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Master Thesis

COVID-19's impact on the maritime cluster in Møre and its future challenges

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Executive Summary

The ongoing pandemic has resulted in the strongest and most intrusive safety measures ever done in Norway in peacetime. Countries, industries, clusters and businesses worldwide have experienced an economic disruption and caused the deepest recession in the global economy in modern times. Thus, the purpose of the study has been to investigate and understand how COVID-19 has affected the performance of the maritime cluster in Møre, its competitive position, and future challenges from qualitative research design. Moreover, the paper follows a two-folded structure, in which part 1 relies on secondary data from publicly available sources, which aims to examine several aspects of the cluster's environment from the Emerald model. In contrast, part 2 includes primary data from in-depth interviews with cluster companies and stakeholders to analyse and discuss their main future challenges and COVID-19's impact.

The cluster analysis (part 1) revealed that the Møre cluster had a strong Emerald with many favourable environmental conditions. However, the pandemic's ripple effects on the cluster's performance had disrupted its turnover, profitability, employment and growth expectations due to slower markets and higher costs. Thus, the cluster's competitive position has been temporarily weakened from the pandemic by creating uncertainty, less profits and risk of bankruptcies. Yet, COVID-19 might have been a wake-up call to accelerate the transition towards the green shift. The authors also identified two main future challenges from the analysis. Firstly, the potential reduction in qualified labour that chooses to stay and work in the cluster. Secondly, the risk and costs of restructuring towards the new environmental regulations.

The in-depth interviews (part 2) revealed that the cluster's main future challenges are to adjust towards the green shift, attracting and developing talented workers, as well as maintaining a complete cluster, maritime environment and culture in Møre. Further, the interview analysis showed that COVID-19 had impacted the cluster mainly by temporarily disrupting the transformation from the oil & gas market while at the same time causing a loss of competence in terms of furloughs and layoffs. However, it has also positively raised awareness of the need to restructure towards the green shift and acquire Norwegian talents.

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1.0 Introduction

For this master thesis, the authors have chosen to examine COVID-19's effect on the maritime cluster in Møre and how the cluster has adjusted to the outbreak. The cluster has been through many crises since the 1970s and coped with external pressure very well through restructuring (Amdam & Bjarnar, 2015). The paper investigates whether they will manage this crisis just as well, with their long history of being able to respond to external shocks. By analysing the maritime cluster and its members situated within the cluster, the paper will carry out a case study to provide exploratory and in-depth research. Moreover, the paper seeks to understand the future challenges of the cluster and how the pandemic has affected the cluster's performance and its competitive position.

The topic of an innovative cluster in the context of a current pandemic is highly relevant. Not only does it affect the Norwegian maritime industry but also the entire country's economy. Businesses and clusters worldwide are experiencing a crisis. The maritime industry is no exception, where economic ripple effects and fluctuations in oil prices are creating the deepest recession in modern times (Blue Maritime Cluster, 2020). Without the right measures being taken, the industry can risk a wave of bankruptcies, extensive redundancies and a complete halt in value creation and innovation. This will have major consequences for the country and for the government's ambition to be a world-leading maritime nation. 70% of Norwegian exports during the last hundred years has come from the sea industry (Blue Maritime Cluster, 2020). The maritime and oil service industry may lose 20 000 workplaces and 500 billion NOK of revenues in the next three years because of the pandemic (Fjose et al., 2020a). This will spread to other businesses as well since one job in the shipbuilding industry generates more than five jobs in the surrounding community (Blue Maritime Cluster, 2020).

The cluster itself is very interesting as it is one of only three Global Centers of Expertise (GCE) in Norway – the highest level in the hierarchy of *Norwegian Innovation Clusters* (Jakobsen, Helseth & Aamo, 2020). Together with the oil equipment/drilling cluster in Sørlandet (GCE Node) and the oil & gas subsea cluster in Bergen (GCE Ocean Technology) (Blue Maritime Cluster, n.d.). The GCE cluster program aims at mature clusters with a systematic collaboration in

strategic areas within and outside the cluster with R&D institutions and other relevant partners (Innovation Norway, 2020). It has strong potential for growth nationally and internationally to achieve increased innovation, value creation, and attractiveness within the global value chains.

1.1 Background and Context

Norway is in a unique global position in terms of natural resources and industrial knowledge. With its long coastline and enormous petroleum and energy resources. No other nation in the world has a similar dominance in combining ocean, technology, and knowledge (Reve, 2009). Norway is one of the major global maritime nations, controlling one of the largest commercial fleets, dominating in maritime services and many advanced segments of industrial shipping, the oil & gas industry, seafood production and subsea technology. From an economy with one of the highest cost levels, the nation has developed smarter and more cost-efficient technological solutions to stay competitive in the maritime and energy industries (Reve, 2009). Consequently, Norway has emerged as a Global Maritime Knowledge Hub through centuries of investments in maritime expertise, of which industrial clusters have played an essential role in developing the country as a competitive nation.

On February 26th, 2020, the first case of COVID-19 was identified in Norway (Helsenorge, 2020). The World Health Organisation (WHO, 2020) declared the outbreak a global pandemic on March 11th. It resulted in the strongest and most intrusive safety measures ever done in Norway against the further spread of the virus. Countries, industries, and businesses worldwide have experienced an economic disruption and caused the deepest recession in the global economy since the post-World War II period (World Bank Group, 2020a). In the second quarter of 2020, Norway had its deepest decline ever recorded in the economy with -6.3% (negative growth) GDP (SSB, 2020). Which indirectly affected and reduced household consumption, the demand of products and services, currency fluctuations, increased unemployment, and layoffs, among other ripple effects. Despite the rise of economic activity from the third quarter and positive vaccine news, the spread of the deadly virus has picked up, creating an unusually high uncertainty about future developments in the economy (Norges Bank, 2020).

The ripple effects from COVID-19 threatens both tens of thousands of jobs and hundreds of billion NOK in direct sales and exports from the maritime industry (Blue Maritime Cluster, 2020). Norway is highly dependent on the maritime sector for further growth and prosperity. Thus, a complete and well-positioned maritime cluster is necessary to maintain the cluster through the ongoing crisis if the country wants to live off the maritime industry for the decades to come.

In the near future, the world will undergo a profound economic and technological restructuring to halt climate change and ensure a sustainable future. The Norwegian maritime industry is leading in the development of climate- and environmental technology; thus, it is important that the crisis does not stop the pace of innovation (Blue Maritime Cluster, 2020).

1.2 Contribution, Purpose and Research Question

The study's purpose is to understand how the pandemic has affected the performance of the maritime cluster in Møre, its competitive position, and future challenges by talking to several cluster members and by using public documents and reports. Thus, the paper aims to examine several aspects of the cluster's environment by analysing and determining the cluster's attractiveness and competitiveness from the Emerald model (Reve & Sasson, 2012). Before analysing and discussing our main findings from the cluster members.

To our knowledge, no previous research has analysed COVID's effect on the maritime cluster in Møre through the Emerald model (cluster analysis) and how the pandemic has affected its performance, competitiveness, and impact on future challenges. Therefore, the authors believe that the study is of high relevance as it aims to contribute to the theory of clusters and regional resilience by exploring the pandemic's effect on a maritime cluster and how the members have adjusted to the crisis. Hence, the authors propose the following research question:

> *What are the main future challenges for the maritime cluster in Møre, and what impact has COVID-19 had in meeting these challenges?*

To address the presented research question, the paper will draw on in-depth interviews from cluster members and other stakeholders, as well as building a

comprehensive understanding of the cluster's attractiveness and competitiveness from cluster theory and theoretical framework.

1.3 Thesis Structure

The thesis will follow a two-folded structure to distinguish and analyse how the cluster and its maritime industry appear from existing data and publicly available sources (Part 1) against how it actually is from the respondents (cluster members and stakeholders) to get an in-depth understanding of their experiences, views and reflections around COVID-19 and their future challenges (Part 2):

Part 1. Firstly, the paper will describe and analyse the cluster as it appears today from existing data. Specifically, the authors will first present the history and development of the Møre cluster before conducting a cluster analysis to determine its attractiveness and competitiveness and see how COVID-19 has impacted the cluster. Then, the authors will summarise the pandemic's effect on the cluster's performance and competitiveness, as well as identifying the cluster's main future challenges from the analysis.

Part 2. Secondly, to get an in-depth understanding, the thesis will draw on interviews from cluster members and relevant actors to discuss their main future challenges. Specifically, investigating key factors for cluster attractiveness, how the cluster should develop further, and important conditions for the cluster to stay competitive in the future. Furthermore, the authors will analyse and discuss how COVID-19 has affected the cluster, how the cluster has adapted to the pandemic, and its impact on meeting their future challenges. The authors will also identify other obstacles when facing these challenges before concluding the paper.

2.0 Literature Review

This literature review will shed light on some theoretical lenses that can be used to better understand and discuss our research problem by first exploring prior research on clusters during crises and the gap in the literature. We then present cluster theory before introducing the Emerald model by Reve & Sasson's (2012),

which is an essential theoretical framework in this study to analyse cluster attractiveness and its current competitive state.

2.1 Previous Research on Clusters During Crises

As far as we know, some research has been done on how clusters are affected by a crisis. Naturally, less research can be found on how clusters are affected by a pandemic such as COVID-19 and how they handle it, which is why we chose to explore this phenomenon. During earlier crises, like the financial crisis, scholars have studied the impacts on different regional clusters or industries. In which certain clusters and industries have experienced fewer negative effects and downturns and made it out better than others.

Mazurek (2011) studied 14 regional clusters in the Czech Republic during the global financial crisis in 2008. He found that different clusters were affected very differently by the financial crisis, even within the same country. The clusters experienced different degrees of effects, such as a huge growth in unemployment, a drop in elementary construction production, sales of goods and services fell, and lower economic activity (Mazurek, 2011). In which some clusters experienced heavy downturns in all measured areas, whereas others only experienced downturns in some. Mazurek (2011) states that certain necessary factors to overcome the crisis were to stimulate collaboration between clusters and regions, as well as adopting similar policies and measures.

Moore & Mirzaei (2016) found that industries with higher dependency on external finances are more vulnerable to financial crises in terms of industry growth, measured in the growth rate of fixed capital formation, output, and value-added in 23 industries in 82 countries. It was also found that low- and lower-middle-income countries tend to be less affected by financial crises due to less developed financial systems and markets (Moore & Mirzaei, 2016). At the same time, the global financial crisis in 2008 forced firms to postpone long-term innovation investments, in which Zouaghi et al. (2018) found that firms with stronger internal resources are more resilient during a financial crisis. They also found differences in needs for high- and low-tech industries, where human capital is more important for low-tech industries as a coping mechanism against the financial crisis on

innovation performance, whereas R&D and dynamic capabilities are more important in high-tech industries (Zouaghi et al., 2018).

Furthermore, emerging literature about regional resilience has drawn a lot of attention in the context of economic crises, which is referred to as a regions ability to recover from external shocks and the long-term ability of regions to develop new growth paths (Boschma, 2015). Regional resilience has been associated primarily with long-term adaptability, how history can stand in the way of economic renewal, and how to overcome it (Boschma, 2015).

Other scholars study clusters life cycles and resilience on underlying mechanisms that lead to different paths (Suire & Vicente, 2014; Menzel & Fornahl, 2010). Suire & Vicentre (2014) argue that resilient clusters are those who manage to disconnect their cycle from the cycle of products and show continuous growth – by decreasing their vulnerability through adaptability to resist external shocks and reorienting themselves towards new technology. Moreover, according to Amdam et al. (2020), external shocks result in new development paths from an evolutionary economic geography perspective. This is especially in regions with related variety, where related industrial sectors exist in a region that promotes development from spill-overs between the sectors (Amdam et al., 2020). They argue that regions with a high degree of related variety are more flexible in terms of allocating resources across sectors and are thus more capable of responding to shocks (Amdam et al., 2020).

Lastly, several authors have studied the history and development of the Sunnmøre region and its resilience, which will be presented later in chapter 6.1 (Amdam et al., 2020; Amdam & Bjarnar, 2015). A historical perspective of the region's ability to recover from past crises contributes to our knowledge of regional resilience and how the region's experience might impact the cluster's adaption to the ongoing pandemic.

2.2 Cluster Theory

The underlying concept, which economists have referred to as agglomeration economies, dates back to 1890 in the work of Alfred Marshall, in which he characterised clusters as a concentration of specialised industries in certain localities (Belussi & Caldari, 2009). Marshall is regarded as the first to

conceptualise what he referred to as industrial districts, and his contributions have served as a starting point for many scholars in the field of clusters (Bahlmann & Huysman, 2008). The agglomeration of firms has long been recognised in economic geography and regional science, but the phenomenon was viewed too narrowly and not related to international competition in which inputs are widely accessible from many locations (Porter, 1990).

For a long time, it was common to look at each organisation individually, whereas Michael Porter may have been the one to popularise the concept of clusters in *The Competitive Advantage of Nations* (1990). However, cluster analyses can be traced back to 1967, of which Thompson introduced a new industry perspective. Instead of analysing firms individually, Thompson decided to analyse their interdependencies with their environment (Thompson, 1967). Pfeffer and Salancik (1978) did the same thing, and later scholars started to view firms as open systems depending on information, resources and personnel from their environment. Specifically, Scott (1981) analysed firms as open systems as they are dependent on flows of information, resources, and personnel, contradicting the previous definitions of seeing firms as closed systems.

There is no universally agreed definition of clusters. Professor Paul Krugman (2008 Nobel Prize Laureate in Economics) refers to clusters as agglomerations and knowledge linkages (Reve, 2009). Michael Porter defines it as critical masses in one place of linked industries and institutions – from suppliers to universities to government agencies – that enjoy unusual competitive success in particular fields (Porter, 1998). He later made a simpler definition, explaining clusters as a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities (Porter, 2000). In his book *On Competition,* he defined clusters as a system of interconnected firms and institutions whose value as a whole is greater than the sum of its parts (Porter, 2008).

Furthermore, Reve (2009) says that industrial clusters are characterised by a combination of close cooperation and intense rivalry, fostering innovation and entrepreneurship, of which Silicon Valley and Boston have these characteristics in the information technology and biotech industries. Other scholars argue that clusters are engines of regional economic growth (Turkina et al., 2016). Also,

several empirical studies of clusters have found regional benefits such as entrepreneurship and job creations (Porter, 2003; Delgado et al., 2010, 2016).

Overall, cluster theory is based on the belief that concentrating industries in specific geographic areas can create competitive advantages. By having several organisations operating within a geographical area, clusters can lead to positive externalities, knowledge spill-overs, and innovation (Porter, 1998; Bresnahan & Gambardella, 2004).

2.2.1 The Emerald model

The Emerald model by Reve & Sasson (2012) will be used in this study to analyse and determine the cluster's competitive position and attractiveness. The model provides a framework that is used for analysing the attractiveness of locations, which differs in their abilities to attract advanced education and institutions, highly talented employees, related firms, advanced academic specialists, R&D projects, competent investors, owners, and the creation of environmental solutions (Reve & Sasson, 2012). Moreover, the framework suggests that a cluster's performance or economic competitiveness in terms of industrial attractiveness can be measured and divided into seven dimensions; *Cluster Attractiveness - Educational Attractiveness - Talent Attractiveness - R&D and Innovation Attractiveness - Ownership Attractiveness - Environmental Attractiveness*s.

The authors have chosen to include the Emerald model because it captures several elements of the research question the authors are looking to answer. Firstly, it identifies the weaknesses of the cluster and the areas in which the cluster needs to improve and can therefore be used as a starting point for analysing the cluster's future challenges from the RQ; *What are the main future challenges for the maritime cluster in Møre?* Next, the model captures or identifies and analyses the cluster's strengths, performance and competitiveness in different areas. Thus, the Emerald model is a suitable tool to be used as a base to study the cluster's ability to face its challenges, which is related to the second part of the RQ and a starting point to; *What impact has COVID-19 had in meeting these challenges?*

Cluster Attractiveness

This dimension determines whether industry or region holds a critical mass of firms that make it possible to define a cluster by looking at the geographical

concentration, size, and critical masses of firms and institutions (Reve & Sasson, 2012). A cluster is more attractive if it is more complete. Hence, a cluster that encompasses all parts of the value chain or value creation process is more attractive. Further, a cluster facilitated by an organisation is more attractive than a cluster without, and if a cluster can continuously prove its value creation or economic resources, it becomes more attractive (Reve & Sasson, 2012). Lastly, a cluster is more attractive if its activities are internationalised, as it shows proof of the cluster being competitive in foreign markets as well as its domestic market.

Educational Attractiveness

Reve & Sasson (2012) argue that an industry's ability to successfully compete in its market is increasingly dependent on investments and access to human capital. Suppose an industry is to be attractive over time. In that case, it must be able to draw the best human capital into educational programs that provide the prerequisite knowledge upon which firms can use (Reve & Sasson, 2012). Further, a cluster is more attractive when the number and growth of graduate students taking cluster-specific subjects increase, as well as when foreign students intentionally take their education in a relevant local institution.

Talent Attractiveness

Another way to measure a cluster's competitiveness is through a cluster's ability to attract talented individuals. The industry should attract highly competent human capital before investing in new technologies and competence development (Reve & Sasson, 2012). Some scholars measure the total number of firms and employment when analysing clusters (Delgado et al., 2010). While Reve & Sasson (2012) shift the focus from total employment to only count the vital and skilled labour. They argue that everything else equal; a cluster becomes more attractive when human capital increases. Also, a higher level or growth of salary and skilled foreign labour in the cluster can indicate higher talent attractiveness.

R&D and Innovation Attractiveness

To measure R&D and Innovation Attractiveness, one can look at the publication of studies in the cluster's subjects. The number and growth of both publications and academic workers indicate R&D and Innovation Attractiveness (Reve & Sasson, 2012). As the productivity of academic resources increases, more ideas

are available to be utilised by the cluster. One should also look at what the firms within the cluster are doing in terms of R&D and innovation. By looking at the level of spending on R&D investments as a per cent out of total sales, examining product-, service-, and new market-innovations, as well as the level and growth of patent registrations, are good measures for R&D and innovation attractiveness (Reve & Sasson, 2012). As the cluster draws more R&D investments, more knowledge-intensive projects emerge, consequently disrupting the market.

Ownership Attractiveness

Cluster organisations need owners to finance activities, whether it is financing innovative projects or injecting capital into existing ones. A cluster's ability to attract competent capital, whether it is national or foreign, tells us something about its attractiveness (Reve & Sasson, 2012). By examining the ownership of more than one firm and foreign ownership indicates if cluster firms are attractive outside the region and national borders. Moreover, a cluster is more attractive if it has good access to several venture capitalists. At the same time, many venture capitalists indicate that new projects are being pursued, which will eventually impact cluster performance and value creation.

Environmental Attractiveness

Clusters must also be able to tackle the environmental requirements of tomorrow. With increasing demands for environmental-friendly processes, clusters with better environmental solutions are becoming more attractive, thus essential for future success (Reve & Sasson, 2012). The focus on reducing harmful emissions and pollution to meet global challenges has been a growing criterion for recruits, employees, stakeholders, and other institutions. Thus, a leading cluster in environmental solutions is more attractive than the one that lags.

Cluster Dynamics

The six dimensions previously reviewed describe the conditions under which firms can excel in a cluster, while cluster dynamics determine whether they can utilise these conditions to benefit and create a dynamic environment (Reve & Sasson, 2012). Also, the extent to which firms can utilise the six dimensions depends on how well they create a dynamic environment that involves competition, cooperation, the exchange of goods and services, employees, and

knowledge. Hence, dynamism is a function of competitive and cooperative linkages and the degree of industry labour mobility within the cluster, providing knowledge spill-overs and overlap between industries (Reve & Sasson, 2012). Dynamics have also been explored in terms of knowledge externalities, mostly in the form of labour mobility, and sometimes referred to as Knowledge Dynamics.

There is also a relationship between cluster dynamics and a cluster's ability to adjust to change. Of which a growing number of management scholars are developing dynamic theories (Gooyert, 2019). E.g., theories that explain how clusters change over time and how and why things emerge, develop, grow, or terminate over time. However, the Emerald model's ability to capture and analyse cluster change, and especially from unexpected shocks, is lacking or not mentioned by Reve & Sasson (2012).

In fact, a lot of cluster research focuses on how it functions and disregards the cluster's evolutionary development, i.e., how clusters actually become clusters, how they decline, and how they shift into new paths (Menzel & Fornahl, 2010). Amdam et al. (2020) argue that external shocks result in new development paths in regions from an evolutionary perspective, hence a dynamic process. Thus, the authors have decided to include an element in the *Cluster Dynamics* dimension regarding a cluster's life cycle model from Menzel & Fornahl (2010). The model will be elaborated further in the cluster analysis. In short, it displays the different phases of a cluster, which can be used to explain or show a cluster's ability to restructure from unexpected shocks more clearly and to get a more comprehensive understanding of cluster evolutionary development.

Overall, the six determinants and *Cluster Dynamics* represent an explanatory model of the attractiveness of localities and sources of competitiveness for the cluster. **Exhibit 1** shows a visualisation of the Emerald model from a two-dimensional hexagon surface, with six determinants that make up the ground dimension, while knowledge dynamics represents the second dimension which gives the model its characteristic emerald look.

3.0 Methodology

This section is devoted to the description and justification of appropriate design and methods for the study. Research methodology concerns guidelines, procedures, and techniques to identify, select, process, and analyse data to be able to answer questions about the social world (Straits & Singleton, 2017).

Our proposed research question, "*What are the main future challenges for the maritime cluster in Møre, and what impact has COVID-19 had in meeting these challenges?",* aims towards the exploration of a social phenomenon and to describe the reality as experienced by the respondents; thus, a qualitative research approach is appropriate (Adams et al., 2007).

3.1 Research Design

Research design is the plan of research methods and techniques used for the investigation (Straits & Singleton, 2017). This paper will apply a qualitative research design, specifically a case study. A qualitative case study method enables us to conduct an in-depth exploration of a phenomenon within a particular context (Rashid et al., 2019). The chosen study will be of one single case, the maritime cluster, in the context of a pandemic. Thus, the unit of analysis is the whole maritime cluster in Møre.

