly affiliated with the company and with innovation knowledge. No shareholders are on the board. [1] 2. 1) Suppliers. 2) Customers [2] 3. 1) Suppliers. 2) New businesses, students, people with good ideas they want to test out. 3) Researchers and research projects. 4) Customers and markets [3]

			4. 1) The business are contacted by companies that have thoughts of something they want to do, which they can have realized with SubC Solutions' expertise. 2) Individuals, sole proprietorships 39 Patent owners [4] 5. 1) Customers. 2) The market and its trends [5] 6. 1) Customers. 2) Organisations and clusters (NCE Media) that the business is a member of. [6] 7. 1) Market needs and customers. 2) Has a yearly workshop with their customers, with focus on new thoughts and innovation [7]
Defining urgent challenges	What are 3 urgent challenges your company is facing?		1. 1) Changing standards and framework conditions. Uncertainty. Dependent on others. Need to be able to adapt to changes in regulations in all industries. 2) The market situation in the (non-blue) market. Oil and gas sector is a challenge. It is too easy for companies to get expert approval because of weak regulations. 3) Competition with lower standards and lower prices. Experience is based on providing offers and tenders. Dependent upon competition to win projects. Local, small businesses can lose contracts because they fail to meet requirements (in regards to exclusion and selection criteria). It is difficult and costly to be a small business; this can be a competitive disadvantage (a short-term challenge considering the fact that the company can grow larger). [1] 2. 1) Maintain and develop competence and skills. A wide range of expertise is required. Generation change – dependent on new competences, which may not exist now. The expertise has increased, among other things due to the access to the North Sea. Must maintain competence to maintain quality. 2) Challenging orders. Increasing demands. Many factors play a role in getting good quality. 3) Communications. Lack of technical knowledge from clients, both foreign and local customers. Difficulties with communication, it can cost money and time. 4) Adapt and build knowledge about new markets. Need e.g. more knowledge about aquaculture [2] 3. 1) Fish health and fish welfare. 2) Environmentally friendly production - e.g. operate boats and rafts environmentally friendly. 3) The environment around the cages, taking care of the sea. 4) Logistics and environmentally friendly transport of fish. 5) Everything boils down to sustainability and the green shift. [3] 4. 1) Sell enough to keep your business alive - the market situation and its fluctuations. 2) It is difficult to estimate a price on innovation. When one is to create something new, then it is difficult to estimate the time, there is a risk associated with this. 3) Fixed price in the market. The market is cynical, one has to give a fixed price, if the price is the too high, the business loses the job, if it is too low, the business loses. Competition with companies about similar products. 4) The bureaucracy of the largest orders. It is difficult to keep track of all the arrangements and bureaucracy. [4] 5. 1) Suppliers to the oil & gas industry are still experiencing the consequences of the cost cutting measures implemented by

			powerful stakeholders (operators such as Equinor). It is difficult for small companies to compete with power suppliers with BID frameworks used by operators. 2) Liquidity. [5] 6. 1) Capital. Looking at capital acquisition. Cannot realize all projects by operation. 2) Geographical location in the north of Hordaland. There are few office buildings. Has too little space to relocate. Geography can be a challenge in the future concerning customers, employees and expensive tolls. Limits growth. 3) Fast technology development. It can be challenging to keep up with it. [6] 7. 1) Regulations. The business experiences the directorate as square and difficult, too little development in the industry. The directorate is restrictive and has decided that the industry should not grow. This limits the research opportunities of the company. 2) Costs related to animal welfare, research and development. The way they do their disease attempts is to infect fish. The ways they have done this so far have become very expensive. They must repeat their experiments many times to test many properties. 3) Expertise/competence (is a challenge in the long term). Genetics are becoming more and more complicated, both expertise and technology. Need to link molecular and quantitative genetics. 4) The industry needs to be digitalized. [7]
	What possible solutions for the challenges ?		1. 1) Changes to standards: Stronger and better regulations. Someone who delivers a product cannot inspect this product; a third party, an independent player is needed. The Labour Authority has the opportunity to do something about this. ISO 17020 is to be introduced. There is need for more common regulations across industries. 2) Market situation: upturns, adapt the business to other areas. 3) Competition picture: stricter requirements. [1] 2. 1) Digitalization of the concept development phase / concept sketch. 2) Communication: take part in networks and clusters. 3) Expertise: Connect more strongly to the research communities. Use of apprentices and build them from scratch. [2] 3. 1) Calm the salmon before slaughter, avoid unnecessary stress on the fish. There should be focus on the fish welfare. Well boats where the fish are transported to the shore are still challenging and this must become more sustainable. 2) More focus on freezing methods of fish. The company wants to deliver as fresh a product as possible and wants to find new ways to preserve food in the future. For transport abroad, aircraft is often used, but in the future one must prepare to use less air transport. 3) Sustainable production - Set stricter requirements for the feeding industry / feed producers, in order to improve the fish health, and support greener production. 4) With regards to the energy industry, it is possible with electrification and renewable energy on facilities and boats. [3] 4. 1) The market situation: Work towards entering new industries, e.g. battery, farming, maritime, boats. Get hold of students who want to work in the oil industry. 2) Estimate the price: “skattefunn”, the Research Council, Innovation Norway and spin-off solutions from projects others have bought. There should be