To understand its competitiveness, the impact from COVID-19, and the complexity of the cluster, it is appropriate to go in-depth to get detailed and rich descriptions with a qualitative method to answer our proposed research question. Thus, a case study seems suitable to investigate the social phenomenon of a pandemic and its impact on the maritime cluster. As mentioned, the paper follows a two-folded structure or empirical plan to distinguish and analyse how the cluster appears from existing data through the Emerald model (Part 1) against how it actually is from the cluster members and other respondents through interviews (Part 2). In which both parts will be used to answer the research question.

3.2 Sampling

Researchers distinguish between probability sampling and non-probability sampling, which involves the process of random or non-random selection (Straits

& Singleton, 2017). The paper will apply the non-probability sampling technique, particularly purposive sampling, to select representative units or units typical of the population. In our case, the population is all the members and companies of the maritime cluster in Møre. To find a representative sample, we aimed to interview and talk to the cluster organisation itself, managers from different cluster companies as well as other stakeholders outside the cluster to get an external view. Consequently, by interviewing cluster companies from the entire value chain, we obtain numerous perspectives and richer comprehension of the COVID-19 situation in Møre. This enabled us to understand how the cluster competitiveness has been affected and why some companies respond differently.

The selection consisted of eight respondents from seven interviews, in which the Ulstein Group consisted of two respondents from two separate interviews and Green Yard Kleven with two respondents in the same interview:

Organisation	Cluster affiliation	Respondents	Date and place
Kongsberg Gruppen	Equipment supplier	1 – From top management	05.03.2021, through Microsoft Teams
Skipsteknisk	Ship designer	1 – From executive management	05.03.2021, through Zoom
Green Yard Kleven	Shipbuilder	2 – Executive and top management (**same interview**)	16.03.2021, through Zoom
Ulstein Group	Shipbuilder, ship designer, and shipping	2 – Executive and top management (**two separate interviews**)	17.03.2021, through Zoom 25.03.2021, through written email
ÅKP & GCE Blue Maritime	Cluster facilitator	1 – Executive management	19.03.2021, through Zoom
BI Norwegian Business School	Former strategy advisor in Ulstein	1 – Cluster expert	15.03.2021, through Zoom

For simplicity, in interview situations where two or more representatives are represented from the same company, we will just refer to the organisation as a whole. An exception is the former strategy advisor in Ulstein, which we will refer

to as the cluster expert. This will make it easier than using a lot of different names throughout the analysis.

3.3 Data Collection

The goal was to collect enough data and sufficient information to get a broad understanding of the cluster's current competitive position and the pandemic's effect on the cluster by using both primary and secondary data, which will also provide the basis for our analysis and discussion. Thus, we believe that gathering data from multiple sources creates triangulation to increase the study's validity.

Primary Data

To get an in-depth understanding of the phenomenon thoroughly, we applied one-to-one in-depth interviews as our primary source of data, where respondents can freely explain and describe the situation in their own words. Thus, we were conscious of not saying too much but rather have full attention and focus on the respondent. Hence, fewer biases occurred due to interpersonal factors. This method allowed us to restate or clarify questions that the respondent did not understand (Straits & Singleton, 2017).

Further, by guaranteeing anonymity, it encouraged the respondents to speak more openly and honestly. In which a semi-structured interview guide with open-ended and follow-up questions was used to allow the respondents to fully express themselves and avoid yes/no leading answers. Additionally, we applied different interview guides on different participants based on their roles and activities within the cluster. **Exhibit 2** displays the interview guides that have been carried out.

Secondary Data

The primary data from the in-depth interviews allowed a lot of information to be collected. However, it is time-consuming, and sample sizes tend to be small. Thus, one may question the representativeness of the findings. Therefore, the study will also rely on material from secondary data sources as a supplement to our data collection (Adams et al., 2007). Additionally, to complement, verify and validate the data from our obtained sample. Many second-hand sources are available from written materials such as books, libraries, and the web.

It is essential to assess the quality of the data and consider the authenticity of the data source before using it (Adams et al., 2007). Thus, we will rely on secondary data gathered from the GCE Blue Maritime, annual reports from ÅKP, Menon Economics reports, surveys, and other public documents relevant for the analysis. Secondary data from academic journals and books are mostly used for the methodology and theoretical part but will also be referred to in the analysis.

3.4 Data Analysis

The paper uses a two-part empirical plan and structure, which include two data analysis, in which the first part is an Emerald analysis based on existing secondary data, and part two is an interview analysis based on primary data:

Part 1 of the data analysis will analyse and describe the cluster as it appears today from publicly available sources and determine its attractiveness from the Emerald model analysis. The first part will also analyse and identify the pandemic's effect on the cluster's performance and competitiveness before assessing the main future challenges from the Emerald model.

Part 2 will analyse the in-depth interviews from cluster members and relevant actors on what they see as: the main future challenges, key factors for cluster attractiveness, how the cluster should develop further, important conditions to stay competitive in the future, and how COVID-19 has affected the cluster and impact on future challenges. Here we applied a cross-case analysis to examine the similarities and differences between the various responses to produce new knowledge. Additionally, we cross-referenced with secondary data sources to validate and confirm the information and interpretation of the interview data.

3.5 The Interviews

The duration of each interview lasted between 45 to 60 minutes, whereas the same researcher conducted all the interviews to assure consistency. We sent the participants a sheet of questions before the interviews, so they got time to prepare properly. Six out of seven interviews were carried out through Microsoft teams- or a Zoom call and audio recorded from the record button. A digital video meeting is suitable during these uncertain times to prevent any further spread of the virus. However, we would prefer a face-to-face meeting if the circumstances allowed it.

Moreover, one of the respondents from the top management in Ulstein preferred to conduct the interview in a written format through email due to the essence of time and availability. Each interview was then transcribed in Norwegian after the interview as soon as possible to preserve accuracy. Next, we translated the transcription into English. After the interview, we sent each participant a consent form with written permission to use the data collected. Follow-up questions through email were also scheduled to discuss unclear data.

4.0 Introducing the firms of interest

This section will present the companies that we interviewed to understand their role in the value chain and history within the cluster. Again, we got in touch with eight respondents from seven separate interviews. However, this section will only present the four cluster companies, not the cluster organisation itself, since ÅKP and GCE Blue Maritime will be discussed later. Additionally, we will not introduce the cluster expert either due to confidentiality reasons.

4.1 Kongsberg Gruppen

Kongsberg Gruppen is a leading global technology corporation established in 1814, developing some of the newest and advanced technology for seaborn, deep-sea, land-based, airborne, digital, and outer space industries (Kongsberg, 2021a, 2021b). The group is divided into three main divisions: Kongsberg Maritime, Kongsberg Defence & Aerospace, and Kongsberg Digital. They had revenues of 240 billion NOK in 2019, of which 160 billion NOK (66%) was from Kongsberg Maritime, and 6 billion NOK from the Maritime Department in Ålesund (Kongsberg, 2019; Proff, n.d.a). Kongsberg has 10 793 employees worldwide, where 7 212 are working in the Maritime division and at least 260 in department Ålesund (Kongsberg, 2019; Proff, n.d.a).

Kongsberg's presence in the cluster is mainly centred around its acquisition of the former British company Rolls-Royce Commercial Marine in 2019, strengthening its position as a leading equipment supplier to the maritime industry in Møre (Kongsberg, 2021b; Brewer, 2021). Rolls-Royce had previously acquired several operations in new equipment and services within the offshore sector like Vickers

plc. Today, Kongsberg Maritime produces equipment like propulsion systems, engines, bridge systems and control centres, among many other products and services for the cluster (Kongsberg, 2021c). And the Norwegian Government is the group's major shareholder, owning over 50% of the shares (Rosbach, 2018).

4.2 Skipsteknisk

Skipsteknisk is an independent ship design consultants company established in 1976 and offers know-how and design services for global shipping companies (Skipsteknisk, n.d.a). They are recognised as an innovative consultancy company with a worldwide reputation and one of the leading players in ship design in Møre. Specialise in designing offshore research-, service-, windfarm-, fish farming- and coastguard vessels. E.g., fish trawlers, crab catchers, offshore construction vessels, polar research- and expedition vessels, among others (Skipsteknisk, n.d.b). The company and head office are located in Ålesund with revenues of 133 million NOK in 2019 and over 51 employees (Proff, n.d.b).

During the 1980s, the company established itself as a key player in modernising the fishing fleet in rough and harsh conditions in the North Atlantic (Skipsteknisk, n.d.b). In the 1990s, Skipsteknisk expanded its operation by designing research vessels for research institutes worldwide. Then, in the early 2000s, the company entered the market of specialised and advanced offshore service vessels. Today, Skipsteknisk offers its clients a wide range of specialised vessel design, including wind farm service vessels, fish carriers, coast guard and patrol vessels (Skipsteknisk, n.d.b). The group also consists of an electrical service company Skan-EI AS located in Ålesund, and Skipsteknisk Engineering AS in Turkey and a branch office in China. Skipsteknisk is today locally owned, with all owners residing in Ålesund (Proff, n.d.b).

4.3 Green Yard Kleven

Green Yard Kleven is a newly established company from 2020 when Green Yard Group acquired Kleven Verft after the company filed for bankruptcy the same year (Green Yard, 2020). Once a family-owned company and now externally owned after the acquisition, they now provide the entire life cycle of shipbuilding, from construction, rebuilding, repair and maintenance services to recycling. The

yard operates in Ulsteinvik and specialises in building offshore ships, fishing boats, passenger ships, ferries, yachts, among others (Green Yard Kleven, n.d.a).

Since the company is under a year old as of writing, the available data of revenues and employment is lacking. Yet, Kleven Verft AS had revenues of 2 billion NOK in 2018, while Green Yard AS had 34 million NOK as of 2019 (Proff, n.d.c, n.d.d). Over 400 employees were affected by the bankruptcy, but how many of these are working for Green Yard Kleven is unknown (Iversen, 2020). Between 2015-2018, Kleven had a total loss before tax of 1.2 billion NOK related to the construction of offshore- and expedition ships (Iversen, 2020). Also, the pandemic presented challenges with fewer orders and less demand for shipbuilding.

Green Yard was founded in 2018 in Feda and Norway's leading player in environmentally friendly ship recycling, with 36 employees (Green Yard, 2021; Proff, n.d.c). In contrast, Kleven has a long history and legacy as a shipbuilder and was founded in 1939 by Marius Kleven as a blacksmith in Ulsteinvik (Green Yard Kleven, n.d.b). After the war, it was time to rebuild the fishing fleet, where Marius Kleven and his sons received many assignments in repairs and extensions of vessels. In the 1950s, their facility had a shipyard with several buildings and slipways to accommodate the bigger ships. Kleven got their first shipbuilding mission in 1961 to build a fishing boat in steel and landed major international contracts in the late '60s. The company continued its expansion in the '70s and '80s and was considered one of the largest shipbuilders in Norway in 1989. In the following years, Kleven merged with Kværner and Myklebust. However, in 2018 Kleven was acquired and 100% owned by Hurtigruten after the downturn from the offshore crisis, and no longer family-owned (Green Yard Kleven, n.d.b). Then the company was sold to the Croatian company DIV Group in 2020, which ended with bankruptcy just after four months (Iversen, 2020). Finally, the current owners from Southern-Norway, Green Yard Group, took over (Iversen, 2020).

4.4 Ulstein Group

Ulstein Group is a family-owned company head office in Ulsteinvik which operates in several fields in the maritime industry and is recognised as one of the industry leaders within ship designs and shipbuilding. The group consists of three main divisions: Design & Solutions, Shipbuilding, and Shipping (Ulstein, 2019).

Ulstein both designs and builds vessels like exploration cruises, yachts, fisheries, oil & gas, RoPax and vessels for the offshore wind industry, among others (Ulstein, n.d.a, n.d.b). As of 2019, Ulstein's generated 2.5 billion NOK with 545 employees worldwide (Ulstein, 2019).

Ulstein's long heritage and history in the cluster goes back more than 100 years. The company was established by Martin Ulstein and his brother-in-law Andreas Flø in 1917 under the name Ulstein mek. Verksted (Ulstein, n.d.c). They started as a mechanical workshop to modify local fishing boats, undergoing a global transition from sail-power to motorisation. After Martin died in 1948, his eldest son, Magnulf, took over the position as a manager (Ulstein, n.d.c). In the following years, Ulstein evolved to a global player and took part in many technological transformations in the maritime industry. And in the 1960s, they started producing passenger vessels and propellers under Idar Ulstein, Martin's youngest son (Ulstein, n.d.c). In the late 60's, the company began to introduce its own ship designs adapted for the newly discovered oil & gas fields.

Fast forward, in 1999, most of the company was sold to Vickers (later acquired by Rolls-Royce, and now owned by Kongsberg), but the Ulstein family kept the shipbuilding division and started building the new Ulstein brand (Ulstein, n.d.c). Today, the company has restructured itself from the oil & gas market to the exploration cruise and offshore wind market, headed by Gunvor Ulstein and Tore Ulstein (Ulstein, 2019). In 2020, Cathrine Kristiseter Marti was appointed the new CEO of Ulstein Group, as Gunvor Ulstein and Tore Ulstein left management to concentrate on long-term strategic possibilities for the company as chairmen of the board of directors (Vikan, 2020)

5.0 The maritime cluster in Møre (Part 1)

This is the beginning of the first part of the two-folded structure (using secondary data from publicly available sources), where the authors will introduce the maritime cluster's history and development before conducting a cluster analysis through the Emerald model in the next chapter.

5.1 History and development of the cluster

The history and transformation of the maritime cluster in the district of Sunnmøre can be traced back to the 1860s, from the production of fishing vessels in the shipyards in Ålesund and Vestnes municipality, before new yards grew up in Ulsteinvik and other villages before making a visible transformation of the fishing fleet in the 1920s and '30s (Amdam & Bjarnar, 2015). During the '20s and '30s, several national crises struck the region, where prices for white fish diminished with a collapse in the catch, resulting in bankruptcies of local banks, which made access to capital difficult. The reduced number of fishermen in Sunnmøre fell by 50% until 1939 (Amdam et al., 2020). A national crisis affected the region and spread to fishery and related activities in the interwar period, where firms diversified into new activities such as processing and manufacturing fishing vessels and equipment (Amdam et al., 2020). Thus, the strategy of diversification prepared them for future crises with more legs to stand on.

By the late '40s, the region was unmatched by any other regions in Norway regarding the completeness of the fisheries and related yards, workshops and equipment producers. Yet, a shock in the late '50s occurred when the herring disappeared from the coast, and the cluster had to react by searching for remote fishing areas for new species (Amdam et al., 2020). Thus, the resource/herring crisis was met by specialisation and modernisation of the fishing fleet, as well as restructuring of the process industry. In the 1950s and '60s, they emerged as the leading maritime region in Norway, with strong ties between yards, fisheries, mechanical workshops, and equipment producers. Continuously innovating, the spread of new ideas, and solutions from the yards and equipment producers, laid the foundation for the transition from wooden vessels to the revolution-based steel vessels for deep-sea fishing during the '60s and '70s (Amdam & Bjarnar, 2015). Another breakthrough in the late '70s extended the fishing range and flexibility of the combined ring net and trawler development.

Further, the maritime cluster emerged as the dominating cluster in Norway in the '70s, of which employment grew by 121% in the shipbuilding industry and 363% in the building and maintenance of steel vessels since the '60s (Amdam & Bjarnar, 2015). At the same time, the industrial structure and establishment of

stronger local and regional banks were significantly expanded. And there were about 38 shipyards in 1970. While other parts of Norway suffered from the oil crisis of 1973, the local industry in Møre was strengthened as a cluster. Their ability to innovate and develop new fishing vessels and equipment, as well as proactively responding to supply ships to the new oil & gas fields, created a valuable experience in adjusting to external pressure (Amdam & Bjarnar, 2015). Since the local shipyards were small and flexible, they could more easily move from producing ships to repairing. The local shipyards applied their experience from fishing fleets directly to the new offshore supply vessels (OSVs), as these OSVs were operating in very similar conditions as fishing vessels. In 1974, about 93% of the total industrial workforce in Ulstenvik worked in the maritime industry, and 25% worked in the Møre region (Amdam & Bjarnar, 2015).

From the '80s, a renewal of the factory trawlers fleet was forced to explore global fisheries, which proved to be a profitable market and a key factor in the cluster's success (Amdam & Bjarnar, 2015). During the '90s, the region became gradually more exposed to globalisation, and foreign actors become more interested in investing in the region due to its high competence and reputation. The region's reaction to globalisation was reduced investments in fisheries combined with new investment in the maritime offshore industry and foreign direct investments (FDI) (Amdam et al., 2020). Fast forward to modern times; the cluster has gone through many crises and restructuring processes, notably the profound oil crisis in 2014, where the cluster switched from the oil & gas industry to the production of boats and equipment for the cruise and tourism industry (Blue Maritime Cluster, 2020).

Since 2015 the orders for offshore service vessels have been substantially reduced (Jakobsen, Helseth & Aamo, 2020). Decreased demand from offshore shipping companies has led to less innovation in that segment. Thus, the cluster had to adjust itself with new value chains and linkages. Today, the Møre cluster is facing a new crisis, a global pandemic, and the new transition towards the cruise industry has not been profitable. The coronavirus is likely to mitigate the demand for years to come. As a result, the cluster might be forced to reinvent itself once again.

6.0 Cluster Analysis (Part 1)

In this chapter, the authors will apply the Emerald model to analyse and determine the Møre cluster's attractiveness and competitive position from publicly available sources. Further, the authors have decided to include some national factors in the analyses that directly or indirectly affect the cluster, enabling a more comparative analysis of the cluster against the maritime industry and other regions to understand its competitive position more comprehensively.

After the analyses, each pillar or dimension will be given a score between 1-10, in which 1-4 is considered a weak dimension and not very attractive. A score of 5 is mediocre, and 6-10 is above mediocre and viewed as stronger dimensions, thus indicating attractiveness. Lastly, an overall conclusion of the Emerald model will be presented, the findings from COVID-19's effect on the cluster's performance and competitiveness, as well as the main future challenges.

6.1 The maritime cluster competitiveness in Møre

6.1.1 Cluster Attractiveness

Cluster attractiveness consists of several combined elements, e.g., a cluster facilitated by a cluster organisation is more attractive than a cluster without a facilitator. A cluster is also more attractive if it specialises in a specific sector with activities along the entire value creation process, hence cluster completeness (Reve & Sasson, 2012). Further, regional concentration, the proximity between cluster members, the cluster size, the critical mass of firms and institutions, and internationalisation are relevant to investigate.

Concentration

The cluster is located in the northernmost part of Western Norway in the county and municipality of Møre og Romsdal (see **Figure 1**). The county borders Trøndelag, Innlandet, Vestland, and the Norwegian Sea (Stokkan & Thorsnæs, 2020). There are currently 265 238 residents in the area, with Ålesund being the largest town, while the county administration is located in Molde (Stokkan &

Figure 1. Møre og Romsdal

Source: SNL, 2020

Thorsnæs, 2020). They have a coastline of 9 545 km and a total land area of 15 101 km2 (SSB, 2017). It is common to divide the county and population into the districts of Sunnmøre, Romsdal and Nordmøre. But the boundaries between these areas have been somewhat modified from municipal changes in the 20th century (Stokkan & Thorsnæs, 2020).

From **Figure 2** below, we see that the highest geographic concentration of cluster members can be found in Ålesund, with critical masses of equipment suppliers dominating. Critical masses of shipyards are apparent in Ulsteinvik, shipowning companies in Fosnavåg, and equipment suppliers in Molde, allowing very accessible linkages between firms and knowledge spill-overs (Bugge & Thormodsæter, 2016). As a result, clustering companies benefit from the proximity of key customers and suppliers, creating synergies, collaborative linkages and competition that fosters innovation. The proximity to the coast is a strength for the maritime industry but far from unique, and most counties in Norway have long coastlines, fjords and islands (Jakobsen et al., 2014).

Figure 2. The geographic concentration of the cluster


Source: Bugge & Thormodsæter, 2016

Most of the cluster companies are concentrated in Møre, ranges from small, medium, to large-sized companies that help strengthen the regional maritime cluster (åkp, 2020). Vard Group is considered the largest cluster member measured by operating revenues, followed by Kongsberg Maritime, Havila and Ulstein (see **Exhibit 3**) (Largest Companies, n.d.).

Cluster mapping

The Møre region is home to a unique concentration of maritime companies, surrounded by specialised research and development (R&D) and educational institutions (Blue Maritime Cluster, n.d.). Together they represent the maritime cluster, consisting of 220 members, a total of 13 600 employees and a turnover in 2020 of 47 billion NOK (åkp, 2020). The cluster map from **Figure 3** gives an overview of the network of actors and linkages between the cluster members.

Figure 3. Cluster map representing the cluster members
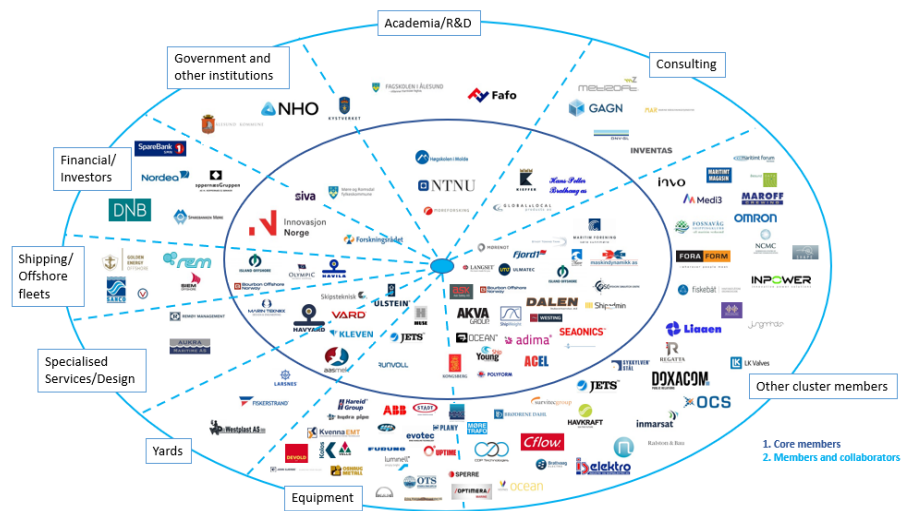
Source: Own team analysis

The cluster companies dominate in all parts of the value chain and can be categorised into four segments: services, shipping, yards, and equipment. Companies like Skipsteknisk, Ulstein Design, Havyard Design and Marine Teknikk designs the world's most advanced offshore vessels operating in some of the most challenging environments at sea (Jakobsen, Helseth & Aamo, 2020). The shipping companies controls and operates this advanced fleet, such as Havila, Olympic, Bourbon, and Island Offshore, operating worldwide. The majority of the vessels are produced by local shipyards like Kleven, Vard, Havyard and Ulstein (Jakobsen, Helseth & Aamo, 2020). Whereas the equipment producers like Kongsberg Maritime CM, IP Huse, Brunvoll supply the yards with, e.g., engines, propulsion, winches, hull coatings, software and electronics.