			more public schemes. 3) Comprehensive system: The bureaucracy can be simpler for support schemes. Possibility to send a package of schemes available to start-ups. An offer of information. [4] 5. 1) More and better cooperation with other suppliers and with the customer. 2) Flexible banks. 3) Become a more solid company that does not depend on external funding. [5] 6. 1) Capital: Looks for a third owner. New partnerships with similar businesses, possibly co-ownership. They work on writing applications. 2) Location: May move parts of its business to Bergen. Contribute to develop new office building in their area. 3) Fast developments: Stay a member of the cluster to stay updated. Create a new part time position as Chief Technology Officer. [6] 7. 1) Need their own lawyer to work with the directorate, regulations and applications. However, the company does not have the means to hire people who can do everything themselves. 2) Reduce consumption. Very few people are allowed to do such experiments, as there are few approved laboratories. Difficult to bring down the costs. Eventually, they may need to reduce the number of experiments and prioritize more. However, if they want to be successful, they must do many attempts year after year to test the properties of new offspring. One possible solution may be to distribute experiments among partners in different countries. 3) The business has many highly educated employees with a doctorate and a master's degree. Someone with a trade certificate too. There is need for many with high education in the future too. Now genetics is becoming even more complicated. 4) Need new expertise in digitization, related to operation, production of fish and documentation. The company has only 2 research licenses. Depending on data and customers from others. Want good methods for obtaining data. Use data to present and document findings. [7]
Defining path dependency	Which 3 factors, e.g. historical, geographical, cultural aspects, are important for your business?		1. Competence is important without it the company has nothing. Good work culture in the company is also central. [1] 2. 1) Localization in relation to the fishing fleet has been important for starting the business. Still close to the coast, offshore stations and subsea centres. 2) Relation to Swedish friendship business/ competition. 3) Small size and flexible. Ability to adapt. 4) History. BOSS products from the fisheries sector. [2] 3. 1) Geographical - seafront location and local preservation of jobs. Bremnes Seashore focuses on producing salmon at Bremnes, and not abroad. The focus is on the local community and this is linked to the freshness of the fish. Bremnes Seashore innovates among other things to preserve jobs locally. 2) Historical – The region has been engaged with fish farming for a long time and the company is linked to the local community. A cornerstone business. By preserving the company, it creates ripple effects, income and jobs for the municipality. [3] 4. 1) The company has an open mind. The company runs the way the wind blows. Openness and desire to drive something characterize the business. 2) Geographical proximity to the oil and gas industry

			and networks that are relevant. The proximity to Hordaland has meant a lot and created networks. However, this is not essential. 3) Focus on reliability and quality, everything they deliver works. Quality culture within the company [4] 5. 1) Historical: the crash of the oil price and the crisis has strongly affected the company. 2) Geographical factors are important concerning the local market. Digital communications dominate concerning international markets. Cloud solutions. [5] 6. 1) The business recruits people with different backgrounds, which gives new impulses. 2) The business uses their networks, especially businesses that are larger than they are. 3) Being digital and focusing on green energy. [6] 7. 1) Geographical - Location in Bergen. The competence environment is here. Located in a city with a strong expertise and research environment, as well as a cluster. They have high-educated staff. 2) Historical - SalmoBreed was formed by three aquaculture companies that established a joint commercial breeding company. These are historical important partners [7]
	Which 3 factors are limiting your success?		1. If the competence disappears and the work culture is poor, it is limiting the company's success [1] 2. 1) Production capacity. The ability to expand production is small. Too expensive to move your business today, but perhaps an opportunity in the future. 2) Fluctuations in the market. Unpredictability and market fluctuations. Difficult with staffing when the market is unpredictable. 3) Risky change. The company has a size that actually requires a larger administration than what they have today. Restrictive toward making heavy investments. [2] 3. 1) Location – it is difficult to grow due to its location. There is little space and nature is an obstacle. 2) Quality vs. Costs: It is expensive to produce high quality salmon. It is expensive to produce, and the salmon price is high. In Norway, we have low willingness to pay, which makes it more difficult to produce and sell high quality salmon. 3) Neighbouring issues (neighbouring company). Lack of solutions to environmental problems. Applies to policy on fallowing and zone structure. It is a prerequisite that the industry operates sustainably to take care of the environment long-term. Many companies work with the sea and one is dependent on the neighbour taking care of its environment. Area cooperation is central. E.g. infections being spread via the sea. Here the authorities could have higher requirements on the industry. [3] 4. 1) The company does not stock shelf products with large margins. It is therefore expensive to produce each time, and it would be cheaper to make more products each time. 2) The market, fluctuations, depending on deliveries and sales. Difficult to plan for the future, as it is difficult to predict which orders will come in the future. 3) Scepticism of electrical solutions and new technology. SubC Solutions is very innovative and the customers may be sceptical about testing new products and new businesses [4]