Furthermore, from Porter's (1998) definition of a cluster, we see that Møre is definitely a maritime cluster with critical masses of firms in one geographical area

which links maritime industries and institutions, from a pool of shared suppliers, universities and government agencies which are interconnected.

Cluster organisation

ÅKP (Ålesund Kunnskapspark) is the regional hub for innovation, business- and social development in Møre and the facilitator of the cluster project GCE Blue Maritime on behalf of the cluster members (åkp, n.d., 2020). With headquarters in Ålesund, the Blue Maritime project is funded by Innovation Norway, SIVA, Forskningsrådet, Møre og Romsdal fylkeskommune and managed by a steering committee, consisting of 12 key people from the maritime industry, county and NTNU Ålesund (åkp, 2020; Blue Maritime Cluster, n.d.). Thus, the cluster can draw on extensive expertise and network from the ÅKP knowledge environment.

The cluster was admitted as an official Norwegian cluster under the Norwegian Centre of Expertise (NCE) status in 2006 by the government and awarded the Global Centre of Expertise (GCE) status in 2014 due to its unique global market position, rapid innovation, and its important contribution to Norwegian value creation (NMCC, n.d.; åkp, 2018). Within 10 years, the cluster project GCE Blue Maritime's goal is to be recognised as the world's leading and most innovative knowledge and competence cluster in advanced maritime operations (Innovation Norway, n.d.). The cluster program GCE will contribute to this by strengthening the cluster's competitiveness and value creation through collaboration, increasing the pace of innovation, access to highly qualified labour, research capacity, and promoting international attraction (Innovation Norway, n.d.; NMCC, n.d.).

Furthermore, the cluster project GCE Blue Maritime creates value for its members by providing several services for the cluster, such as (**1**) offering competence, by providing professional seminars, courses, conferences, and workshops (åkp, 2020). (**2**) Providing growth and internationalisation programs for companies. (**3**) Simulation and testing services by offering expertise and tools for virtual prototyping and development of digital twins. (**4**) Providing networks and relationships with industrial environments, clusters, and decision-makers nationally and internationally. (**5**) Services in R&D and innovation projects, helping to mobilise, develop and implement projects. (**6**) Recruitment measures against youth. (**7**) And hosting international delegations (åkp, 2020). These

initiatives increase value creation and strengthen the collaboration and knowledge-sharing in the region, thus contributing to cluster attractiveness.

Moreover, the authors will try to distinguish between the Møre cluster as a construction of all maritime companies and related activities against the cluster organisation ÅKP and cluster project GCE Blue Maritime. However, GCE Blue Maritime Cluster is also often used as a term and synonym for the cluster as it includes the majority of the maritime companies and members. We are aware of the difference between the cluster as a construction through shared values, norms and history against an organisational phenomenon like ÅKP and its project GCE Blue Maritime. Thus, we will be cautious to distinguish the latter.

Cluster completeness

There are 14 shipyards, 170 suppliers of equipment producers, 13 ship designers, 18 shipping companies in the cluster (åkp, 2020). With several R&D institutions, universities, and ÅKP science park, as a result, the cluster reveals the existence of economic activities across the entire value creation process, from R&D to manufacturing, suppliers, designers, and owners. Hence, a complete value chain.

As mentioned in Meld. St. 10 (2020-2021), the Ministry states that the region of Møre has the most complete regional maritime environment in Norway (p. 22). Thus, enabling synergies between cluster members from highly collaborative processes throughout the value chain. The cluster includes firms and institutions engaging either horizontally- or vertically structures (see **Figure 4** below). Other companies operate in several parts of the value chain simultaneously, e.g., Ulstein, Vard, Havyard, and Aas Mek are both ship designers and shipbuilders.

Figure 4. The cluster's value chain
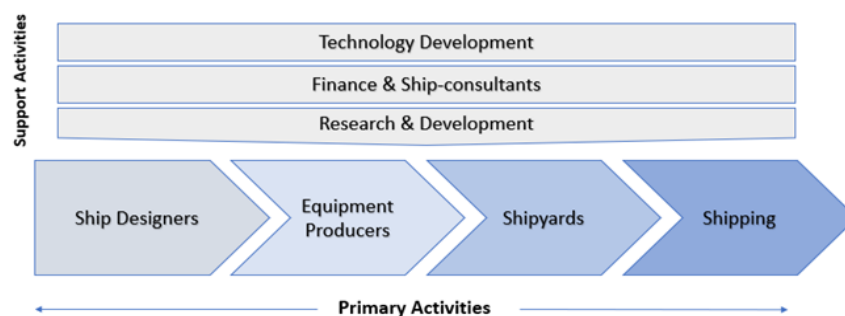
Source: Adapted from Blue Maritime Cluster, 2020

A vital prerequisite for competitiveness in the maritime industry is the transfer of competence between different value chain parts. Plus, the transfer of competence between companies onshore and offshore. The mobility between the sea and land-based industry contributes to linking companies and exchange knowledge, including vertical links and horizontal links in the value chain. Yet, a report on GCE Blue Maritime Global Performance from Menon Economics reveals that the traditionally tightly integrated value chain, once the key feature of the Møre cluster, is becoming looser, and the cluster linkages are weakened (Jakobsen, Helseth & Aamo, 2020).

Many offshore shipping companies have not ordered ships for years. Thus, the yards have been forced to find new customers and suppliers outside the region, and these relationships have become important in order to stay competitive (Jakobsen, Helseth & Aamo, 2020). As a result, the cluster has reinvented itself with new value chains and linkages towards the exploration cruises. In September 2020, Menon Economics published a report confirming a historically high construction activity of exploration cruises (åkp, 2020). Despite the corona situation, few ordered projects between 2016-2019 were cancelled or postponed.

Value configuration

Different value configurations are present in the cluster, whereas Fjeldstad and Stabell (1998) distinguish between the value chain, value shop, and value network. The value chain transforms inputs into products, as in manufacturing firms. Value creation mechanisms include activities such as inbound logistics, operations, outbound logistics, marketing, and services (Fjeldstad & Stabell, 1998). E.g., yards and equipment producers operate in a typical value chain. Further, a value shop resolves customer problems. It provides value from knowledge sharing, problem-solving and creating solutions. Consultancies, specialised services firms, and ship designers from the cluster can be categorised as value shops. Lastly, the value network links nodes – customers, things, and places – and provides services that allow various exchanges (Fjeldstad & Snow, 2018). E.g., communication services, banking, and finance companies provide value by connecting clients with investors. Overall, the cluster creates value from all configurations, increasing diversity, rivalry, and attractiveness.

Value creation

Value creation has no explicit definition, whereas SSB (2020b) defines value creation as the gross product in basic value, i.e., the value of what has been produced minus the operatic costs of making it. While value-added is often used as a measure of activity, a company's purchases of goods and services subtracted from its turnover, or the sum of EBITDA (*Earnings Before Interest, Taxes, Depreciation and Amortisation*) and wage costs (Jakobsen, Helseth & Aamo, 2020). Value-added has some key advantages other measures lack, e.g., it avoids double-counting purchases of goods and services, making it more comparable across business sectors. This is important in a cluster like Møre, where there is a high degree of internal sales (Jakobsen, Helseth & Aamo, 2020).

Value creation in the Norwegian maritime industry

Norway's total value creation from the maritime industry was 89 billion NOK in 2018, accounting for 3% of the mainland economy (Meld. St. 10 (2020-2021)). Divided by counties, Vestland had the highest maritime value creation of 18,4 billion NOK, followed by Oslo and Rogaland (See **Exhibit 4**). And then Møre og Romsdal with 8,5 billion NOK (excluding economic activity related to banking, finance, and services towards extraction of oil & gas). The value creation from the maritime industry in 2019 and 2020 is yet to be determined.

Value creation in the maritime cluster of Møre

As of 2018 and 2019, the most critical industry for value creation was the oil & gas industry, accounting for almost 40% of cumulative value-added for both 2018 and 2019 (10 billion NOK). This is followed by fisheries & aquaculture (7 billion NOK) and the cruise industry (2,7 billion NOK) (Jakobsen, Helseth & Aamo, 2020). A report on how the pandemic affected the value creation of the whole 2020 and 2021 is yet to be published. Therefore, the following section will rely on Menon Economics latest report on cluster performance from 2020 with estimates and forecasts regarding COVID-19 (Jakobsen, Helseth & Aamo, 2020).

From **Figure 5** below, we see that the value-added (EBITDA + wage costs) has been multiplied several times since 2004 (7 billion NOK), peaking in 2014 (26 billion NOK) with over 10 years of continuous growth, before drastically dropping in four consecutive years due to the offshore crisis. Thus, the maritime

industry can be characterised as a cyclical industry and dependent on high oil prices. But in 2018 and 2019, the value creation grew, primarily driven by land-based segments in design and services (Jakobsen, Helseth & Aamo, 2020). The cluster expected further growth in the coming years, but COVID-19 altered those expectations significantly.

Figure 5. Value-added split by wage cost and EBITDA
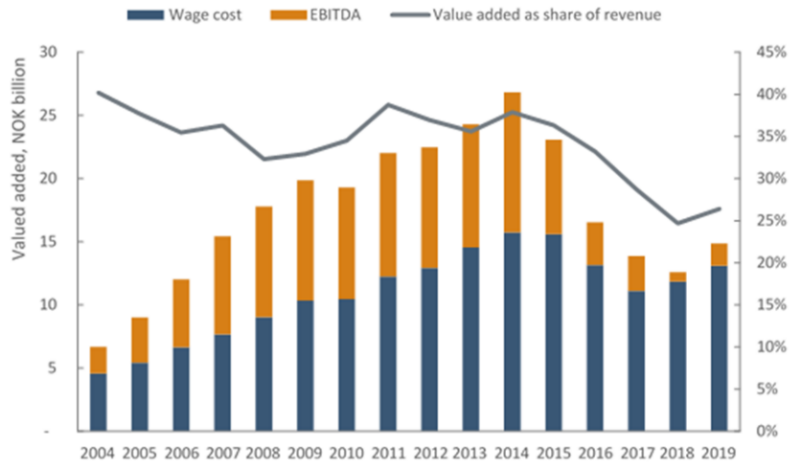
In 2019, the cluster's total value creation was approximately 14.6 billion NOK, which consisted of 6.8 billion NOK from the shipping segment (~46%), 4.0 billion NOK from equipment (~27%), 3.2 billion NOK from services (~22%) and 0.6 billion NOK from the yards (~4%) (åkp, 2019; Jakobsen, Helseth & Aamo, 2020). Further, from ÅKP's homepage, we eventually found that the value creation in 2020 was 15 billion NOK, which is almost exactly the same as in 2019 (åkp, 2020, 2019). This is surprising as both the turnover, employment, and profitability did plunge due to COVID-19 (åkp, 2020). There was no underlying information that could elaborate more on this, and how much of these 15 billion NOK is from shipping, services, equipment, and yards is yet to be determined.

Revenues in the maritime cluster of Møre

From **Figure 6** below, we see that the offshore oil & gas segment is still the biggest contributor to the cluster's combined revenues as of 2019, five years after the offshore crisis. Yet, the dependency has gradually been lowered since 2014. In fact, the oil & gas industry revenue contribution has decreased from 50% in 2017 down to 32% in 2019 (Jakobsen, Aamo et al., 2019). However, the proportion is

still high for the shipping companies, with 65% of their revenues coming from oil & gas, making these cluster members vulnerable to oil price fluctuations.

Figure 6.

Left: Distribution of the cluster's revenues **Righ**t: Turnover distributed on the value chain
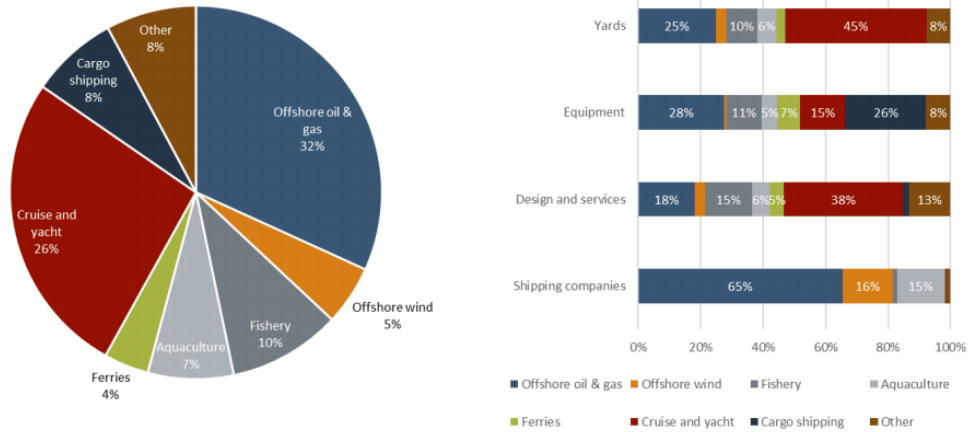
Source: Jakobsen, Aamo et al, 2019

Following the offshore oil & gas, the cruise and yacht, and the fishing industry constitute the second and third largest market segments for the maritime cluster in Møre (Jakobsen, Aamo et al., 2019). In fact, the cruise and yacht market has had the most significant growth due to many new contracts and orders towards the yards and service companies. But the transition towards exploration cruises has not been profitable for the yards, and COVID-19 will likely affect the demand for years (Jakobsen, Helseth & Aamo, 2020).

COVID-19's effect on revenues and profitability

Since the oil crisis in 2014, a constant oversupply of offshore vessels is still affecting both profit margins and activity among most companies in the cluster. The historically profitable offshore market has largely been replaced by less profitable deliveries towards new expedition cruise vessels, fishing vessels, ferries, and well boats (Jakobsen, Helseth & Aamo, 2020). The yards are struggling to be profitable from the cruise industry because the new-building activity fell and because many shipbuilders engaged in fierce competition for new contracts, pushing down margins (Jakobsen, Aamo et al., 2019). This is then affecting the demand and orders towards equipment suppliers.

The cluster experienced increased revenues in 2018 and 2019, mainly driven by a rise in the cruise industry – new orders from many national and international cruise companies (Jakobsen, Helseth & Aamo, 2020). Fisheries and aquaculture did also experience increased revenues. Simultaneously, the offshore oil & gas market's income had declined since the offshore crisis before growing slightly in 2019 (see **Exhibit 5**). However, the cluster's turnover is estimated to be reduced from 55.3 billion in 2019 to 47 billion NOK in 2020 (-15%) due to COVID-19 (Jakobsen, Helseth & Aamo, 2020). But this is yet to be verified and determined.

Menon Economics yearly survey of the cluster revealed that the yards have been hit hardest by COVID-19 and expect their revenues to be halved by 2021 compared to the 2019 level (Jakobsen, Helseth & Aamo, 2020). The offshore shipping companies also anticipate a decline in revenues in 2020 and 2021 (see **Figure 7** below**)**. The same can be said for the service companies, but they represent the most stable and profitable segment.

Figure 7.

Top: Revenues from the four segments. **Bottom**: Income from Møre, domestics, and exports
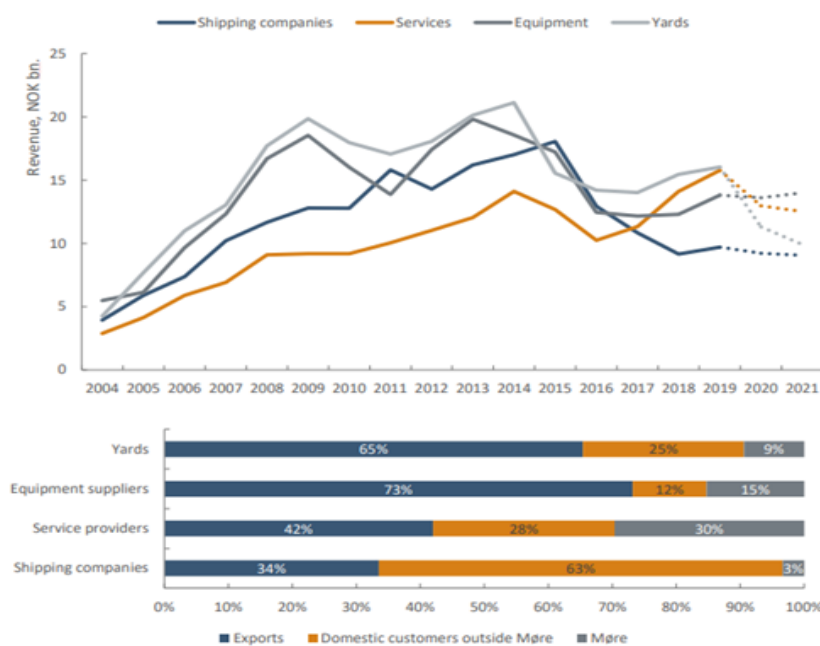
Source: Jakobsen, Helseth & Aamo, 2020

In contrast, the well-boat operators expect continued growth, together with the equipment suppliers, which anticipate their revenues to surpass 2019 levels (Jakobsen, Helseth & Aamo, 2020). The equipment suppliers are less affected

since they are more diversified towards export and other markets. Hence, they do not rely on domestic customers that much compared to the shipping companies.

The Menon Economics survey on cluster members reveals that 93% of the respondents say that *slowing markets* are the main factor for weakening profitability for most companies (Jakobsen, Helseth & Aamo, 2020). And 46% says that COVID-19 is a direct consequence, causing reduced cost-efficiency and temporary higher costs (see **Exhibit 6**). This was followed by *lower prices* and a *depreciation of the NOK currency,* which had its lowest value at 11.8 USD/NOK on March 11th, 2020 (Jakobsen, Helseth & Aamo, 2020; XE, 2021). The currency drop is partly explained by fear, uncertainty and a sudden fall in oil prices. Thus, the currency's decline made it more expensive to import parts and equipment, but beneficial for the export industry in which foreigners have to pay more. One year later, as of March 11th, 2021, the currency has strengthened itself to 8.4 USD/NOK while oil prices rose, affecting the import prices positively and the profitability of export products negatively with smaller margins (XE, 2021).

Other and deeper explanatory reasons why cluster companies experience decreased profitability under COVID-19 are the effect of delayed deliveries due to customer demands (Jakobsen, Helseth & Aamo, 2020). Delayed deliveries from subcontractors, delays due to lack of inspection opportunities for customers, making finishing projects less urgent, as well as increased cost of hired labour and other delays internally in the companies (see **Exhibit 7**).

Internationalisation

In 2019, Møre og Romsdal exported 89 billion NOK of goods and services, corresponding to 12% of the total Norwegian exports (excluding oil & gas) (Fjose et al., 2020a). As a result, Møre was the 4th largest exporter in Norway by county and number 1 in export per employee by county in 2019 (excluding oil & gas) (see **Exhibit 8**). The biggest export industries from Møre og Romsdal include seafood (~33% of total export), the process industry (~25%) and the maritime- and offshore supplier industry (~24%) (Fjose et al., 2020a).

Furthermore, Norway is not a member of the European Union (EU) but enjoys a good and close relationship through the European Economic Area (EEA) agreement which ensures trade in the internal market for the cluster. Norway is

also a part of the Schengen Agreement and cooperates with the EU on other international matters (Norwegian Ministry of Foreign Affairs, n.d.). Further, the country has been a World Trade Organisation (WTO) member since 1995 (WTO, n.d.). Enabling the Møre cluster to operate and export to over 70 countries, making the cluster very internationalised and globally competitive (åkp, 2020).

Conclusion of Cluster Attractiveness

As presented, the cluster members are concentrated in a small geographic area, which allows synergies, knowledge sharing, and proximity to suppliers and customers. The Møre cluster is supported by the cluster project GCE Blue Maritime, which is facilitated by a strong organisation, ÅKP – providing several services and initiatives to increase collaboration, knowledge-sharing, and value creation, among other things, which contributes to increased attractiveness. The companies hold horizontal and vertical structures, covering activities throughout the entire value chain, hence creating a complete value creation process from ship design, equipment, construction, and shipping.

Further, the competitiveness is strengthened by the presence of all types of value configurations. However, the cluster is somewhat weakened since the maritime industry is cyclical and still vulnerable to oil prices. In 2020, COVID-19 disrupted the growth expectations, but the cluster remained at 15 billion NOK in total value creation in 2020, approximately the same as in 2019. We do not know why the value creation was the same, but the turnover, employment and profitability did plunge. In which the yards were hit hardest from their transformation from the offshore market to the cruise market. Lastly, the cluster and Møre is very internationalised, exporting and operating globally. Thus, it is evident that the cluster attractiveness is strong: **8/10**

6.1.2 Educational Attractiveness

For any cluster to stay competitive, there must be good access to human capital. And if an industry is to be attractive over time, it must be able to draw the best-qualified labour into relevant educational programs (Reve & Sasson, 2012). Further, a cluster is more attractive when the number and growth of graduate students taking cluster-specific subjects increase and when international students intentionally take their education in the cluster region.

Educational expenditures in Norway

Norway has one of the highest government education expenditures as a percentage of GDP (6.5%) among the OECD countries (NCES, 2020). Norway spent 41% higher than the OECD average at 21 993 USD per student at the tertiary educational level, primarily due to the substantial R&D expenditure within the institutions (OECD, 2019). The educational system is mainly funded by public funding, with minimal private financing. Both public primary and secondary schools are free of charge, and the government also finances most higher education expenditures. Each year, the government contributes to strengthening the maritime industry through an annual allocation of 38.5 million NOK to develop maritime competence, administered by Markom 2020 – a collaboration between maritime educational institutions that has since 2011 received funds from the state budget (Meld. St. 10 (2020-2021)).

Access to competent human resources

Norway's population is highly educated compared to many countries, which benefits the cluster in terms of access to qualified human capital. In 2018, 44% of the population aged 25-65 had a tertiary education compared to 39% from the OECD average, while the proportion of bachelor, master's and doctoral qualifications in Norway was 32%, which is about the same as the OECD average (OECD, 2019). In fact, the share of younger (25-34 years) women with tertiary education is 36% higher than younger men. In contrast, the employment rates after finishing tertiary education are 88% for women and 90% for men (OECD, 2019). Also, full-time female workers earn just 75% of the salary of full-time male workers, indicating a gap in gender equality. Yet, Norway has been one of the most active nations in tackling gender inequality compared to other countries.

Despite having a highly educated workforce, Norway is facing an ageing population which is seen as a major challenge for both the cluster and country. The birth rate for Norwegian women is historically low, with 1.48 in fertility rate as of 2020, compared to 1.95 in 2010 (SSB, 2021a). The development of fewer babies and more elderly people increase the risk of lower employment and a loss of competencies in the future when highly educated labour retires, which reduces the supply of human resources. There is also a risk of fewer people choosing

maritime directions. Yet, this phenomenon also affects other developed countries and Norwegian regions and industries.

Universities and educational institutions in Møre

The universities in the Møre region provide the cluster with broad access to human capital in graduates with maritime-related degrees. In 2019, Møre experienced an all-time high number of 121 000 applications in higher education (a 12 % increase from 2018), and no other county had a similar growth that year (Sunnmøreposten, 2019). There are at least five universities, colleges and vocational schools within Møre og Romsdal: Høgskolen i Molde, Høgskolen i Volda, NTNU Ålsesund, Folkeuniversitetetet, and Fagskolen i Ålesund (Studentum, n.d.). Three of these educational institutions are members of the cluster and offers maritime-related education, namely NTNU Ålesund, Fagskolen i Ålesund, and Høgskolen i Molde. Of which NTNU is regarded as the country's leading institution for engineering and maritime education. In 2020, the university was ranked 4th globally in the subject Marine/Ocean Engineering from the Global Ranking of Academic Subjects (ShanghaiRanking, 2020). Other non-member universities in Western Norway that offer relevant maritime education are Forsvarets Høgskole and Høgskolen på Vestlandet (Studentum, n.d.).

As of 2020, from the NSD database, 891 registered people studied maritime-related subjects, and 11 839 people studied engineering from all universities and vocational schools in Norway, which has increased steadily since 2016 (NSD, 2021a). Hence, a growing supply of maritime and engineering graduates are available for the cluster. 280 of these 891 registered maritime students (31%) and 3340 of these 11 839 engineering students (28%) studied at NTNU (from all campuses: Trondheim, Gjøvik, and Ålesund).

Moreover, 80 of all 197 maritime graduates (40%) and 780 of all 2609 engineering graduates (29%) in Norway came from NTNU in 2020 (NSD, 2021b). How many of these graduated from NTNU Ålesund is not specified and unknown. But the most critical observation is the increase in students taking maritime-related subjects overall in Norway and NTNU from 2016-2020, which should be seen as a positive sign for the cluster (see **Exhibit 9 & 10**). Some examples of relevant bachelor and master's degrees from NTNU Ålesund include shipping

management, shipping logistics, ship design, bio-marine innovation, renewable energy, marine operations, nautical studies, among other subjects (NTNU, n.d.).

Still, a report from the Norwegian Shipowner's Association mentions that funding for maritime operational education has been too low for a long time and requires updated technology and simulator training (Norges Rederiforbund, 2019). The technological development in the maritime industry is changing fast, and operational education must constantly be developed to satisfy new requirements and needs from the industries, which requires governments, educational institutions, and business to collaborate and adapt (Norges Rederiforbund, 2019). We do not know if this applies to NTNU Ålesund, Fagskolen i Ålesund, and Høgskolen i Molde. However, it affects Norway's overall maritime academic level, as well as the cluster regarding access to qualified labour.

Other initiatives

Two out of three youths who move from the region to pursue higher education do not return after graduation (Mafoss, n.d.). This is a well-known phenomenon among many regional districts, where people move to more central places to study and find vacant positions in these cities (Regjeringen, 2020). In order to increase the recruitment of young talents to maritime professions, the Ocean Industry Talents was launched in 2013 by ÅKP, MAFOSS and Maritimt Forum Nordvest (Ocean Talent Camp, n.d.a). Through this project, the region's maritime actors collaborate in giving local youth knowledge about maritime-relevant education- and careers. Together with NTNU Ålesund and Fagskolen i Ålesund, the project group also arranges events, such as the Ocean Talent Camp (OTC), career fairs, and middle- and high school gatherings. During the OTC, youths meet representatives from the maritime industry and learn about maritime-related education choices and career opportunities (Ocean Talent Camp, n.d.b).

International students

Regarding international students in Møre og Romsdal, the only available data is from Høgskolen i Molde, where we observe a slight increase in international students in the last 10 years. From **Exhibit 11**, there were 145 international students in 2010, peaking in 2014 with 230, before going down to 190 in 2016. Finally, it turned upwards in 2017 and 2018 before going down from 190 in 2019

to 150 in 2020, which we assume is due to COVID-19. Before the merger of NTNU and Høgskolen i Ålesund (HiÅ) in 2016, HiÅ experienced an increasing flow of international students from 60 in 2010 to 160 in 2014 and 180 in 2015 (NSD, 2021c). Yet, compared to other universities and colleges in Norway, it seems like most international students are going to Universitetet i Oslo (2 845 in 2019) and BI Norwegian business school (2 160 in 2019), and NTNU (2 370 in 2019) (NSD, 2021c). Unfortunately, we do not know how many of these NTNU students are from the NTNU Ålesund campus.

Only 50 international students in Norway took maritime education in 2019 compared to 110 in 2011, which is very low compared to 1 520 taking technology subjects and 2 225 taking mathematical-scientific subjects in 2019 (NSD, 2021c). Some explanatory factors could be a lack of study programs taught in English. E.g., Høgskolen i Molde barely offers 7 out of 46 study programs in English (Høgskolen i Molde, n.d.a, n.d.b). While NTNU Ålesund offers 4 out of 34 study programs in English, in contrast, NTNU Trondheim has 56 study programs in English (NTNU, n.d.). A survey of 2600 international students in Norway revealed that English-language study programs are the most crucial factor for attracting these students, followed by untouched nature and other environmental reasons (StudentTorget, 2017). Thus, making it difficult for the cluster region to attract international students and reduces its overall attractiveness.

Conclusion of Educational Attractiveness

The cluster has good access to qualified labour from a highly educated population, with five educational institutions in the region, of which three offers maritime-related education. Of which NTNU stands out for being internationally recognised for its Marine/Ocean engineering programs. Further, Norway is facing an ageing population which is seen as a major challenge for the cluster, with a risk of a lower supply of human resources in the future. Additionally, most youths who move from the region to pursue higher education do not return after graduation. Yet, projects like Ocean Industry Talents and events like Ocean Talent Camp help increase the recruitment of youths in maritime professions in the region.

Further, Møre has experienced an all-time high number of applications in higher education from 2018-2019. And the increased number of students taking

maritime-related subjects in Norway and NTNU over the last four years is a positive sign of educational attractiveness. However, only a fraction of all international students takes maritime-related subjects and choose Møre as their location, which could be explained partly by a lack of English taught study programs. Overall, the educational attractiveness is above mediocre: **6/10**

6.1.3 Talent Attractiveness

All countries, regions and cities compete to attract the best people, expertise, companies, and investors. Globalisation has made it easier to attract talents, and companies have become more internationally mobile than ever before. Traditionally, the competition was about access to natural resources, cheap labour, or favourable tax conditions. Now the competition has turned towards access to relevant expertise, knowledge environment and customer relations (åkp, 2016a). From a knowledge-based perspective, as the human capital increases, a cluster becomes more attractive (Reve & Sasson, 2012).

Regional initiatives

Møre og Romsdal, with its internationally oriented business community, is strongly exposed to competition from other regions and countries (åkp, 2016a). ÅKP contributes to strengthening the host attractiveness through both small and large measures and activities. Such as enhancing regional growth by assisting the region and local government with project management services (åkp, 2016a). ÅKP, together with NTNU and Norsk Maritimt Kompetansesenter (NMK), formed Campus Ålesund, a fully integrated learning and innovation arena for the entire region, where cooperation between business and academia are closely linked. As a result, contacts between talents and employers can more easily be established in Møre. Thus, contributing to increased talent attractiveness.

Salary growth

There has been high salary growth in the cluster, indicating increased productivity and higher talent attractiveness. The average salary per employee increased continuously from 2005 to 2015 by more than 80% (Jakobsen, Aamo et al., 2019). Compared to the national salary growth of 52% during the same period, the cluster's growth was significantly higher (Pedersen, 2021). After the salary peak in 2015, wages per employee gradually fell, and almost down 10% in 2018

(Jakobsen, Aamo et al., 2019). The decline can be explained by the fact that people who lost their jobs from the offshore crisis had high salaries, whereas many employees received performance-related payments, contributing to a higher overall wage level (Jakobsen, Aamo et al., 2019). In times with poor performance, one should expect the bonuses to be reduced as well. Nevertheless, a wage increase occurred in 2018 and 2019, but then in 2020, COVID-19 hit and worsened the outlook significantly (Jakobsen, Helseth & Aamo, 2020). The salary growth after the pandemic hit is yet to be analysed and determined.

NHO ranking of municipality and counties

Every year, NHO ranks both municipalities and counties according to attractiveness and local growth potential based on business conditions, the labour market, demographics, the competence related to employment with higher education, and municipal finances (NHO, 2020). Regarding the municipality ranking, the highest-ranked municipalities are recognised as having a high percentage of skilled workers, educational institutions, and business environments necessary to attract talents. Of all the 356 municipalities, Ulstein (15th), Ålesund (20th) and Giske (25th) were ranked highest within the county of Møre, indicating talent attractiveness (NHO, 2020).

Among Norway's 11 counties, Møre og Romsdal ranks no.7th and has picked up on the total indicator since the fall in oil prices in 2014 (NHO, 2020). Further, Møre has strengthened itself in the business industry (5th place) and labour market (5th place), with increased purchasing power, more employees in the private sector and reduced unemployment. However, both the net relocation, lower municipal solvency, and higher municipal administrative expenses create a negative development within the demography (9th place) and municipal finances (9th place) (NHO, 2020). Of which demography is based on population growth, net immigration between municipalities, and youth compared to the elderly ratio.

We further observe that the population in Møre og Romsdal has increased less compared to other counties, which might explain the negative development in the demography. From 2013 to 2020, Møre og Romsdal had a 2.25% increase in population from 259 404 to 265 238, compared to Vestland with a 6% increase, Rogaland with 7%, and Oslo with 11% (SSB, 2021b). This could also be

explained by more people moving out from the county than in, and that Møre competes with many other major counties and appealing cities such as Oslo, Bergen, and Stavanger, which offer many urban qualities people desire. In addition, these cities often provide many opportunities to make a professional career. Thus, it seems to us that there is room for improvements and new attractive measures to draw and retain the population in Møre, e.g., tax reliefs, infrastructure or other cultural measures.

Employment in Møre og Romsdal

In 2019, approximately 90 000 people were employed in the Norwegian maritime industry, roughly 3.2% of the total labour force (2 840 000 people) in Norway (Maritimt Forum, n.d.; SSB, 2021c). Møre og Romsdal had the second-highest employment in the maritime industry in 2018 with 12 700, just after Vestland county with 17 500 (excluding banking and financial services, or services related to the extraction of crude oil & natural gas) (see **Exhibit 5** again). In fact, Møre had its peak of 15 000 maritime employment in 2009-2013 before dropping in 2014 from the oil and offshore crisis (Meld. St. 10 (2020-2021)). Thus, maritime employment seems attractive in Møre but vulnerable to external shocks such as fluctuations in oil prices, which might prevent settlements in the region.

Today, the region of Møre og Romsdal has 127 397 employed (all professions), and the unemployment in the area is at a record high due to COVID-19 (SSB, 2021d). At the end of February 2021, 4 175 completely unemployed people were registered in the county, which is 3% of the labour force in Møre and 1 253 more than last year (NRK, 2021). In addition to 2 909 partial unemployment and laid off people (NRK, 2021). As a result, people must be willing to move to get a job. Yet, this affects all counties and municipalities. However, the labour market in Møre is gradually improving, with 946 fewer unemployed from peaking on January 12th with 4 877 to 3 931 as of March 16th, 2021 (NAV, 2020).

Employment in the maritime cluster of Møre

The employment in the cluster has dropped from 14 500 in 2019 to 13 600 in 2020 (-6%) as a result of COVID-19 (åkp, 2019, 2020). Hence, 900 employees vanished in 1 year, and the companies expect to reach 1 500 by the end of 2021 from the pandemic's ripple effects (Jakobsen, Helseth & Aamo, 2020). For

companies that have experienced a decrease in employment, the Menon Economics survey shows that 48% were fired and 52% temporarily laid off (Jakobsen, Helseth & Aamo, 2020). Still, it is worth noticing that employment has declined significantly since the oil crisis in 2014, from peaking with over 18 000 employed in the cluster down to 13 600 in 2020 (see **Exhibit 12**).

Again, the restructuring from oil & gas to exploration cruises has made the cluster less vulnerable to oil price fluctuations. But the conversion was costly, and some shipyards and shipping companies have high debts and negative results despite being diversified globally (Fjose et al., 2020b). The fall in income from COVID-19 entails an increased risk of bankruptcy in the industry. And several companies do not have the liquidity to cover more than three months of salary before the equity has been used up (Fjose et al., 2020b). Consequently, future bankruptcies could potentially result in much higher unemployment.

National factors for attracting talents – tuitions and study places
Norway is one of two countries in Europe (together with Germany) that offer free tuition regardless of nationality in public universities to students both inside and outside the EU and EEA member countries (Study.eu, 2020). There is no price discrimination between Norwegian and international students. Hence, they pay the same tuition fees, making it attractive for foreign talents to study in Norway. Private institutions charge higher tuition fees, but these are often much lower than in other countries. The caveat is the cost of living in Norway, estimated at 11 640 NOK per month, which is a lot compared to other countries (Edmit, n.d.). Still, students have access to substantial support for living expenses (OECD, 2020).

Further, the state controls, to an extent, the dimensioning or distribution of study places following the demand in the Norwegian labour market, which may lead to a reduced supply of specialised maritime competence in periods with high activity. Thus, the activity and demand for labour in the maritime industry are cyclical, depending on the oil & gas prices, international freight market, exchange rates, trade agreements, and the world economy (Meld. St. 10 (2020-2021)). And it might be challenging to recruit enough talents now and then when the state controls the distribution of study places.

The maritime industry in Norway is also clearly male-dominated, and the proportion of female employees at sea in the period 2016-2020 was only 12%, most of these in catering (Meld. St. 10 (2020-2021)). A survey among the Norwegian Shipowner's Association members in 2020 shows that only 16% of the employees were women (Meld. St. 10 (2020-2021)). Also, the proportion of women within maritime-related subjects from NTNU is below 20% (Forskningsrådet, 2020). Thus, there is a lack of diversity and competence in the Norwegian maritime sector, limiting the potential to attract talents from all genders. However, there is a trend with more women taking technical and economics subjects at the master's degree level (Norwegian Shipowner's Association, 2021). This trend indicates a growing recruitment basis for increasing the percentage of women in the maritime industry. To further secure talents and diversity, the Norwegian Shipowner's Association has set itself specific goals that a minimum of 40% should represent each gender in its board and committees by 2025 (Norwegian Shipowner's Association, 2021).

National factors for attracting talents – wage levels and taxes

Norway is one of the most expensive countries globally, which might prevent some price-sensitive foreigners. Yet, this is compensated with a high salary if they choose to stay and work. The average wage in Norway is 47 970 NOK per Month compared to 18 891 NOK per Month in Europe (1876 euro at 10.07 EUR/NOK exchange rate) (Trading Economics, 2021a, 2021b).

Torben Sneve (CEO of Adecco Norway) says that Norway has traditionally been helped by a high wage level when it comes to attracting talent but must become better at thinking internationally regarding recruitment and development talents (KarriereStart, 2017). International experience and networks are crucial for innovation, yet Norway has a unique challenge of recruiting talent with global experience, where employers are not good enough to value foreign experience. Also, Norwegians are generally too reluctant to travel due to the high standard of living, making workers too comfortable at staying home (KarriereStart, 2017).

Another national factor for attracting talents is the personal income tax, where Norway is among Europe's lowest with 38% (including top marginal tax),

compared to other Nordic countries; Sweden has the highest with 57.2%, followed by Finland with 56.9% and Denmark with 55.8 % (Trading Economics, 2021c).

The personal income tax in Norway is a combined tax system where all income is subject to a flat income tax at 22% plus a top marginal rate of up to 16.2% based on people's earnings (Nordea trade, 2020). Yet, the tax levels on personal income have gradually reduced from 42% in 2011 to 38% in 2016 (Amundsen, 2018). This is because Norway has other larger revenue streams available than income taxes, such as the oil fund and direct income from oil & gas production, contributing to reducing the ordinary income tax rate (Amundsen, 2018). Yet, Norway has high indirect taxes on consumption, which could be a dealbreaker for attracting some people, especially on products that the state considers harmful in one way or another. E.g., alcohol, sugar, and petroleum-fuelled cars.

Norway's ranking at growing, attracting, and retaining talents

The Global Talent Competitiveness Index (GTCI) is an annual benchmarking report by INSEAD, the Adecco Group, and Google inc that measures and ranks 132 countries based on their ability to grow, attract, and retain talents (Lanvin & Monteiro, 2020). The results for 2020 puts Norway in 9th place overall, behind Switzerland (1st), the US. (2nd), Singapore (3rd), Sweden (4th) and Denmark (5th) (Lanvin & Monteiro, 2020). Norway's lowest-ranked pillar is on attracting talents (16th), but one of the global leaders when it comes to retaining talents (2nd), just behind Switzerland (1st). Norway scored relatively poorly on attracting international students, although it scored high on women's leadership opportunities and the gender development gap (Lanvin & Monteiro, 2020).

Other influential rankings

In the last 15 years, Norway has topped the Human Development Index (a world ranking of the standard of living in different countries), often explained by Norway's high GDP per capita and the expensive welfare state (Tenold, 2019). The Gross Domestic Product (GDP) is a measure of total production, productivity, economic growth in an economy, or the monetary value of all final goods and services produced within a year (Roser, 2013). In contrast, GDP per capita is a metric that breaks down the nation's output per person, which is a widely available and often used measure for a nation's prosperity. Further, the Norwegian

society is built on egalitarian values with free access to health provisions and financed education through a high level of taxation, which could attract some demographics into Møre that does not have these privileges.

As of 2019, Norway is ranked no. 13th of 195 countries on the political stability index with 1.19 points, of which -2.5 is considered weak, and 2.5 is strong (The Global Economy, 2021). The index measures perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means (The Global Economy, 2021). This indicates that Norway is one of the most politically stable and democratic countries globally, which might also be an underlying reason for attracting foreign talents into the cluster.

Conclusion of Talent Attractiveness

As analysed, ÅKP, in collaboration with NTNU and NMK, has contributed to strengthening the talent attractiveness through Campus Ålesund. A learning arena for the entire region where business and academia are closely linked, connecting talents to potential employers. There has been a high salary growth between 2005-2015 in the cluster compared to the average national. But this stopped as the offshore crisis's economic ripple effects hit, and people lost their jobs. The restructuring from oil & gas to exploration cruises has made the cluster less vulnerable to oil price fluctuations, but COVID-19 has slowed down the global market, resulting in many employees being laid off or fired.

Further, Norway is one of few nations offering free tuitions and low fees, and Møre has the second-highest employment in the Norwegian maritime industry, indicating talent attractiveness. Despite having high wages and attractive tax conditions, the employment in the maritime industry is very male-dominated, cyclical and affected by oil price fluctuations, exchange rates, the international freight market, trade agreements, and the world economy. Which might prevent talents from working in the industry and settle in the region. Consequently, we find the talent attractiveness for the cluster to be above mediocre: **6/10**

6.1.4 R&D and Innovation Attractiveness

R&D and innovation attractiveness are also important for cluster competitiveness and play a central role in economic progress and social development. From a

knowledge-based view, high-cost countries need to base their value creation on the unique combination of knowledge resources (Reve & Sasson, 2012). As the productivity of academic resources increases, more ideas are available to be utilised by the cluster. Thus, a common way to assess R&D and innovation attractiveness is to examine the number and growth of patents and publications in cluster subjects. A rise of patents often reflects more incentives, such as venture capital funding that encourage R&D and innovative solutions.

Academic work

There are considerable differences in publication volume between the Norwegian counties. In which Oslo contributed to a third (~33%) of all national publication in 2018 (Forskningsrådet, 2019a), followed by Trønderlag (~17.9%), Hordaland (~15.2%) and Troms (~7.3%), which reflects the major universities located in these counties, accounting for over 70% of the scientific publication in Norway. Møre og Romsdal is in the lower range and accounts for 1.4 % of the total national publication (Forskningsrådet, 2019a). If we measure relative to the population, then Møre has 1.6 publications per 1 000 residents, Oslo with the highest publication of 15.7, Troms with 13.8, Trønderlag with 12.2, Hordaland with 9.2, while Sogn og Fjordane had the lowest figures of 0.6 (Forskningsrådet, 2019a). How many of these scientific publications are maritime-related and published from Møre og Romsdal are unknown.

In fact, Norway is among the top countries with the highest publication figures relative to the population and ranks as number four, below Switzerland, Denmark and Sweden (Forskningsrådet, 2019a). Further, the scientific publication in Norway is divided into five categories, of which medicine & life sciences subjects account for 26%, followed by natural sciences with 25%, social sciences with 22%, technology with 17%, and humanities with 10% of the total scientific publications (Forskningsrådet, 2020). Maritime technology and marine-related subjects account for 7.4 % of all Norwegian technology publications and 1.1% of the national publication. Of which NTNU holds 49% of all maritime technology-related scientific publications (Forskningsrådet, 2020). How much of these are published from NTNU Ålesund is yet to be determined.

Further, the merger between NTNU and HiÅ in 2016 has probably helped the maritime publication figures in the cluster, as state colleges often have little R&D funding from the industry and low R&D funding in general, which is why some institutions seek to advance to university status (Fagerberg et al., 2009). From the Department of Marine Engineering at NTNU as a whole, we see a steady increase in academic work, from 19 scientific publications in 2004 to 59 publications in 2008, 166 in 2012, and 226 in 2019 (NSD, 2021d).