			5. For a small company it is difficult to get a hold of the right skilled personnel. The principle is "Both, employees and customers shall be satisfied" [5] 6. 1) Liquidity and capital. 2) Their geographical location limits the growth of the business [6] 7. 1) The reputation of the industry, especially in the media. 2) Regulations. 3) Strong competitors who have many own licenses (broodfish and R&D) that contribute greatly to the operation. They have bigger "muscles" to do research and development than SalmoBreed. Including risks related to IP registrations from competitors who can limit their business. [7]
Defining future strategies	How are you preparing for the future?		1. Fixed strategy plan and various forums and meetings within the company. Among other things, use of SWOT analyses. [1] 2. 1) The company works towards new markets, such as aquaculture. 2) Maintain today's high quality. Concentrate on the requests that come and adapt to the future needs. Adapt in order to survive. 3) New technology. Use of 3D printing to prepare for the future. They offer services that few are involved with. They are involved in a R&D project on digitization that will lead to a printing method that is adapted to their production. [2] 3. 1) The company works actively with the authorities and organizations. Highlight the knowledge the company has and share knowledge and challenges. 2) The company has hired its own fish health personnel to address future challenges. 3) Build RAS (Resicirculating Aquaculture Systems) plants. This will be one of the largest in the country. 4) The company has established its own R&D department. [3] 4. The business takes one day at the time, because they do not know what they need to do in order to be viable in five years. 2) Work with all-electric solutions, to replace hydraulics. [4] 5. 1) The company knows where they want to be and how to get there. Organic growth step by step. 2) The company has conducted a formal strategy process and worked out a long-term detailed plan. 3) Become certified in certain relevant standards for the industry (ISO, Achilles). 4) Closer cooperation with hubs. 5) Cooperation with other companies concerning new technologies (3D printing). 5) Oil and gas should never be more than 50% of the portfolio. Include also marine, maritime, service (bridges). [5] 6. A yearly strategy meeting with the owners and the board. Focuses on what they want to achieve within a one-year perspective. [6] 7. 1) Has a strong genetic team working globally. Thus, they stay professionally strong. 2) Invested in a land-based production plant in Salten to ensure the fish health of broodstock. Gears production to adapt to the value chain. Ensure market needs. [7]

	What is needed to be competitive for the future?	• New competences (training)	1. Competence in aquaculture (marine biologists, fish health, water quality, fish welfare) - 2 companies [1], [3] 2. Underwater inspection (geologists) – 2 companies [1], [3] 3. Technical competence (material technology) – 1 company [2] 4. Product development – 1 company [2] 5. Communication - 1 company [2] 6. Data analysis skills – 2 companies [3], [7] 7. Competence on markets – 1 company [3] 8. Project management – 2 companies [3], [7] 9. Knowledge about RAS plants – 1 company [3] 10. Knowledge about innovation (new/fresh thinking) – 1 company [3] 11. Technical/electronic competences – 1 company [4] 12. Battery competence – 1 company [4] 13. Competence about automation, electronics as well as mechanics and hydraulics – 1 company [4] 14. Technical electronics and software (development) – 1 company [4] 15. Become approved as a trainee company to attract workforce with the right education (engineering, technical – mechanical) [5] 16. Skills sharing with other companies [5] 17. Molecular and quantitative genetics [7] 18. Legal expertise [7] 19. Biological and technical competence. Competence about what the customers need. Understand how the products behaves in new technologies [7] 20. Lobbyists [7]
		• Research & innovation	1. Software (engineering) – 1 company [1] 2. Material technology – 1 company [2] 3. New technical production processes – 1 company [2] 4. Knowledge about salmon – 1 company [3] 5. Knowledge about streamlining processes (lean) – 1 company [3] 6. Automation of heavy work tasks – 1 company [3] 7. Market innovation – 1 company [3] 8. The company is not addressing this quite yet. First, they are building a solid base that can support future R&D initiatives. Need to be independent, as the company cannot rely on complicated and confusing funding mechanisms. These applications are performed by consultants who take a big chunk of the funding. [5] 9. Cooperate with other supplier companies as a team in R&D projects [5] 10. Capital to internal R&D – 1 company [6] 11. Capacity to explore external R&D – 1 company [6] 12. Work more towards universities and colleges – 1 company [6] 13. Should have several research licenses and broodstock licenses. [7]
		• Additional finance	1. Dependent on support from Innovation Norway and other forms of economical support – 2 companies [1], [4] 2. Self-propelled business – 1 company [2] 3. Increased funding of research projects – 1 company [3] 4. Help to preserve local jobs – 1 company [3] 5. Overdraft – 1 company [4] 6. Access to capital and funding that comes in directly into the company, not through consultants (funding) – 1 company [5] 7. Evaluation of having a third owner - company [6] 8. New capital – 1 company [6] 9. Partnerships with similar businesses – 1 company [6]

			10. Get more research funding [7] 11. More financing through public grants [7]
		• New networks & collaborations	1. International networks or clusters or collaborations– 3 companies [1], [2], [3] 2. International/national networks within maritime industries – 1 company [1] 3. Cooperation with different universities – 1 company [3] 4. Cooperation with hospital environments (e.g. knowledge about muscles and cramps) – 1 company [3] 5. Cooperation with different organisations – 1 company [3] 6. No, the business are sufficient with the cluster that they are member of today; this is due to little time and a small staff. They appreciate being part of an ocean technology cluster – 1 company [4] 7. Cooperation with other SMEs will be decisive, especially with regards to innovation and R&D projects – 1 company [5] 8. Cooperation with academia – 1 company [6] 9. Cooperation with large actors and customers, amongst this culture institutions - 1 company [6] 10. Cooperation with students [7] 11. Universities and partners in other countries [7] 12. Connect to the digital competence and access to data [7]
Defining direction	Which developments in energy transition seem promising for your company?		1. Growth within aquaculture. The fact that the seafood industry is going to double is considered positive. Stricter requirements for controls of boats are promising for the business. [1] 2. 1) Hydraulic power. Modernization of hydropower. 2) Wind power. The business already works heavily within this field, but there still much more to be obtained, e.g. within wind and watermills. [2] 3. 1) Electrification of boats - "the green shift". 2) Package technology and packaging - Optimize packing technology to improve durability and become more environmentally friendly. [3] 4. 1) Subsea mining. 2) Electrification (replacement for hydraulics). 3) Extraction of methane gas. [4] 5. Wind power, wave power and aquaculture [5] 6. 1) Customized content. Portable HoloDeck – digital prototyping lab 2) Aquaculture and innovation in the industry. 3) Visualisation of drawings – digital prototyping. [6] 7. Use the competence they already have about salmon to other species, transfer of competences [7]
	Which developments are inevitable for your company?		1. Technology. Social Media. Further education of own employees to ensure competent workers [1] 2. 1) Access to raw materials. The world's access to raw materials is changing. Among other things, the lack of sand leads to increased prices. Businesses no longer have long-term access to raw materials. Must focus on alternative materials, due to the environment, prices, access, regulations etc. 2) new technology, related to production processes. Businesses are forced to follow