Møreforskning is also an essential R&D institution in the cluster, which offers and produces scientific studies for public or private actors in the cluster. They create many research-based analysis and reports available within maritime subjects. Since 1996, roughly 180 reports on marine subjects have been published to support local growth (Møreforskning, n.d.a). However, only 14 of these was available in English (Møreforskning, n.d.b). Moreover, Møreforskning's role is to contribute to knowledge sharing through R&D and increase the cluster's value creation, as well as arranging seminars, workshops, conferencing, and lectures on maritime topics, strengthening the R&D pillar (Møreforskning, n.d.c).

Patents

Another way to assess innovation attractiveness is to look at the growth of intellectual properties, i.e., the number of patents. Møre og Romsdal had a steady growth in the number of patents in force in the last 10 years. However, the number of applications has reduced recently, from 95 applications in 2018 to 56 in 2019 and 62 in 2020 (NIPO, 2021). So far in 2021, we observe 27 applications from Møre. Most of these applications are categorised as Human Necessities, Performing Operations, Transporting, Fixed Construction, and Mechanical engineering from the International Patent Classification system (NIPO, 2021).

In March 2021, 46.1% of all patent applications from Møre has been granted, with a total of 401 patents in force (NIPO, 2021). In comparison, Rogaland has one of the highest patent approval rates of 49.2% and 1 160 in force, Hordaland with 35.5% approval rate and 495 patents, Oslo with a low 28.1% approval rate and 529 patents in force (NIPO, 2021). Besides, 5.6% of all the patent applications in Norway are from Møre og Romsdal, while Oslo and Rogaland have the highest patent application of 17% and 16.9% (NIPO, 2021).

How many of these patents mentioned above are from the maritime industry is unknown. Yet, statistics and new data show that marine patent applications globally have rocketed over the last decade as the industry search for increased efficiency (Eason, 2021). In which the US and South Korea dominate the maritime patent market, followed by China, UK, France, and Norway in 6th place with almost 4000 patent applications between 2007 and 2017 (Eason, 2021).

Public R&D and innovation funding

In 2017, a total of 2.2 billion NOK was used in operating expenses for R&D within the maritime industry, accounting for 3.3% of the total operating expenses for R&D in Norway (Meld. St. 10 (2020-2021)). The amount has almost doubled since 2009, of which the private business sector contributed to the majority of R&D expenses (Meld. St. 10 (2020-2021)). The total operating expenses for R&D in the maritime industry as of 2018, 2019, and 2020 is yet to be determined. Moreover, the physical infrastructure for R&D and innovation are crucial for staying competitive in the maritime industry. Thus, an important scheme is the investments in catapult centres such as the Ocean Space Centre, supporting maritime companies through the development from the concept stage to market introduction (Norges Rederiforbund, 2019). Further, the maritime industry has several public funding opportunities that strengthen the cluster's competitiveness from institutions like the Research Council (Norges forskningsråd), Maritim21, SkatteFUNN, Innovation Norway, and Enova (Regjeringen, 2014, 2021):

> **The Research Council** supported maritime projects with 380 million NOK in 2019 (Meld. St. 10 (2020-2021)). A large part of R&D funding for the maritime industry is allocated through the Research Council's maritime and offshore operations programs such as MAROFF. The program targets the shipping, shipbuilding, service, and equipment industry and prioritises funding to environmentally friendly energy utilisation, maritime operations, and advanced transport (Regjeringen, 2014). As of 2019, they had a budget of 185 million NOK, which was 25 million NOK more than the previous year, allocated by the Research Council (Forskningsrådet, 2019b).

> **Maritim21** is an initiative and a strategy for R&D and innovation to increase the competitiveness of the maritime industry, prepared in

collaboration between the maritime actors on behalf of the Research Council and research communities (Maritim21, n.d.). The strategy for 2021 is to provide a review and promote R&D and innovation within green shipping and digitalisation as a follow-up to the government's maritime strategy (Meld. St. 10 (2020-2021)). Free reports are available on their website.

SkatteFUNN is a vital tool and tax deduction scheme for R&D in the maritime sector. Small and medium-sized marine businesses can get a 20% tax deduction of the R&D project costs, and large companies can get an 18% tax deduction (Regjeringen, 2014). The incentive is to motivate companies to acquire new knowledge, information, or experience, leading to new or better products, services, or production methods. In 2014, there were 365 approved maritime projects with a budgeted tax deduction of 185 million NOK (Regjeringen, 2014). How many projects got a tax deduction in 2019 and 2020 is yet to be determined.

Innovation Norway aims to trigger socio-economically profitable business development through expertise, networks, and capital. They contributed 6 billion NOK in loans, grants and guarantees to businesses in 2019 (Meld. St. 10 (2020-2021)). In which 416 million NOK was spent on the maritime industry. Since the beginning of the 2000s, the efforts of strengthening Norwegian cluster development intensified when Innovation Norway, SIVA and the Research Council joined forces and created a national cluster program called the *Norwegian Innovation Clusters* (Norwegian Innovation Clusters, 2019). The cluster program assists with financing, competence, consulting, network, and profiling services.

Enova is a key organisation that promotes innovation, new climate, and energy solutions. Their programs are aimed at late-stage technology development and early market introduction. They have supported the maritime sector by about 3.2 billion NOK since 2016, which has contributed to accelerating the maritime sector's electrification, among other things (Meld. St. 10 (2020-2021)). The funding mainly supports general technology development in low- and zero-emission vessels, autonomy, energy efficiency, and alternative fuels.

The competition for the funds intends to ensure that the projects with the best quality and potential will get support. These measures have strengthened innovation significantly in recent years. As a result, Norway is far ahead in marine technology and innovation for long-term research and higher education plans. And the development and implementation of low- and zero-emission solutions within autonomy and digitalisation have become increasingly important for obtaining a competitive advantage (Meld. St. 10 (2020-2021)). Besides, the government's policy for R&D and innovation shall contribute to the greatest possible value creation in the economy within a sustainable framework.

Other R&D funding opportunities

Møre og Romsdal County Municipality supports companies that want to start R&D projects by providing guidance, financial support and coordination for strategy work, among other services (Møre og Romsdal fylkeskommune, n.d.). In fact, they saw a lack of risk-averse capital funding in the region, which hindered many projects and entrepreneurs from realising their potential over a decade ago. Consequently, *Møre og Romsdal Såkornfond AS* was established in 2007, which provided venture capital to more risky projects – explicitly investing in start-ups, seed, or other early-phase projects (Grunfeld et al., 2013). The fund aimed to provide small and medium-sized companies in Møre with long-term equity to trigger innovative projects in the early development stage. The fund's capital base is 165 million NOK, in which 75 million NOK of these is a borrowing limit from Møre og Romsdal County Municipality (Grunfeld et al., 2013).

Conclusion of R&D and Innovation Attractiveness

As revised, R&D and innovation are crucial for establishing the competitiveness of the maritime industry. Regarding academic works and the share of national publications, the Møre region is in the lower range compared to other counties. NTNU accounts for almost half of all maritime related scientific publications. How many of these publications are from NTNU Ålesund is unknown. Yet, Møreforskning has contributed a lot to the cluster by publishing research-based reports within maritime subjects, strengthening the R&D attractiveness. Møre has also had a steady growth of patents in the last decade despite some lower numbers in the previous two years, with a relatively high approval rate, thus indicating

many intellectual properties and high innovation attractiveness. How many of these are maritime-related are yet to be determined. Lastly, the cluster has no shortage of governmental subsidies and public funding opportunities, providing venture capital and tax deduction schemes for R&D and innovative projects. Overall, the R&D and innovation attractiveness is quite strong: **7/10**
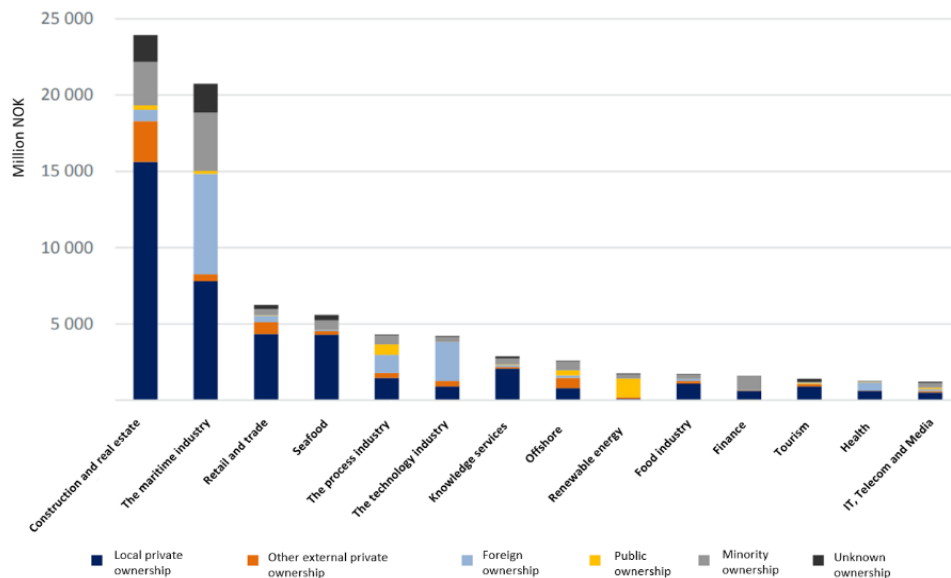
6.1.5 Ownership Attractiveness

The industry's ownership attractiveness is defined as the extent to which the cluster manages to attract competent capital, either national or foreign, to finance its activities (Reve & Sasson, 2012). Thus, access to capital and venture capitalists is crucial to financing existing and growing firms. We also examine the types of ownerships, of which a high presence of foreign ownership indicates that the region is attractive outside the boundaries of the cluster and national borders.

Local-, national-, and foreign owners

As of 2014, most companies in Møre og Romsdal were under local ownership, of which individuals and families control and own the firms. Most of these individuals and families are residents in the region and represent over 50% of all value creation in Møre, while 25% of the value creation are from external owners outside the county, including Norwegians and foreigners (Jakobsen et al., 2014). From **Figure 8** below, the types of owners vary considerably between industries in Møre og Romsdal with few public ownerships.

Figure 8. Largest industries Møre og Romsdal measured in value creation by ownership

Source: Jakobsen et al., 2014

The maritime industry is dominated by local private ownership and foreign ownership, indicating attractiveness for these ownership types but not so much for other Norwegian external owners. In fact, half of Møre's foreign ownership is within the maritime industry, indicating that the cluster is attractive to invest by foreigners (Jakobsen et al., 2014). Some examples of foreign-owned companies considered international leaders that have previously invested in the region are Rolls Royce Marine (now nationally owned by Kongsberg), Vard, Bourbon Offshore and Edison Chouest Offshore (Jakobsen et al., 2014).

More recently available data shows that a large proportion of medium-sized companies are still dominated by family ownership. Moreover, both family-owned and local owners are strongly present in the maritime export industry, and both shipping companies and equipment manufacturers are dominated by local owners (Jakobsen, Stokke et al., 2020). As of 2018, the Norwegian private ownership in Møre og Romsdal accounted for 54% of the value creation (compared to 39% nationally) and 67% of employment (61% nationally) (Jakobsen, Stokke et al., 2020).

Furthermore, both decision-making authority and R&D locations depend on the types of ownerships. Hence if the ownership is local, the decision-making authority and all other head office function will be located in the local business community (Jakobsen, Stokke et al., 2020). The high element of local personal ownership in Møre is, therefore, a strength for the county's long term value creation, especially in times of recession, where local owners often maintain the level of activity and focus on restructuring within the region, while externally owned companies are more likely to centralise the business and move out of the county (Jakobsen, Stokke et al., 2020). E.g., the offshore shipping company Farstad, which was located in Ålesund, and moved to Solstad head office after the acquisition of Farstad in 2017 (Jakobsen, Stokke et al., 2020).

Despite being attractive for local and foreign ownership, there seems to be a lack of other external Norwegian ownership attractiveness. From an in-depth interview by Menon Economics, it was revealed that family-owned firms are proud of their connection to the family business and values local ownership, and there was no doubt that business owners in Møre were aware of the opportunity to raise

external capital, such as private equity funds, but it was not perceived as desirable (Jakobsen, Stokke et al., 2020). However, external ownership can become necessary for companies with investment needs or export ambitions that lack equity or access to capital. This challenge is bigger in industries where one struggles with low profitability, such as the yards. E.g., Kleven was one of the biggest shipyards in Norway and family-owned struggling being profitable, and was sold in 2018 to Hurtigruten, and then to a foreign company (DIV Group) in 2020, before going bankrupt and now owned by the Green Yard (Iversen, 2020).

Geographical condition

The region has good conditions for attracting maritime owners within shipbuilding with deep fjords, making it possible for large ships to be built and docked in many places (Jakobsen et al., 2014). Yet, several oil fields such as the Ormen Lange- and Draugen fields might be the most significant contributor to attracting owners and companies. Fosnavåg city, now dominated by large offshore shipping companies, was mainly built upon fishing resources and the most crucial industry up to the 1970s (Jakobsen et al., 2014). The large fishing grounds outside Møre provide a good basis for the fishing industry, marine farming, breeders, and potential companies wanting to establish themselves in this region.

Initiatives by the government

The government policies in Norway are certainly playing a vital and supportive role in shaping the firm's competitive environment, especially attracting foreign shipowners. The government have numerous instruments, like investments in infrastructure, tax regimes, subsidy schemes and various other support instruments (Benito et al., 2003). The introduction of the Norwegian International Ship (NIS) register was a critical policy effort undertaken in the 1980s, reversing the trend of overseas registration of vessels. Consequently, ships registered in the NIS sail the Norwegian flag and are subject to Norwegian jurisdiction with several financial benefits, tax schemes, and high safety and working standards regarding international regulations from International Maritime Operations (IMO) and International Labour Organisation (ILO) (Sjøfartsdirektoratet, 2016).

Further, a critical scheme for the maritime industry is the tonnage tax regime, where companies are exempt from ordinary tax on their shipping income. Instead,

they must pay a tax based on the net tonnage of vessels (Skatteetaten, n.d.a). To be covered by these special provisions, the company must be registered in the NIS or a Norwegian-registered limited company that owns ships directly or indirectly through a company. This special taxation arrangement is considered competitive compared to similar shipping taxation arrangements in other European countries with ordinary tax on general income (Sjøfartsdirektoratet, 2012). In fact, from the 2018 Shipowner Association Survey, 63% of the 93 surveyed shipping companies say that they would most likely move their businesses out of Norway if the tonnage tax regime would be significantly weakened (Norges rederiforbund, 2018). Thus, a competitive tonnage tax regime is essential for maintaining Møre's attractiveness as a host municipality for shipping companies.

Next, the tax refund schemes for seafarers are considered by many as the most critical factor in getting shipping companies to choose Norwegian seafarers as crew on their ships. The seafarers' allowance is a deduction of 30% of income earned onboard a ship in service if the minimum requirement of 130 days at sea during the income year is met (Skatteetaten, n.d.b). Hence, ships registered in the NIS may apply for grants based on their payments of Norwegian advance tax deductions, social security, and employer's contributions (Sjøfartsdirektoratet, n.d.). Again, from the shipowner survey, eight out of 10 shipping companies respond that they will replace Norwegian seafarers with foreigners if tax refund schemes for seafarers are significantly weakened (Norges rederiforbund, 2018).

The Norwegian tax system

This section will elaborate more on the taxes relevant to ownership and companies established in Norway. The Norwegian tax system consists of value-added taxes (VAT), corporate taxes, social security tax, net wealth taxes, local real estate taxes, among other registration duties that companies need to be aware of (Arntzen de Besche, 2017). In fact, Norway has one of the highest sales or value-added taxes globally, with 25% in value-added taxes (VAT) on goods and services. Only Hungary and Bhutan beat Norway with 27% VAT and 50% VAT (Trading Economics, 2021d).

Further, Norway's corporate tax has been reduced from 28% since 2013 down to 22% in 2019, whereas an OECD study from 2008 found that corporate income

taxes are the most harmful form of taxation for economic growth (Trading Economics, 2021e; Asen, 2019). And countries with lower corporate tax are likely to attract more foreign investment. Yet, Norway's corporate tax at 22% is slightly below Europe's average of 22.5% but above the global average of 21.4% (Trading Economics, 2021e; Asen, 2019). Compared to neighbouring countries, Sweden has 21.4% in corporate tax, Denmark 22%, and Finland 20% (NHO, n.d.a).

Regarding the social security tax, an individual working in Norway is subject to Norwegian social security contributions. The standard rate for a company is 14.1% of gross earnings, whereas the employee's contribution is 8.2% based on gross wages (KPMG, 2020). This is not considered high compared to other nations like Sweden and Finland, where owners have to pay 31.42% and 22.6% in social security taxes (Trading Economics, 2021f). Yet, exceptions can be granted under certain conditions, e.g., a person insured under another social security scheme from another EEA/EU country can be wholly exempted (KPMG, 2020).

Further, owners of a property in Norway are eligible to pay real estate taxes, computed on the assessed value using a rate between 0.2-0.7%, decided by local authorities and municipalities (KPMG, 2020). Moreover, many people believe that the wealth tax is a burden for many Norwegian owners and should be removed. It is a tax on working capital for company owners and a tax on personal net wealth above 1.5 million NOK (NHO, n.d.b; Skatteetaten, 2021a). Norway is one of five OECD countries with a wealth tax, where companies pay 0.64% tax on working capital, while citizens must pay a 0.85% tax on their net wealth, consisting of a flat 0.15% tax to the government and varying 0.7% tax to the municipality (NHO, n.d.b; Bunn, 2021). The wealth tax is highly debated, where some see it as the most effective means of achieving economic redistribution, whereas others look at wealth tax as a barrier to capital by reducing private savings and double taxation.

Tax differences between Norwegian and foreign owners

Both Norwegian and foreign owners are eligible to pay 25% VAT (on most goods and services), social security tax of 14.1% (depending on the type of industry), corporate tax at 22%, and real estate taxes irrespective of their residence (Altinn, 2020a, 2020b; Skatteetaten, 2021b; KPMG, 2020). Again, the corporate tax rate

has been reduced in recent years, which might attract more foreign investments, but the high VAT could be seen as a barrier for foreigners. Still, as mentioned, favourable maritime tax schemes like the tonnage tax system for shipping companies and tax refund schemes for seafarers make the Norwegian tax system very favourable to all types of maritime owners in the cluster registered in NIS.

The main difference is that foreign owners do not have to pay either wealth tax or tax on dividends in Norway if they are not registered as tax residents (Skatteetaten, n.d.c). This gives a competitive advantage to foreign owners and enables these companies to invest more in R&D or enjoy a larger profit. Moreover, suppose Norwegian companies cannot afford to pay wealth tax during difficult times and goes bankrupt (worst-case scenario). In that case, there is an opportunity for foreigners to buy these local companies cheaply. The shipowner survey shows that 97% of the shipowners confirm that removing wealth tax on working capital is crucial to ensure competitive framework conditions for Norwegian private ownership (Norges Rederiforbund, 2018). Yet, the government reduced the valuation of working capital in 2020 from 75% to 65% (NHO, n.d.b).

In 2019, Bø municipality announced that they were going to reduce their wealth tax from 0.7% to 0.35% to attract and retain more companies and wealthy people (Alsberg, 2019). Several other municipalities have been inspired and want to follow the same measure, e.g., the mayor of Vestnes municipality in Møre og Romsdal, Geir Inge Lie says he is inspired by Bø and wants to do the same (Rystad, 2020). This is a potential and interesting measure to the municipalities in Møre og Romsdal and a debated topic among politicians. Though it could attract more external Norwegian ownership outside Møre to invest in the region, creating new workplaces and contributing to the cluster's value creation.

Access to capital

Investments in new ships, technology and innovation are very capital intensive, and therefore access to capital is crucial for the growth, development and restructuring of maritime owners. Fortunately, Norway has long been a leading player in marine and shipping finance, with many funding and finance opportunities from the government, private banks, and financial institutions

One way to acquire capital for the cluster companies is through the Oslo Stock Exchange (OSE). OSE is considered one of the largest shipping stock exchanges worldwide, with numerous financial and insurance institutions specialised in the shipping sector (Benito et al., 2003). Additionally, OSE is the largest stock exchange of Oil service companies in Europe and seafood companies globally, making it easier to find investors and raise equity from public investors through an initial public offering (IPO) (Oslo Stock Exchange, 2019).

Further, several private financial institutions specialise in the shipping, offshore, and logistics sectors, such as DNB and Nordea, which are among the most prominent shipping banks globally, providing good financial opportunities, advisory, loans, and other maritime services (Magnusson, 2013). Private banks like Pareto Securities have a strong track record in shipping and offshore project finance and investment banking, such as raising equity and arranging debt financing for individual offshore projects (Pareto, 2021). Ship brokerage firms like Clarkson Platou identifies maritime investment opportunities and executes project financing solutions on behalf of owners and financial investors (Clarkson, n.d.). Lastly, NRP is recognised as a leading manager and facilitator of direct investment, private funds, and financing within the maritime industry (NRP, n.d.).

After the financial crisis in 2008, banks and financial institutions radically changed their solvency requirements and earnings on the projects they are willing to finance (Norges Rederiforbund, 2019). Hence, access to capital has somewhat weakened, and the capital offered today can be more expensive than previously. Thus, the Norwegian Shipowner's Association argues that good export financing schemes are important for the maritime industry to ensure access to finance as a supplement to traditional bank financing.

Foreign investments

The commonly used definition of foreign direct investment (FDI) is that a single foreign person or company owns at least 10% of the shares in a Norwegian company, which is often a high enough ownership interest to have a certain influence on the company's operation (Innovation Norway, 2018). Moreover, Innovation Norway has the national coordinating role in attracting international investors. They are the first door for foreign investors, collaborating closely with

the regions because few municipalities have the capacity to set up a separate organisation to receive inquiries from international companies (Innovation Norway, 2018). Moreover, a collaboration between the Research Council, Innovation Norway, and SIVA established *Invest in Norway* in 2013 (Invest in Norway, n.d.). Their task is to facilitate international investments and position Norway as an attractive country for investors. Consequently, this benefits the cluster as well as the county of Møre indirectly in attracting FDI

In 2016, the FDI in Norway was worth over 1 092 billion NOK (compared to 864 billion NOK in 2011), corresponding to 35% of the country's GDP (Innovation Norway, 2018). About half of all FDI is either directly or indirectly associated with the oil & gas industry. Hence, around 255 billion NOK FDI was linked to companies operating within oil & gas, 183 billion NOK to the industry and production, 152 billion NOK to the oil-services, followed by the retail industry with 113 billion NOK in FDI (Innovation Norway, 2018). Moreover, there are some incidents of greenfield investments in Norway, where companies build everything from the ground, but most FDI is happening when a foreign company acquires a Norwegian company.