			the developments, or else they fall outside. 3) Need for food production of fish. Watch out for deep-water fishing. [2] 3. 1) "The green shift" industry is going through the transition faster than expected. New market regulations are expected. 2) Humane slaughter and slaughter boats. 3) Consumer are concerned with the "green shift". Consumers do not want plastic packaging. 4) The company must have daily operation, at the same time, as they must be at the forefront. [3] 4. 1) Electrification. 2) Digitalisation and big data. [4] 5. 1) Everything that has to do with the green transition. 2) Wind power, wave power, aquaculture [5] 6. 1) General technology trends. 2) Follow the conjectures in different industries. 3) New demands in the aquaculture industry. [6] 7. 1) The fact that the salmon industry does not seem to grow or develop. 2) Fish health and welfare. Infection experiments are becoming more and more challenging to do, due to strict fish health requirements. 3) IP rights (other companies register genes / technology / processes) that can prevent us from developing. These can be competitors, but also biotech companies in other countries. [7]
Leveraging innovation potential	Are you considering exploiting new ventures?	• New markets	6 companies - [2], [3], [4], [5], [6], [7]
		• New technologies	6 companies - [1], [2], [3], [5], [6], [7]
		• New products	7 companies - [1], [2], [3], [4], [5], [6], [7]
		• New partners	6 companies - [1], [2], [3], [4], [5], [6], [7]
		• Other…?	1. Geographical markets – 3 companies - [1], [2], [4] 2. Give competences to high schools and the academic community – 1 company [2] 3. Work profitably and sustainably, first-mover advantage – 1 company [3] 4. Inform and affect the authorities, create arenas and better collaboration – 1 company [3] 5. Cooperation with academia – 1 company [6]
Defining innovation steering	Who is driving or pushing innovation?	• Customers	• 7 companies - [1], [2], [3], [4], [5], [6], [7]
		• R&D	• 5 companies - [1], [2], [3], [6], [7]
		• Policy	• 6 companies - [1], [2], [3], [5], [6], [7]
		• …?	• Internal development and internal professionals – 2 companies [1], [4] • Suppliers, society in general, organizations and authorities – 1 company [3] • Digitalization – 1 company [5] • Trends – 1 company [6]

Defining emergent patterns	What is significantly different in the last three years?	• New partnerships & collaborations	1. New structure, but the company is similar since 2012. Among other things, new board. There is new collaboration with drone company in England. No external shareholders. [1] 2. New 3D printing collaboration. Possibly new cooperation on material technology [2] 3. More active work against the authorities. New R&D department [3] 4. Stronger collaboration with other businesses due to the decline in the oil industry [4] 5. Nothing new. The business have always had good partners and good cooperation with suppliers [5] 6. The company has become more aware of forming partnerships, being more proactive [6] 7. Gone from working closely with previous owners to stand more on their own legs, become more independent. The company needs to manage much more by itself. [7]
		• Scope (local, regional, EU, international, etc.)	1. New offices at Fosnavåg. More international business and internationalization, including a request from Australia. More focus on aquaculture and vessels over the past three years. [1] 2. Overall little change. Increased focus on the fisheries sector in South America [2] 3. Little change, continued international work over the whole world [3] 4. Increased international collaboration, with Italy and China [4] 5. The scope has expanded internationally [5] 6. No, but even more international companies are reaching out to the business [6] 7. New land based facilities in other countries [7] 8. Cooperation across corporations internationally [7]
		• New (digital) communications	1. Use online cloud solutions. Digitization, use of an app for time registration and orders. [1] 2. More video meetings via Skype. Common workspace, SharePoint. Digitization of communication [2] 3. More digital communication by using SharePoint, sky solutions etc. [3] 4. Not many new communications. They have always used Skype and Projectplace [4] 5. Cloud solutions for communications and cooperation [5] 6. No, has always been digital. More accept by the customers to use digital solutions [6] 7. Use of skype and other digital solutions [7]
		• Knowledge sources and sharing	1. Sent an employee to the university to gain more knowledge [1] 2. New collaboration with high schools and vocational schools [2] 3. New R&D department. Interdisciplinary focus on all projects. The company combines people from all departments [3] 4. No. [4] 5. Designed tailor made training programs fir new employees. Specific program for each position [5] 6. Buys access and subscribes to course databases. Use of YouTube to learn [6] 7. Transfer their competence to new species [7] 8. Combination of vaccines and genetics to boost an effect [7] 9. Interesting projects across he corporation, amongst other nutrition [7]

		• Innovation processes and solutions	1. Clearer accreditation processes. Change of management. Given innovation processes and solutions, there is many things that are done unconsciously, they adapt but perhaps without thinking carefully about this. They are a new business, but they have tools for this. They do not have any formal structure for innovation processes. Even though it is not documented, the innovation process takes place nonetheless [1] 2. 3D printing [2] 3. Formalized and structured processes. Distribution of roles in all departments [3] 4. No. [4] 5. Building a solid economic base first [5] 6. Yes, there are structured innovation processes. The business defines what they want to achieve, who will do the work and how much time they are to spend on the work [6] 7. RAS technology and investment in a land based facility. Allows the business to give their customers a product (roe) when they need it [7]

6.4 Part 3: Job Forecasting and Skills Gap Analysis

JOES Frekhaug Stål AS ENGLISH.xlsx

JOES Synfaring AS ENGLISH.xlsx