Geographically, FDI is strongly concentrated in Rogaland and Oslo. Other counties that received a large part of FDI are Hordaland and Akershus (now Viken). From **Figure 9** below, we see that Møre og Romsdal received 18 billion, which equals roughly 2% of all the FDI in 2016.

Figure 9. FDI in billion NOK distributed on geography, 2016
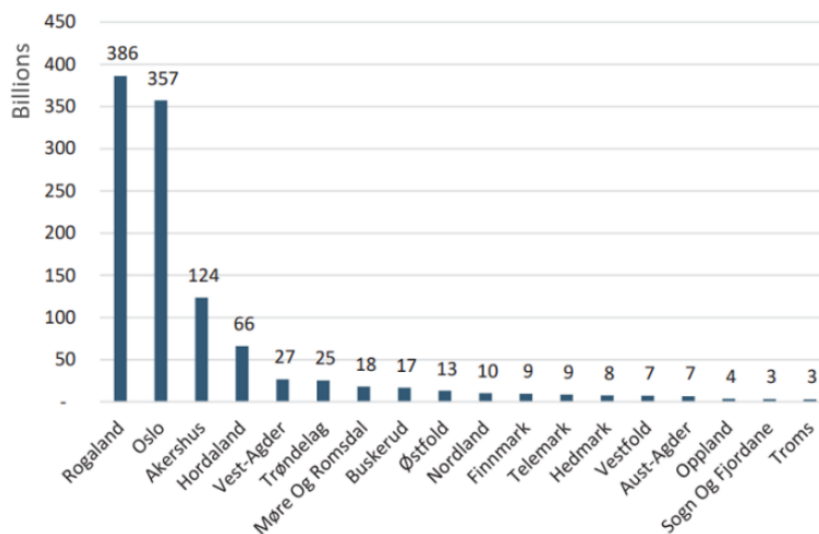
Source: Menon Economics, referred in Innovation Norway (2018)

Further, Møre og Romsdal has experienced a decline in FDI from 2012 to 2016 of -2.3%, with no information explaining why (Innovation Norway, 2018). In contrast, Rogaland had the biggest FDI increase of +74.8%, mainly driven by the oil industry and Oslo with +65.7% driven by real estate and transport (Innovation Norway, 2018). Moreover, a survey on Norwegian municipalities and their attitude to foreign-owned companies show that half of the mayors have a positive attitude towards foreign ownership, whereas 14% do not consider it desirable in their local business community (Innovation Norway, 2018).

Doing business in Norway ranking

As of 2020, Norway ranked 9th out of 190 countries in doing business, scoring exceptionally high on the ease of starting a business pillar, characterised by a rapid procedure/time and low costs to establish a business (World Bank Group, 2020b). This indicates that Norway is an attractive country to invest in and benefit owners and the environment in which cluster companies operates. Norway is also ranked the world's most resilient country to do business in due to its strong economic productivity, stable political environment, low corruption, high natural hazard risk quality, and robust corporate governance (Johnson, 2020). The latter could imply that Norwegian maritime companies are more likely to survive and thrive in the post-pandemic era.

Conclusion of Ownership Attractiveness

As reviewed, ownership attractiveness is vital for the cluster to attract national and foreign competent capital to finance its activities. The maritime industry is dominated by local private/family- and foreign ownership, with the largest share of foreign ownership of any industry in Møre, indicating ownership attractiveness for the cluster in the private sector. But, not so much for other external Norwegian owners, which affect the attractiveness. The region also has great conditions for attracting maritime owners within shipbuilding with deep fjords and proximity to the coast. While initiatives like the tonnage tax regime and refund schemes help maintain Møre's host attractiveness for local and foreign owners.

Further, the corporate tax reduction might attract foreign investments, but the VAT is still considered high. Next, the wealth tax gives the domestic and local owners a slight disadvantage against foreigners since the measure does not apply

to non-registered tax residents. Yet, it might attract international owners to stay. There are also several funding opportunities for the maritime industry, resulting in many ways to raise capital, but the access to capital has somewhat weakened after the 2008 financial crisis. Regarding FDI, Møre og Romsdal received only 2% of Norway's total FDI, which has room for improvements. Overall, the ownership attractiveness is strong for the cluster: **8/10**

6.1.6 Environmental Attractiveness

There is an ever-increasing demand for cleaner industrial processes, of which institutions and key players see the need to reduce harmful emissions and pollutants to meet global environmental challenges (Reve & Sasson, 2012). This criterion has a growing impact on the behaviour of recruits, current employees, and other stakeholders in the cluster. A leading cluster in greener solutions is, therefore, more attractive than a cluster that lags behind.

International maritime framework conditions

The maritime industry in Møre is a global industry and operates under established international framework conditions regulating shipping and marine policy. As one of the world's largest shipping nations, Norway's interest to work for strict international requirements for safety, working conditions for the crew, climate, and environment is also affecting the Møre cluster. Both international regulations from IMO (International Maritime Organisation) and EEA (the European Economic Area) regulate matters related to climate and environment, among other conditions for the maritime industry (Meld. St. 10 (2020-2021)).

> **IMO** is an agency of the UN (United Nations) responsible for measures preventing pollution from ships, among other legal, safety, and security matters (IMO, n.d.a). In 1997, IMO introduced a new annex to the International Convention for the Prevention of Pollution from Ships – which entered into force in 2005 (IMO, n.d.b). In 2011, IMO adopted mandatory technical and operational energy efficiency measures to reduce CO_2 emissions from international shipping significantly – entered into force in 2013 (IMO, n.d.b). In 2018, the IMO reached a landmark agreement on a 40% reduction in greenhouse gas emissions by 2030 and 50% by 2050, called the initial GHG strategy (IMO, n.d.c).

EEA agreement entered into force in 1994, bringing together the EU
Members and other non-EU members like Norway (EFTA, n.d.). The
agreement guarantees equal rights and obligations within the internal market
for individuals and economical operations in EEA. Through the agreement,
much of the EU's policy on environment and climate change has been
incorporated into Norwegian law, e.g., the EU Emissions Trading System
targeting renewable energy, energy efficiency, and energy savings (Ministry
of Foreign Affairs, 2015).

Overall, regulations from IMO and EEA agreements make it favourable for
shipowners and cluster members to use as little fuel as possible. Hence, the cluster
members and maritime players in Møre are pushed to reinvent and target new
types of fuel and energy-efficient solutions to remain competitive and profitable.

The maritime industry's future

The global maritime transport market accounts for 2.5% of global greenhouse gas
emissions (Jakobsen, Stokke et al., 2020). The green shift is currently in the start-
up phase regarding shipping, with only 0.3% of the world fleet using alternative
fuels (Jakobsen & Helseth, 2021). However, the maritime industry is becoming
increasingly greener, both in the shipping and industrial segment. Despite the low
activity in the world's shipbuilding markets, Jakobsen & Helseth (2021) expect
the activity to catch up in 2026-2030, especially in niche segments such as
offshore wind, aquaculture and seabed minerals markets.

The government's ambition of halving emissions from domestic shipping and
fisheries by 2030 will involve promoting the use of low- and zero-emission
solutions in all vessel categories (Norwegian Government, 2019). Although the
transition to a green shipping sector is well underway, the pace of change must be
increased substantially to achieve this ambition. Yet, Norway is in a leading
global position for the deployment of zero- and low-emission technology in the
maritime industry, and by 2022, more than 1/3 of the country's car ferries will use
electric propulsion systems (Norwegian Government, 2019).

In fact, Norway was the first in the world to introduce the carbon tax in 1991,
encouraging companies in the maritime industry to compete, innovate and build
more environmentally friendly ships (Norsk Petroleum, n.d.). The government has

announced that the carbon tax will increase by 5% each year from 2020-2025 as a policy instrument to promote the development of zero- and low emission solutions (Norwegian Government, 2019). Also, to meet its 2030 goal of cutting greenhouse gas emissions by 50% compared to the 1990 level (Ministry of Climate and Environment, 2020). They have further allocated millions to programs that accelerate low- and zero-emission shipping solutions. Such as 458 million NOK for Enova's *Green Fund* and 7 million NOK for the *Green Shipping Programme* in the 2019 state budget (Norwegian Government, 2019). Overall, the cluster is highly affected by future international frameworks and policymaking.

The situation in the maritime cluster of Møre

The green transition will affect the export market in the cluster. In fact, Møre og Romsdal has the second-highest oil dependence after Rogaland in 2017 (Jakobsen, Stokke et al., 2020). Møre has no traditional established operators with headquarters in the region. However, there are several companies in the petroleum industry (Linjebygg, Axess, AxTech, etc.) in addition to a large maritime sector serving oil & gas operations in Møre. (Jakobsen, Stokke et al., 2020). Despite the decline in oil dependency for the cluster since the offshore crisis, a fall in oil production still affects both the cluster significantly. And therefore, the cluster must reinvent itself towards other greener segments.

To succeed in the green restructuring in the maritime industry, companies must invest in R&D and innovation, increase production efficiency, develop domestic markets, and stimulate more exports (Jakobsen & Helseth, 2021). However, a survey among maritime export companies in Møre stated that they struggle with high costs and price competition when dealing with foreign competition (Jakobsen & Helseth, 2021). The low-cost efficiency is due to high wages and prices on inputs, low productivity, or a combination of these (Jakobsen & Helseth, 2021). Thus, access to cost-effective input is somewhat limited in a high-cost country like Norway, whereas the equipment suppliers and yards must rely more on the reputation and quality of their products when competing with foreigners.

Today, we identify Green Yard Kleven as one of the leading pioneers in recycling and sustainability. They perform green recycling of vessels by the strictest national and international agreements and regulations. In 2021, the state

administrator in Møre og Romsdal gave Green Yard Kleven in Ulsteinvik permission to recycle ships. Thus, making Green Yard Kleven the only shipyard in Norway that can handle the entire life cycle of ships from new construction, repairs, rebuilding and recycling of ships (Green Yard Kleven, 2021).

We further see a trend and change in the environmental profile, i.e., more companies positioning themselves in offshore wind farms and recycling ships, demonstrating environmental attractiveness. However, there is still a significant presence of diesel and petroleum fuelled engines in the production of vessels, which has room for improvements. Shipyards like Ulstein and Green Yard Kleven have taken a big step, providing vessels for the installation of offshore wind platforms. But most of the ships are still using petroleum-fueled energy solutions. Thus, there are opportunities to readjust to more alternative fuels such as hydrogen or battery electric power. Lastly, all the companies within the entire value chain are responsible for acting more sustainably. Still, one could assume that the shipping companies have a greater responsibility to the environment regarding what fuel types they want to use because they are the customers/buyers that have the power in the decision-making when ordering vessels from the yards.

Risk or opportunity?

The world is facing a major common problem in terms of global warming from greenhouse gas emissions. Through the Paris Agreement, countries have committed themselves to a shared ambition to reduce climate change and keep the average global temperature below 2 degrees Celsius (Jakobsen, Stokke et al., 2020). Whether the world will achieve the goals of the Paris Agreement depends on a large-scale restructuring of the economy and the way we produce and use energy. Such major economic changes involve clusters undergoing massive economic shifts, which could be both a risk and an opportunity.

The risk for the cluster members is partly due to a decline in Norwegian petroleum production and demands for emission reductions which could create uncertainties related to extensive and costly economic restructuring. In contrast, the maritime cluster and the companies have an opportunity to be a leading pioneer in transformation and new technologies that help the transition to a

greener economy. Moreover, by building on the existing know-how technology from the offshore industry, the cluster might acquire a competitive advantage.

Conclusion of Environmental Attractiveness

The ability to foresee and meet tomorrow's environmental requirements will be a major contributor to the future success of the Møre cluster. With an increasing demand for cleaner industrial processes, stakeholders see the need to reduce harmful emissions and pollutants to meet global environmental challenges. In addition, many international regulations and framework conditions influence the maritime industry and cluster. Hence, it pushes for lower emissions, requiring restructuring and new investments in greener technology, which could either be a risk or an opportunity for the cluster.

We further see a reduced dependency on the oil & gas industry. Thus, some companies have started to look at the offshore wind farm industry and the introduction of ship recycling, which is very promising. But the cluster is still dependent on the petroleum market and is yet to reinvent itself to a greener industry with more sustainable fuel options for shipping. Thus, the cluster needs to look at the environment as a profitable area for new technology development and business opportunities. Overall, the environmental attractiveness is quite strong but has huge potential to exceed in the future: **7/10**

6.1.7 Cluster Dynamics

While the six dimensions previously reviewed describe the conditions under which firms can excel in a cluster, cluster dynamics determine whether they can utilise these conditions to benefit and create a dynamic environment (Reve & Sasson, 2012). The dynamic environment should involve competition and cooperation, as well as the exchange of goods, services, employees, and knowledge. Hence, dynamism is a function of competitive and cooperative linkages and the degree of industry labour mobility within the cluster, providing knowledge spill-overs and overlapping industries. Further, this dimension will include an element regarding a cluster's life cycle from Menzel & Fornahl (2010), as the Emerald model lacks the ability to capture a cluster's evolutionary development and unexpected shocks.

Competitive and collaborative linkages

The Møre cluster is a maritime knowledge hub encompassing the whole value chain, with firms and research centres highly concentrated in a small geographical area. The proximity to each other makes the collaborative linkages between companies, customers, suppliers, and research institutions stronger. Thus, a dense network of interconnected firms promotes better coordination and trust within the cluster, allowing synergies and knowledge transfer between stakeholders. Due to nearby rivalry, there is also a local pressure to innovate, which drives firms to constantly upgrade their products and processes (Benito, et al., 2003).

The majority of competitive and collaborative linkages are connected to the oil & gas industry, linking the cluster with many regions and offshore companies in Western Norway. Moreover, the famous phrase from the Ulstein Group describes the maritime cluster of Møre rather accurately *"we collaborate when we can and compete when we must"* (Nor Shipping, n.d.). Of which, the horizontal companies (operating in the same segment in the value chain) are more likely to compete for contracts, technology, and other resources on different levels. In contrast, vertical companies (different operations in the value chain) are more likely to collaborate due to upstream/downstream coordination, mutual agreements and contracts.

Labour mobility and other maritime regions

A vital prerequisite for competitiveness in the maritime industry has been the transfer of labour between different parts of the value chain, both onshore and offshore. The mobility between the sea and land-based industry contributes to linking employers and the exchange of knowledge necessary to grow. Moreover, the yards, equipment- and service suppliers are diversified towards, e.g. fisheries, aquaculture, cruise, ferries, and offshore and shipping segments, thus enabling labour mobility between different maritime segments.

Further, the cluster has several related maritime regions, stimulating even more competence transfer, knowledge spill-overs and labour mobility between geographical areas. Of which different regions specialise in different parts of the maritime industry. Northern-Norway has traditionally focused on fishing and coastal transport but has recently leaned towards offshore activities with an arctic focus (Maritimt Forum, n.d.). Central Norway is known for their large and leading

maritime innovation and knowledge environments. The Bergen region offers actors within several maritime segments but is traditionally known for its large shipping companies. Haugesund is also known for shipping, shipyards, and the design of offshore vessels. Lastly, Stavanger and Southern Norway are closely related to the petroleum and oil drilling industry, while the Oslo region is the centre for shipping finance and maritime services (Maritimt, Forum, n.d.).

Related clusters

As of 2015, there were 36 clusters in Norway, with 2070 partnering companies and 366 R&D- and educational institutions, and at least five clusters related to maritime operations (Skogstad, 2016). The Norwegian maritime clusters are characterised by a high number of highly competitive firms operating globally, preoccupied with new technology, dedicated to innovation, as well as sharing a common labour market and relying on the same suppliers (Reve, 2009).

Furthermore, the national cluster program, *Norwegian Innovation Clusters*, consists of (**1**) Arena/Arena pro levels which target immature clusters to stimulate further national growth, (**2**) NCE (Norwegian Centre of Expertise) targeting clusters with potential international growth and the (**3**) GCE (Global Centre of Excellence) level aiming at mature clusters with a stronger global position and development potential (Norwegian Innovation Clusters, 2019). Norway has three strong GCE clusters, and all of them are related to the maritime sector – GCE Blue Maritime (known for the whole lifecycle of shipbuilding), GCE Ocean Technology (known for underwater tech, subsea installation, and seafood production) and GCE Node (known as the oil drilling cluster) (Norwegian Innovation Clusters, n.d.). Despite operating in different maritime segments, there is an overlap between maritime competence, labour pool and suppliers – enabling extensive collaborative opportunities and labour mobility between clusters.

Cluster's life cycle and ability to restructure from external pressure

As the Emerald model lacks the ability to analyse unexpected shocks, this section will include the model from Menzel & Fornhal (2010), which will be used to explain and show the cluster's life cycle and its ability to adapt and restructure itself towards new markets and products from the offshore crisis in 2014.

The cluster has been through several dramatic crisis and challenges and coped with external pressure via restructuring, as reviewed in chapter 6.1. Moreover, the maritime sector is largely affected by factors that are outside the scope of control for cluster companies, as it is the second-largest export industry in Norway after petrol and vulnerable to market cycles, demand conditions, exchange rates, and oil price levels (Maritimt Forum, n.d.). As analysed, the cluster's largest proportion of revenues is still from offshore oil & gas. Thus, a period with low oil prices and demand still affects the cluster's activity and production.

Menzel & Fornhal (2010) argue that clusters develop through different phases of life cycles: (**1**) an emergence phase, (**2**) a growth face, (**3**) a sustainment phase, and (**4**) a decline or renewal, which depend on the technological heterogeneity of firms (see **Figure 10**) (Menzel & Fornahl, 2010).

Figure 10. The cluster's life cycle
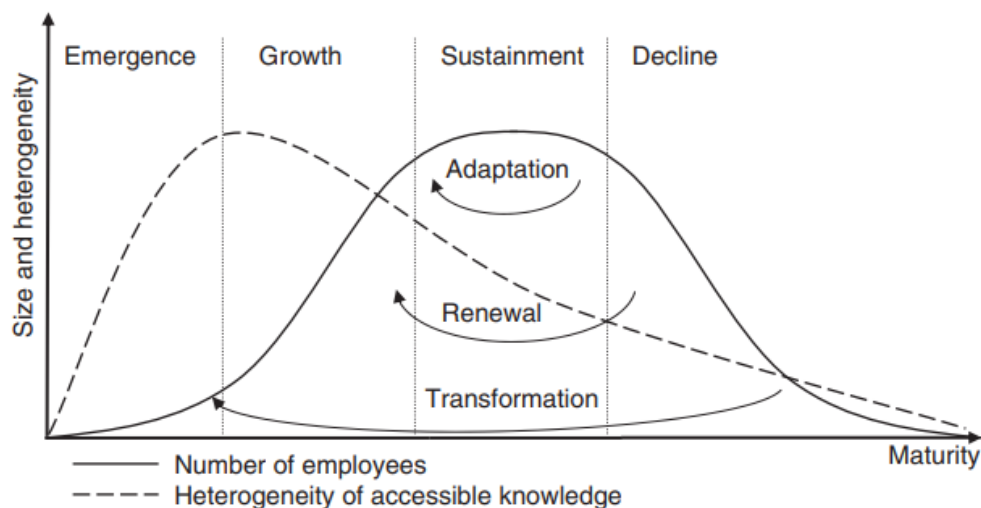
Source: Menzel & Fornahl, 2010

As the cluster emerges, few companies exist where heterogeneity increases strongly due to new companies venturing into new technological areas (Menzel & Fornahl, 2010). The technological path becomes increasingly focused within the growth phase, and the heterogeneity decreases until the cluster has matured/sustained. However, if the heterogeneity cannot be sustained and the cluster is focused too narrowly (specialised), it loses its capacity for renewal and declines. If diversification and heterogeneity increase again, the cluster moves back in a new growth phase and transforms itself, e.g., clusters that manage to diversify by adapting to a changing environment (Menzel & Fornahl, 2010).

The Møre cluster has been through several transformations and managed the strategy of diversification towards new markets in the decline phase from external shocks, specifically the offshore crisis in 2014 – one of the more notably shocks in the 21st century for the cluster. From June to December 2014, the crude oil price fell from 110 USD to 50 USD per barrel from a large oversupply and production, which triggered the offshore crisis, affecting the whole maritime industry with bankruptcies and supply/demand in the world market (Jakobsen, Aamo et al., 2019). Consequently, the cluster was too specialised in the oil & gas industry and lost its capacity for renewal and entered into a decline phase where orders for offshore supply/support vessels (OSVs) had been substantially reduced by less demand from the shipping companies. Yet, the falling petroleum prices led companies to restructure themselves from oil & gas with diversification towards new markets (åkp, 2016b). This made the maritime companies less vulnerable and dependent on oil price fluctuations. Both ship designers and shipyards had to adapt and switch from OSVs to other vessels like ferries, well boats, cruise ships, and service vessels to the offshore wind market (åkp, 2016b). Thus, the cluster transformed itself with new value chains and linkages in the growth phase.

Today, the Møre cluster faces a crisis of a pandemic, which affects the cluster with laid-up vessels, less demand, risk of bankruptcies, layoffs and cyclical oil prices. Moreover, it disrupted the turnover, profitability, employment and growth expectations due to slower markets and higher costs (åkp, 2020). From December 2019 to April 2020, the crude oil price fell from 63 USD to 19 USD per barrel from the uncertainty around COVID-19, but the development picked up sharply after, and as of June 2021, the crude oil price per barrel is back at 70 USD (Macrotrends, 2021). COVID-19 impact on an already volatile oil & gas market might have been a wake-up call for more diversification towards other new sustainable markets. Only time will tell whether this is a temporary crisis that requires adaption or renewal of its ongoing transformation or if it requires a new restructuring phase, which will be further analysed and discussed in part 2.

Conclusion of Cluster Dynamics

The maritime cluster in Møre is part of an ecosystem and a network that consist of close collaboration between institutions and companies in the Norwegian maritime industry. The proximity of cluster members promotes high labour

mobility and knowledge transfer between different parts of the value chain. The industry's labour pool and competence overlap with several maritime segments, enabling labour mobility between other geographical areas and clusters.

Further, the Møre cluster has shown resilience against major challenges by transforming itself into new markets, linkages, and value chains, indicating adaptability and dynamism. How the cluster have responded to the pandemic remains to be explored from the interviews in part 2. For now, it seems like the cluster dynamic between firms is relatively strong, with tight cooperative and competitive linkages within the cluster, other regions, and industries: **8/10**

6.1.8 Conclusion of the Emerald model
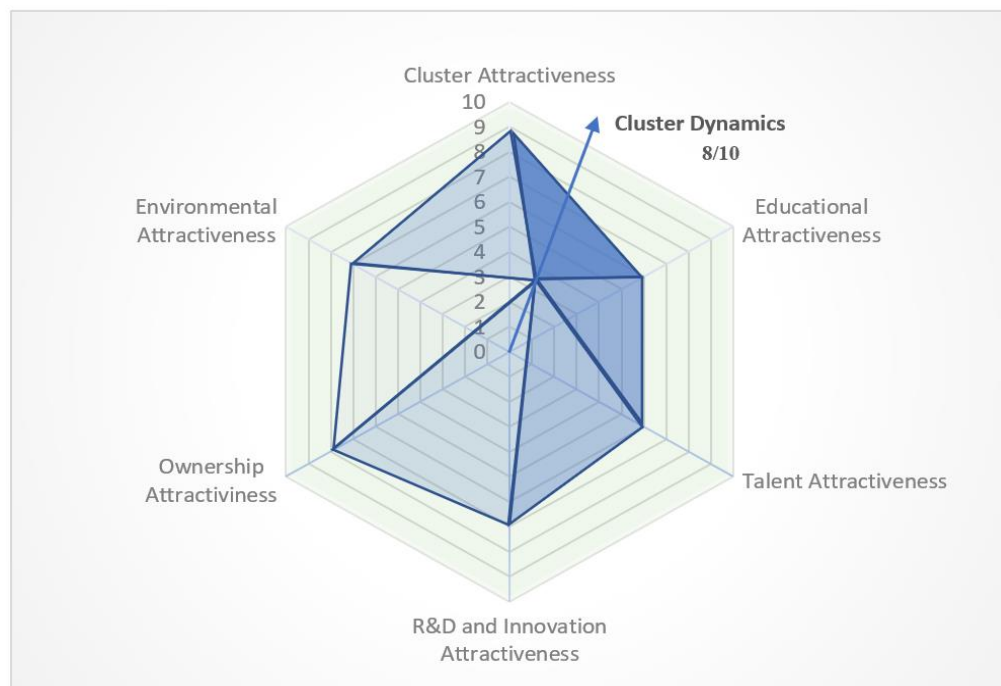
After analysing all the dimensions of the Emerald model for the maritime cluster in Møre, the *Cluster Attractiveness* scored the highest of 9. Due to its global position and internationalisation, ÅKP's important role as a cluster facilitator, companies from all value configurations, holding horizontally- and vertically structures, covering activities throughout the entire value chain, indicating cluster completeness. Despite the pandemic's effect on profitability, turnover, and employment, the cluster's value creation seems to be the same in 2020 as 2019, which is yet to be further analysed. Next, we gave *Ownership Attractiveness* the

second-highest score of 8 due to many FDI and capital opportunities, favourable tax conditions and initiatives by the government towards maritime ownership, and good geographical conditions making it possible for large ships to be built and docked in many places. Also, the maritime industry is dominated by both local- and foreign ownership, indicating that the cluster is attractive for private investors but not so much for other external owners. *Cluster Dynamics* also received a score of 8 due to the close collaboration between institutions and companies in the maritime industry, high labour mobility and knowledge transfer between different parts of the value chain, overlap with other sectors, and vigorous competition that pushes companies to innovate. At the same time, the cluster's ability to adapt to shocks and showing resilience indicates dynamism.

Next, we gave both *Environmental-* and *R&D and Innovation Attractiveness* the third-highest score of 7. *Environmental Attractiveness* is scored this high due to Norway's leading global position in the maritime industry in terms of zero- and low-emission technology. Also, the international and national framework conditions create enormous opportunities for the cluster to exceed greener technology and sustainability. But the cluster is still dependent on the petroleum market and yet to fully transform itself. Further, we gave *R&D and Innovation Attractiveness* a score of 7 caused by the established research institutions supporting the cluster with maritime research, with many public and private funding options for R&D projects. Also, the region has a high approval rate and growth of patents compared to other counties, indicating many intellectual properties and innovation attractiveness. Yet, Møre og Romsdal is in the lower range regarding academic works and share of national publications.

The cluster scores slightly lower on the *Talent* and *Educational* dimensions, which we consider the cluster's weaknesses, as the maritime industry and region have somewhat overlooked these areas. We gave *Talent Attractiveness* a score of 6 because employment in the maritime industry is still dependent on oil price fluctuations, exchange rates, the international freight market, trade agreements, and the world economy, which might prevent talents from choosing maritime education and settlements in the region. However, the cluster has restructured itself from oil & gas to more exploration cruises, making the cluster more diversified. The maritime industry is also dominated by males, limiting the

potential to attract talents from all genders. Still, Møre has the second-highest employment in the Norwegian maritime industry, with Campus Ålesund as an important intermediary to connect talents to potential employers.

Regarding the *Educational* dimension, the cluster has access to a highly educated and competent workforce from five universities, of which three offers maritime-related education. However, we saw that the maritime-related subjects were mostly taught in Norwegian, which creates a barrier for international students to choose Møre as their location. We identified an increase in students taking maritime-related subjects overall in Norway and NTNU, which is positive for the cluster, but how many of these students are from NTNU Ålesund, Fagskolen i Ålesund or Høgskolen i Molde is unknown. Also, a lot of youths that pursue higher education do not return to Møre after graduation. Yet, ÅKP has launched several initiatives and events to inspire and recruit youth to maritime professions. As a result, we gave this dimension a score of 6.

Overall, it is evident that the maritime cluster of Møre has a strong Emerald despite the ongoing situation with COVID-19. The cluster has many favourable conditions that make the cluster attractive and internationally competitive and can easily compete with other leading maritime hubs with its complete value chain, GCE status and history of transformation.

COVID-19's effect on the cluster's performance and competitiveness

The pandemic has affected the cluster's performance and competitiveness in terms of reducing its turnover, profitability, and employment. The main reason for the reduced profitability is the ripple effects that caused slowing markets, reduced cost-efficiency, temporary higher costs, lower prices, a depreciation of the NOK currency from lower oil prices. Other explanatory reasons why firms experience decreased profitability under COVID-19 is the effect of delayed deliveries due to customer demands, subcontractors, lack of inspection from customers, increased cost of labour and other internal delays. The shipyards, shipping companies and ship designers are more affected than the equipment suppliers since they are more diversified towards export markets. The yards have been hit hardest by COVID-19 regarding revenues and profitability since they are in the middle of a transformation process towards exploration cruises, which has not been profitable.

The total turnover for the cluster is expected to be reduced by 15% from the ripple effects from 2019-2020, but this is yet to be determined.

Furthermore, the impact of COVID-19 resulted in 900 employees either being laid off or fired in the cluster, indicating that the maritime industry is vulnerable to natural hazards and external shocks. The pandemic has also resulted in fewer international students in Møre og Romsdal, which affect the opportunity for cluster companies to attract more foreign talents. Overall, we think that the cluster's current competitive position is temporarily weakened from the pandemic's ripple effects with a fall in income from slowing markets, creating an uncertain period for the cluster with higher costs, less profits, and risk of several bankruptcies. The latter is yet to be verified and observed in the post-pandemic.

Despite its negative effect on performance and competitiveness, COVID-19 might also be a wake-up call for a greener future. Thus, one could say that the pandemic has affected the cluster's competitive position positively since more customers, firms, institutions, and other stakeholders are more aware of climate change than ever before. Hence, demanding further environmentally friendly solutions might accelerate the shift from oil & gas to sustainable markets like solar, hydro, and wind farms, as well as replacing fossil fuels with more hydrogen or battery-powered vessels and propulsion systems. Moreover, as mentioned, the maritime industry's leading position in climate- and environmental technology development creates an opportunity for the cluster to excel in the transition. Overall, there is vast potential to grow into new and other sustainable markets, securing a competitive advantage if the cluster succeeds in the transformation process.

Main future challenges from the Emerald model analysis
One of the main future challenges for the maritime cluster in Møre identified from the Emerald model analysis is the potential reduction in qualified labour that choose to work in the region. As examined, two out of three students taking higher education in other regions do not return to Møre after graduation due to finding vacant positions in other more prominent cities. Thus, it is important that Møre stays attractive as a host. Further, the country faces an ageing population, together with a historically low birth rate, demanding more labour in the health and care services sector. Hence, this development increases the risk of lower

employment and a loss of maritime competencies in the future when highly educated labour retires, which could reduce the supply of maritime labour.

Another major challenge is the risk and costly restructuring process related to a decline in petroleum production and the adaptation to new environmental regulations and international framework conditions. E.g., the government suggests a 5% carbon tax increase each year from 2020-2025 to meet its goal of halving emissions from shipping and fishing vessels by 2030 (Norwegian Government, 2019). This will require a substantial transition to greener markets, low- and zero-emission ships, R&D investments, production efficiency, developing domestic markets and stimulating more exports. However, maritime export companies in Møre struggle with costs and price competition when competing with foreigners due to high wages, prices on inputs, and low productivity.

7.0 Interview Analysis & Discussion (Part 2)

This is the second part of the two-folded structure (using primary data from in-depth interviews), where the authors will analyse and discuss the interviews to understand the respondents' experiences, views, and reflections around the COVID-19 pandemic and their main future challenges.

7.1 Cross-case analysis: Main future challenges

This section will investigate current key factors for the cluster's attractiveness, how the cluster should develop further, and important conditions for future competitiveness to understand what the interview subjects perceive as the main future challenges for the cluster. A cross-case analysis will be made to identify similarities and differences from the data findings based on opinions by the cluster expert, current cluster member companies, and the cluster organisation itself.

7.1.1 Key factors for cluster attractiveness

From the Emerald analysis, existing secondary data were used to discover that the Møre cluster had many current strong areas in terms of attractiveness, namely within *Cluster Attractiveness*, *Ownership Attractiveness*, *Cluster Dynamics*, *Environmental Attractiveness*, *R&D and Innovation Attractiveness*. Meanwhile,

this chapter investigates what the cluster members and stakeholders themselves perceive as current key factors for cluster attractiveness. Maintaining these factors should be one of the priorities when the cluster develops and moves forward into new markets and challenges. The responses were quite similar regarding this subject, as three factors were repeatedly mentioned as key for cluster attractivity: maintaining a complete cluster, maritime environment and culture in Møre.

A complete cluster

A common perception among the interviewees is that being part of a complete cluster and GCE Blue Maritime comes with important benefits. Although several companies are located at Møre simply because of historical reasons, it is being part of a complete cluster that makes them stay there. An example of this is Kongsberg Maritime, arguing that it is precisely for historical reasons that the company is located at Møre, but the benefits of being in a complete cluster persuade them to stay. When asking the question, "What makes it so attractive to be located in Møre versus other places?" (see **Exhibit 2**), they said:

> *There are two reasons. Firstly, is the historical reason. Ulstein had equipment factories that they sold in 1999 to a British company Vickers plc, which was sold the same year to Rolls Royce and later bought by Kongsberg Group in 2019. The second is a strategic decision, location, and a desire to be part of the cluster dynamics. The cluster works closely across shipping companies, shipyards, and equipment manufacturers and has a very high degree of export* (**Kongsberg Maritime**).

Similarly, Skipsteknisk and Ulstein Group are also located at Møre because of historical reasons, and have decided to stay as a strategic decision to be a part of the complete cluster:

> *The company was based here from the time it was founded. The current benefits of being part of the cluster are that it offers close contact with equipment suppliers, shipyards and shipping companies* (**Skipsteknisk**).

> *The main factors for being located at Møre is our history and tradition, but also the availability of production facilities and operators. At Møre, there is*

a very dense environment, and the entire value chain is available to deliver the services and products we offer (**Ulstein Group**).

According to our respondents, there are several benefits of having close access to all companies from all parts of the value chain. Firstly, the geographical proximity creates an environment in which it is easier to build friendly relationships with suppliers and customers. A respondent from Green Yard Kleven argues that the complete cluster and geographical proximity leads to better products because of improved contact and relationships:

It is a cluster with shipowners, shipyards, suppliers, technology companies, design companies, and a well-established research environment. There is an enormous strength to have all these companies here together, and it creates a lot of activity in the area. A lot of contact and relationships between shipowners, shipyards, and subcontractors, who all cooperate to create great products (**Green Yard Kleven**).

Additionally, Kongsberg Maritime mentions that geographical proximity leads to a more comfortable arena for building inter-organisational relationships:

Geographical proximity leads to easier cooperation between member companies, and creates a circle on how to collaborate for shipowners, shipyards and equipment manufacturers. Also, you meet people from the cluster in social contexts such as children's football games, making it easier to call each other afterwards and pick up the phone (**Kongsberg Maritime**).

Having a complete cluster is especially important for the maritime industry. The cluster organisation ÅKP argues that shipbuilding is dependent on cooperation between several different parts of a value chain to produce satisfactory products:

Shipbuilding depends on many different subjects. The cluster offers proximity and relationships to suppliers and customers. Interacting well with subcontractors is completely critical in this industry. And it reduces the chances of mistakes during production. (**ÅKP**).

According to a former advisor for the cluster, the benefit of having a complete cluster is not something that every maritime cluster has. Thus, it is an important part of the competitiveness and attractivity of the Møre cluster:

> *It is important to have a complete cluster. So, the fact that they have shipowners, shipyards and equipment manufacturers is important. Elsewhere you have, for example, only shipyards and nothing around, or just shipowners, while in Møre, there is the concentration of a complete cluster* (**Cluster expert**).

Another benefit of having the entire value chain available in the region is the quick feedback that companies can get from both suppliers and customers, according to Ulstein Group:

> *The dense environment and availability of the entire value chain means that companies get very fast feedback on design and shipyard assignments from various customers in Møre* (**Ulstein Group**).

Maritime environment and culture

The respondents mention another important factor for the cluster attractiveness, namely the maritime environment and culture existing in the Møre area. The maritime industry has lived in the region for centuries. And the cluster offers plenty of relevant competence, which has been developed over many years according to the cluster organisation ÅKP:

> *The culture and historically built knowledge around building ships makes it attractive to be in Møre versus other places* (**ÅKP**).

Ulstein Group also finds the culture from the Møre region to have benefited the environment within the maritime cluster:

> *The environment in the cluster also benefits from a culture of innovation, technology, and new opportunities from the Møre area. It is unique and very connected to Sunnmøringer. And the culture and environment make it so much easier to start a business because there are so many people you can talk to and collaborate with* (**Ulstein Group**).

Furthermore, the region has a culture of engineering, with educational facilities to build more competence in the future. Moreover, there is a positive competitive environment that facilitates and motivates improvement within the cluster members. Skipsteknisk is one of the companies that find the environment in Møre to be important for the cluster:

> *The cluster offers an engineering environment, as well as nearby educational facilities. Even though the companies do not always work together, the cluster offers an environment where the companies build each other up. Furthermore, the cluster offers the availability of resources such as employees with relevant competence* (**Skipsteknisk**)

Because of the already existing maritime culture within the region, there is easy access to a highly qualified workforce with competence within different parts of the value chain. A former strategy consultant for Ulstein Group and cluster expert mentions the competence of the workforce despite educational levels:

> *Another thing that makes firms want to be in Møre is the competence of the workforce. Local shipbuilders had practical skills. Not necessarily a lot of education, but they were incredibly good at working and knew everything about boats. It is a competence driven industry and attractive because so many other businesses are located in the area* (**Cluster expert**).

Although companies such as Ulstein Group are originally located at Møre because of historical reasons and the availability of a complete cluster, the easy access to a competent workforce, culture, proximity to customers and suppliers are important factors for being a part of a cluster:

> *Being a part of a cluster means that the impulses increase, experience and expertise circulate, and there is a great supply of competent operators, proximity to customers and suppliers, and a culture of togetherness within the cluster* (**Ulstein Group**).

7.1.2 How the cluster should develop further

This section of the paper will uncover the main directions in which the respondents believe the cluster should move towards the nearest future. It attempts

to answer the question of how the cluster should develop further. According to the interview respondents, there are two main ways in which the cluster should develop: becoming greener and focusing on attracting and developing talent.

The green shift

The main consensus from the interviews seems to be that the further development of the cluster should be focused on a restructuring towards the green shift. There appears to be a common acceptance that the entire maritime industry is heading towards more environmentally friendly solutions. Not only because of expectations from the market but also because of regulations from governing organisations such as IMO. According to Ulstein Group, climate change is one of the great challenges that lies ahead for both our planet and the cluster:

> *The environmental and climate challenges are perhaps the biggest challenge ever, and how can we contribute. Yes, digitalisation will be important, but we must continue to work on more environmentally friendly solutions that will become even more important* (**Ulstein Group**).

Although some members see the green shift as a threat, most respondents claim that the green shift should be seen as an opportunity for further growth. Kongsberg Maritime thinks the green shift is a great opportunity, especially for equipment suppliers:

> *The green shift is a key for us going forward, where we can create technology that contributes to more environmentally friendly shipping. And we have a whole bunch of technology that can contribute to the green shift and green shipping. International regulations from the UN and IMO sets framework conditions for the industry. Pushing for lower emissions is an advantage for a technology company like us, contributing to innovation. This means that the shipping industry must invest in new and greener technology and buy equipment from us to make it happen. But we wish things went faster, and it takes time* (**Kongsberg Maritime**).

Although the green shift has been a relevant topic for some years, there is always more experience and expertise to be gained on the subject. Green Yard Kleven

strongly believes that the cluster must approach green shift proactively and focus on adjusting to the green market instead of dwelling on the past:

> *We have to be a bit offensive on the green shift. We must look at it as opportunities and not a threat. The green shift is positive because it forced us to develop further. We must realise that it is a new age we are entering, a new industry, different technology. There are also other environmental requirements now than 5-10 years ago, the oil period is over, and the ship prices we got previously will not happen again* (**Green Yard Kleven**).

Knowing what the future market will look like is difficult but staying ahead of competing countries and clusters is key for the competitiveness of the Møre cluster. According to Green Yard Kleven, the cluster should work hard to predict the future needs within the maritime industry. They also have some ideas on activities that will be relevant in the green future:

> *We are working well through maritime associations to see what the world will look like in 2030. The cluster must adjust to the green shift and work intensively through the research community to find out what we think will come in 5-10-15 years to be part of that wave. I think we should start with recycling ships by removing old tonnage in a green way as well as rebuilding old ships to be greener, for example, by inserting battery packs or other innovative solutions* (**Green Yard Kleven**).

Some companies see the green shift as a threat rather than an opportunity but still admit that the concept of the green shift itself is a good thing. E.g., Skipsteknisk is worried about the expectations on the industry regarding the pace of adjustment to the green shift but still view the shift itself as something positive:

> *The green shift is very relevant nowadays, and it is a positive thing, of course. However, we see some challenges because many believe it can happen on a large scale in a short time. It has become unpopular to engage in oil-related business, but in reality, the world will be dependent on oil for a long time to come. Offshore fleets and cargo fleets cannot run on battery, gas or hydrogen. It is acceptable for ferries that cross a fjord and along the coast, but the capacity in these energy sources is very limited in relation to*

volume. Even if the green shift is positive in itself, one must have a realistic view of how fast it can happen (**Skipsteknisk**).

It is quite evident that the cluster is already working hard on adjusting to the green shift. According to the cluster expert, there are already signs of greener activities and vessels. The expert also believes that Norway has an opportunity to take a competitive position in the greener maritime markets. When asking, "Is the green shift a threat?" the expert said:

> *Absolutely. The green shift is one of the big things they are working on right now. You can see it with green shipping, emission-free boats, electric ferries, and all this. Norway may be able to take a position here. Other things are going green, so it is clearly one of the great development forces. Restructuring from carbon-based to greener industries requires the whole business to change* (**Cluster expert**).

Other respondents also agree with the former strategy advisor and cluster expert in that Norway has a great opportunity to take a special position in the future of the maritime market. The respondent from Skipsteknisk mentions that Norway is starting to get a lot of expertise at hydrogen operations and fuel cells. Green Yard Kleven mentioned that we are heading towards a market for smaller ships, which fits the Norwegian maritime companies well since other countries have more expertise in building larger ships. Kongsberg also thinks the green trend is a huge advantage for Norway and the rest of the Nordic region because these countries are already good at green maritime technology.

Attracting and developing talent

According to our respondents, another key area in which the cluster should develop is developing the workforce. This includes attracting experienced workers and recently graduated students within relevant fields, as well as promoting relevant education for local youth.

Improving the educational system in the country would increase the availability of competence, but the cluster itself is restricted in how much they can influence the Norwegian education system. However, one thing they can do is to attract young people to pursue an education and career within the maritime field. The cluster

organisation ÅKP believes it is important to showcase possible job opportunities to motivate young people to pursue maritime careers. They also stress the importance of young talent when facing an era of digitalisation and environmentally friendly solutions:

> *Host attractiveness is a big activity for us. We have to make it visible to young people that it is possible to work here, and that there are a lot of exciting jobs. We try to show the range of jobs and positions that exist and that we are an innovative cluster that provides opportunities for young people. We will especially benefit from other types of people and education now when we get the green shift, digitalisation and corona at the same time* (**ÅKP**).

It is also evident that we are entering a more digitalised era of the industry when looking at the types of people the companies want to recruit. According to Kongsberg Maritime, they are looking for workers with advanced technological competence, but the search is not easy:

> *We are looking for electrical engineers, but Norway does not have enough of that, and there is a big fight for them. We are looking for people in advanced technology such as within autonomy and remote control. Also, we have advertised several positions for a Cybersecurity team we are restructuring to date, primarily IT and engineering-based positions* (**Kongsberg Maritime**).

Several respondents believe that one of the main problems in recent years is the increasing amount of foreign workforce. According to the cluster organisation, capacity is constantly being topped by hiring foreign labour, and that the proportion has become too high. Skipsteknisk believes that the low population in Norway is a challenge when it comes to the availability of educated workers. Additionally, competence is crucial when developing new technologies as the maritime industry is becoming more and more digitised.

> *We have the challenge that there are so few people in Norway. It is difficult to get enough educated workers in some areas, but competence and*

technology are closely linked. We have to be at the forefront there too, and focus on education (**Skipsteknisk**).

Another challenge is the geographical location of the cluster. According to the cluster expert, the cluster needs to attract talented people, but the Møre region is not the most attractive place to live for talented young people:

> *It is important that the cluster manages to attract the foremost minds. However, it is clear that not everyone finds it as attractive to live up there. Other places such as Oslo have a completely different attraction as a workplace for young talented people* (**Cluster expert**).

It is clear that the respondents believe that the cluster needs more talented and highly educated workers to be competitive in the future. It is also evident that one of the main reasons for this increasing need for competence is the digitalisation of the industry. Kongsberg Maritime mentions that we were in the 4th industrial revolution, with AI and digitalisation being the main driver. Thus, there will be a high need for more expertise within this field. Further, the cluster expert argues that since Norway is a high-cost country, the cluster must respond with technology and high competence to compete with cheaper countries.

Expansion beyond the Møre region

Although respondents agreed that cluster development should be focused on the green shift and attracting and developing talent, there was one developing direction that raised differing opinions. This was about whether the cluster-core should expand beyond the Møre region in the coming years, and while some respondents had belief in expansion, others did not.

Green Yard Kleven mentioned that there is already some activity in the Florø area in Vestland, south of the cluster region. Thus, they do not think it is inconceivable that the cluster will grow a little south. ÅKP believed that the cluster would benefit from spreading a bit because there is so much new knowledge. While Kongsberg Maritime believes that expanding beyond the cluster will be necessary when the cluster is moving into new markets. When asking the question, "Do you think the cluster-core will go beyond Møre by 2030?" they replied:

Yes, maybe. A cluster has no clear boundary, and in Norway, one might say that we have a Norwegian maritime cluster where we have specialised in different areas. The Møre cluster has specialised itself in offshore, but when we are not just offshore anymore, we will see that we need cooperation beyond the cluster. To the south, seafood is an important point, and to the north, towards Trondheim with an engineering, technology, and economic environment. So, there are already floating borders. So maybe we will get a different structure on the cluster eventually (**Kongsberg Maritime**).

Skipsteknisk, on the other hand, does not believe that the cluster will grow beyond the Møre region in the coming years, but rather the opposite. They believe that the cluster will benefit more by centralising:

I do not think the cluster-core will grow beyond Møre by 2030. It is perhaps rather the opposite that one must centralise a little to become even stronger. Create strong environments and instead try to differentiate a little. I do not envisage it growing out that way. I rather think that the competition is tough all the way, and we must build strong units in a good environment to be viable (**Skipsteknisk**).

The Cluster expert also thinks that the cluster will not expand its core but believes there might be more internationalisation in the future. However, the expert imagines that this will weaken the cluster because some of the business operations will go abroad:

No. It has been shown that those who are outside the cluster have other problems. But the cluster might become even more internationalised, but it is also a way to weaken the cluster. It sounds nice to have a host of companies in or from China, but in practice, it means that the business eventually disappears there (**Cluster expert**).

Although ÅKP thinks the cluster will benefit from spreading a bit, they mentioned the importance of streamlining the core of the cluster and making those who build ships more efficient. Similarly, one of the respondents from Ulstein Group saw some benefits of expanding and finding new ways for the cluster to develop and stated that the maritime cluster might expand to other parts of Norway and

Northern Europe. While the other respondent from Ulstein Group did not believe the cluster will expand beyond the Møre region in the coming years. Yet, the cluster might gradually change and gain international roots and that a stronger degree of internationalisation should be facilitated.

7.1.3 Important conditions to be competitive in the future

This section of the analysis explores the most important conditions for the cluster to be competitive in the future. These are important external factors that must be in place for the cluster to maintain its competitiveness when moving forward with the developments discussed in the previous part of the paper.

Developing educational institutions

There is a common consensus that the Norwegian Government has an important role to play in supporting and strengthening the development and attractiveness of the cluster. One way the government can help build competitive conditions is by strengthening educational institutions. And one of the most critical conditions for future competitiveness is the availability of talent and competence.

As mentioned earlier, the respondents believed that the increasing number of foreign workers is an issue for the cluster. However, one of the main reasons for the high dependency on foreign workers is the lack of competence in the Norwegian workforce and educational system. Skipsteknisk argues that Norway needs to improve its educational institutions for the cluster to remain competitive:

> *We have become very dependent on external labour. It is not because the labour is cheaper, but because we do not have access to it in Norway. We need to become better in areas like education because if we lose access to the workforce, then flagging out all activity will be the end result. That is a big threat to the maritime cluster. We need access to highly educated people that allows us to be at the forefront of the areas we work in* (**Skipsteknisk**).

Thus, to increase the access of talented Norwegian workers, the government must take responsibility by strengthening and investing in higher educational institutions like universities and colleges. The cluster expert also believes such investments are important for the attractiveness of the cluster but thinks that the Norwegian Government is already aware of this need:

> *I think the government, the Research Council, and various actors understand that knowledge investments in education, research, talent development and innovation programs are important.* (**Cluster expert**).

Ulstein Group believes that developing competence is highly important for the cluster's future competitiveness and also believe that the Norwegian education system is important. They mentioned the importance of the government working together with the industries to develop the educational system properly:

> *For the cluster to be competitive in the future, developing and building competence is important and fundamental. Otherwise, you will not be able to develop the environment and the cluster further. Therefore, the cooperation between the business community, academia, and the authorities is crucial* (**Ulstein Group**).

Government financial support

Apart from developing the educational institutions, there are also several other areas in which the government can help strengthen the cluster, such as promoting innovation and stimulating activity. This can, e.g., be done through state funding of innovative projects or the orderings of ships, according to Kongsberg Maritime:

> *I think a lot of what the state does today to promote innovation in sustainability is important and that the cluster members seek funding and support around it. In addition, the state contributes to stimulating activity and work in ordering state ships, such as research and marine vessels in the navy* (**Kongsberg Maritime**).

The cluster organisation ÅKP also supports the idea of government funds and proposes an alternative idea where the state funds full-scale prototypes of different types of vessels. The cluster is currently using a new technology that enables the creation of digital twins of ships. This allows them to develop and get live data on the digital twins instead of taking ships out of service and tearing apart the physical vessel itself. Thus, ÅKP recommends using the prototypes as research studios using the digital twin technology:

> *The government should give funds for full-scale prototypes, such as*
> *shipping vessels, offshore vessels, well boats and fishing boats. The state*
> *should cover 50% and allow us to use the ships as research studios when it*
> *is in operation. We can fill it with sensors and put it in digital twins*
> *continuously* (**ÅKP**).

Another similar area in which the government can create advantageous conditions for the cluster is through capital contribution. According to Green Yard Kleven, one of the recent issues within the cluster has been the lack of equity to finance new projects. Further, Ulstein Group argues that the government can contribute with equity support to relieve the risk of projects:

> *Most Norwegian shipyards have lost their equity, making it difficult to*
> *finance the building of new ships. This needs to be looked at, for example,*
> *by changing the conditions to get financing in terms of equity. Maybe a*
> *temporary arrangement until you get the shipyards back on their feet. We*
> *see in Kleven that there are good projects that should be possible to finance,*
> *but it is difficult with low equity* (**Green Yard Kleven**).

> *The government can ensure stable framework conditions for the industry by*
> *contributing to sufficient equity being generated for new investments. This*
> *risk-relieving support and guarantee can be provided for even the most*
> *expensive new building projects* (**Ulstein Group**).

Equal playing field

The respondents mentioned the importance of equal conditions in terms of laws, rules and regulations for the cluster to be competitive in the future. This includes EU regulations and rules about subsidies. According to the cluster expert, governments are not allowed to subsidise the clusters but can instead support the cluster in other ways. When asking, "Is there anything the Norwegian Government can do to help strengthen the development and attractiveness of the cluster?" the cluster expert replied:

> *Knowledge investments. They aren't allowed to do that much else anyway.*
> *EU rules are pretty clear in that they are not allowed to subsidise, but they*

*can support the knowledge part and the knowledge links that are central to the cluster. That is the only thing they can do (***Cluster expert***).*

However, despite the EU rules regarding government support, some countries are more creative in terms of bending the rules, creating an uneven playing field for companies and clusters from different countries. According to Green Yard Kleven, other countries are more creative than Norway when it comes to this, and it could be due to Norwegian authorities following the rules too strictly:

*A lot of EU rules governs the Norwegian authorities. So, what they can do before the loans are classified as subsidies is a bit limited. But we can see that other countries are more creative with stretching a little further than the Norwegian authorities do. Maybe we also overinterpret the rules in some cases (***Green Yard Kleven***).*

Sometimes, the Norwegian authorities take it even further by shortening the time for Norwegian companies to reach certain environmental goals. According to ÅKP, Norwegian politicians are too focused on rushing environmentally friendly solutions and ignoring whether it is possible to meet the demands. Such unrealistic demands create an uneven playing field because Norwegian firms must follow unreasonable rules which companies abroad do not have to worry about:

Politicians are so focused on what IMO says about security and approvals. Such things take time. IMO has talked about goals in 2050, and the prime minister says that it should be done by 2030. An example is a company that has a zero-emission requirement until 2026, but the problem is that those ships cannot be there by 2026 because they would have to be under construction already if that were to happen. What ends up happening is that the projects go somewhere else. It is a great threat to the industry. We must remember that the rest of the world is not as green as we are (**ÅKP**).

Without an equal playing field, maritime clusters in certain countries will have unfair advantages over others, threatening clusters' competitiveness in these countries. Thus, the Norwegian authorities must allow the cluster to work with equal conditions as companies abroad. Additionally, according to Green Yard

Kleven, the governing authorities like the EU must step in to prevent countries from breaking the rules and regulations:

> *International conditions that are challenging for the cluster are the financing schemes, tax leases in Spain or hidden subsidies in Turkey. We must work for an even playing field. When they price ships, and it goes through Turkey, material cost should be the same, and hourly cost should be the difference. But we see in many cases that it is far beyond that, and it is an unfortunate competitive situation. We are convinced that there are many underpaid workers in these countries. This is much more common down there while we try to comply with strict regulations. I think it is important from an EU perspective that it is addressed so that we work with equal conditions* (**Green Yard Kleven**).

7.1.4 Main differences

Although the respondents were quite similar in opinions of main future challenges for the cluster, there were some main differences. Regarding the key factors for the cluster's attractivity, the respondents had very similar answers. Having a complete cluster as well as a maritime environment and culture was the recurring theme throughout the interviews. Similarly, for the important conditions for the cluster's future competitiveness, respondents' opinions were very similar to strengthening educational institutions, government support, and equal conditions.

However, when it comes to how the cluster should develop further, there were some differences. As mentioned, some respondents view the green shift as a great opportunity for the cluster, whereas others view it more as a threat. One example was Kongsberg Maritime, which viewed the green shift as a great opportunity, especially for equipment suppliers. On the other end, Skipsteknisk saw the green shift as a threat because of the unrealistic short-term expectations. Further, whether the cluster-core will expand beyond the Møre in the coming years was quite split. While some respondents, such as Kongsberg Maritime, believe it will happen, other respondents, such as Skipsteknisk, think it will not. Additionally, some respondents like ÅKP view it positively and beneficial, whereas others, such as the cluster expert, believe that the cluster will become weakened.

7.1.5 Conclusion of cross-case analysis

After analysing the interviews, we have identified what the respondents believe are the main future challenges for the cluster. Also, the respondents were mostly in agreement regarding these future challenges, with a few differing opinions regarding the cluster's further development.

The respondents viewed three factors as highly important for the cluster's attractiveness, and maintaining these factors was interpreted as some of the main future challenges. Firstly, maintaining the completeness of the cluster were highly agreed upon by the respondents. Having companies from all parts of the value chain in proximity and collaborating was seen as very beneficial. This could be a future challenge to maintain when new environmental regulations push companies towards greener markets and potentially disrupt the tightly integrated value chain when companies collaborate and find new customers and suppliers outside the region. The second and third factor was maintaining the maritime environment and culture in the Møre region, as this comes with historically built maritime competence and a culture of innovation. The cluster's history and culture have shown little resistance to change or path dependency over time and thus one of the key factors for the successful restructuring in the past. Therefore, maintaining the maritime environment and culture is identified as some of the cluster's future challenges.

As for how the cluster should develop further, respondents believed the green shift was the next big transformation for the cluster. Although some viewed it as an opportunity and others as a threat, the respondents were accepting the fact it is coming and a main future challenge. Attracting and developing talent was also seen as an important development and challenge for the cluster, as respondents believe the country lacks competence while the need for it will only increase. The third development direction was the expansion of the cluster-core beyond the Møre region. Again, opinions here were split, with some believing it will happen and others not, whereas some respondents viewed it as a positive development, whereas others saw negative effects from it. Thus, it is uncertain whether it goes under a main future challenge. Overall, the adjustment towards the green shift, as well as attracting and developing Norwegian talents, were identified as some of the main future challenges.

For the cluster to be competitive in the future, certain conditions were found. Firstly, the Norwegian Government must strengthen the educational institutions to increase the availability of competence. Secondly, the government should provide financial support to the cluster companies when needed, such as funding for innovative projects, ordering state ships, or offering equity support. Lastly, an equal global playing field in terms of laws, rules, and regulations must be in place to allow the cluster to compete fairly with foreign companies and clusters.

In conclusion, the cluster's main future challenges are adapting towards the green shift, attracting and developing talented workers, as well as maintaining a complete cluster, maritime environment and culture in the area. For the cluster to tackle these challenges successfully, the government must support the cluster and international regulatory bodies to ensure equal competitive conditions.

7.2 Cross-case analysis: COVID-19's effect on the cluster

This part will analyse and discuss the respondents' answers on how COVID-19 has affected the cluster, how the cluster has adapted, and what impact the pandemic has had in meeting the future challenges. The authors will also identify other obstacles for the cluster when facing these future challenges. A cross-case analysis will be used to identify the similarities and differences of the respondents.

7.2.1 COVID-19 Pandemic

First, we analyse the interviews to understand the pandemic's effect on the cluster. By looking at how vulnerable the respondents believe the cluster is to external shocks like COVID-19 and how the pandemic affected the cluster. Before investigating how the cluster has adapted to the pandemic and how it should move forward. Finally, there will be a discussion on how the pandemic has affected the cluster's future challenges.

Cluster robustness

Respondents had varying opinions on whether the cluster is vulnerable or robust to external shocks such as COVID-19. According to the cluster organisation ÅKP, the cluster is incredibly strong because it is so specialised. However, it is also what makes it very vulnerable because of the high dependency on specialised markets. Several other factors were mentioned in terms of cluster robustness, like

the severity of the shocks and whether the downturns are short-term or long-term. According to the cluster expert, the cluster is most vulnerable to big shocks, that significantly impact the markets:

> *The cluster is relatively robust for temporary shocks. But it is not as robust for big shocks such as market shocks when the main market fails. So when COVID-19 is over, they will have a tough period for a while before the market picks up again.* (**Cluster expert**).

Regarding long term versus short term, Skipsteknisk argues that the cluster is more vulnerable to short-term than long-term shocks because the activities will continue to function even during downturns:

> *In the short term, the cluster is vulnerable to shocks because activity stops a bit in the beginning. However, the cluster is robust in the long term, and the activities and industries will continue to function. Under COVID-19, there has been a boom in the construction of well boats, fish farming and these types of activities. The world must have food. The cluster has done well, and I have not seen any major bankruptcies related to the pandemic* (**Skipsteknisk**).

Whether the shocks are significant enough to hamper international trade is also crucial for determining the cluster's vulnerability. According to Ulstein Group, the cluster is vulnerable because of Norway's dependency on international trade. However, they also believe in the strength of restructuring when needed:

> *Norway with its relatively vulnerable economy and dependence on doing business with other countries, such as international trade with other maritime sectors, makes us vulnerable. But we have also shown a certain strength in change that we are keeping up with compared to others, e.g., in the European shipbuilding industry with the restructuring process and within the cruise segment* (**Ulstein Group**).

COVID-19s effect on the cluster

In terms of how COVID has affected the cluster, responses varied depending on the size of the companies as well as which part of the value chain they belong to.

According to Green Yard Kleven, big shipyards took a greater hit than the small ones who kept up performances:

> *It is really market dependent. Big shipyards were hit hard because the markets went away, but smaller shipyards that are competitive on small vessels have done well. They have one or two fishing boats. Meanwhile, we have relied on having up to 7 large volume projects while at the same time trying to convert ourselves to passenger- and explorer vessels. We were well on our way to build expedition ships. Then the pandemic struck in March, and all ship construction was cancelled* (**Green Yard Kleven**).

Another similar situation was Ulstein Group who was finalising a 4-5 years long restructuring process when the pandemic hit. After significant investments in restructuring towards the cruise segment and high expectations of reaping the benefits, the pandemic caused a complete stop in the market.

> *At the beginning of 2020, we thought this would be the year we had restructured ourselves completely and could start reaping our investments, showing results, new contracts in construction and design within cruises, offshore winds and other segments. But then came COVID-19 in March, and everything stopped relative to the cruise segment. The biggest effect for us was that the activity in the market and new contracts stopped, and there has been a significant additional cost associated with this. Corona became a new challenge in the middle of it all after a dramatic restructuring process of 4-5 years. (***Ulstein Group***).*

Additionally, just like Green Yard Kleven, the Ulstein Group also mentions that the smaller shipyards have done better than the bigger yards during the pandemic, despite contracting levels being at a record low in recent years:

> *There are record low contracting levels. You must go 60-70 years back in time to see such low contracting levels in all shipbuilding segments. However, some segments have done well, such as smaller well boats and fishing boats with several orders. In our region, we have some smaller shipyards that have really done well during this period, shipowners who have invested heavily in the well-boat segment and related to fish farming* (**Ulstein Group**).

Certain parts of the value chain were not affected as much as the big shipyards. According to Kongsberg Maritime, the equipment industry is an example in the value chain that was not as severely affected by the pandemic. The main effects were somewhat lower order intakes and travel restrictions related to aftermarket service. The design company Skipsteknisk was also not very affected by the pandemic. They experienced an abrupt halt at first, but operations gradually increased again:

> *COVID-19 has not affected our company much overall. Just when it happened, a lot of activity stopped, and we realised that the bottom fell out of the projects we were working on. However, the world around us continued to function. Our operations gradually picked up again. In broad terms, we have maintained the same activity that we have usually been doing. Full activity and almost normal situation both at the end of 2020 and the beginning of 2021* (**Skipsteknisk**).

Similarly to other respondents, ÅKP believes the sudden stop in order-intakes was the main negative effect of COVID-19 on the cluster. Additionally, they also mention the big shipyards being hit harder than the smaller ones, as well as certain parts of the cluster performing very well despite the pandemic:

> *The order books are so long, so there have not been many redundancies. Yet, no new contracts are coming in, which is the critical part. That said, some parts of the cluster are performing like never before, and those that are within fish farming and well boats, the smaller ones, are doing very well and experiencing an all-time high. The big companies have suffered the most* (**ÅKP**).

Overall, it seems like the cluster was not heavily affected by COVID-19 in the long term, just somewhat in the short term. Sudden stop in order intakes at the beginning seems to be the main effect, but activities did increase gradually. The cluster expert argues that although the pandemic impacted the shipyard industry, the industry would mainly be delayed and disturbed instead of closed down. However, they do mention one specific segment that experienced major failure:

The pandemic has a major impact on the shipbuilding industry, but it is not an industry that disappears or has downturns such as tourism or cruise traffic. It is not closed down, but rather delayed and disturbed, and it is especially delayed and disturbed because of international labour. If there was anything that was affected by the pandemic, it was the cruise industry. So, one of the segments failed, but it is first and foremost a temporary case. I do not think it is a lasting effect on the cluster (**Cluster expert**).

How the cluster adapted to the pandemic

Different companies within the cluster have opted for different strategies to adapt to the changing market during the pandemic. One strategy was to lower costs to save the bottom line. This includes but not limited to; lowering or postponing orders, furloughing and laying off staff, or other cost-reducing measures. E.g., Kongsberg Maritime used a cost-reducing strategy to increase profitability despite the lower order intake:

*We had a lower order intake in 2020 than we wanted. But we have also taken good care of our costs as a main measure for the pandemic, so we had actually increased profitability last year. The bottom line is doing quite well, but we are worried about the top line (***Kongsberg Maritime***).*

Ulstein Group also mentions that they had to focus on reducing costs because of the low order intake:

We must try to reduce our costs in relation to the fact that there is no work, all the work in the yard and design has been postponed indefinitely. We have downsized, laid off people and used all the instruments that limit the costs. We are sure that the market will return strongly, but uncertain when (**Ulstein Group**).

Although costs have been cut, Ulstein Group does argue for the importance of maintaining a certain activity level in order to hold on to key competence:

*Competence disappearing may be a concern you may have in the local maritime environment now that we are in a low cycle. Therefore, it is important to maintain a certain activity to take care of key people and not lose competence (***Ulstein Group***).*

Another strategy was to investigate different markets. This was especially relevant for companies that operated in markets that were struck harder by the pandemic. ÅKP mentions that some companies have started looking at other areas to operate. Skipsteknisk mentions that the adjustments they have made are purely market-related. While Green Yard Kleven, well on their way building expedition ships and experiences an abrupt halt, had to start looking for new markets.

Companies also had to adapt to a more digital working life because of travel restrictions and quarantines. Besides taking care of costs, Kongsberg Maritime mentions finding digital ways of working was also a main measure for the pandemic. And Skipsteknisk talked about using video conferences instead of physically meeting potential customers:

> *We have had to arrange ourselves differently – we do not travel and do not get on board boats. Often the shipowners are along the coast in boats, and you visit them, but you cannot do that now. We have used a lot of video conferencing, which has become the standard. Also, the use of home offices to keep the density down in the office* (**Skipsteknisk**).

Some cluster members have made decisions that lead them better or worse out of the pandemic than other members and competitors. E.g., Ulstein Group, which took advantage of good periods to build up equity and reserves. And by adapting the capacity to the market and being more careful in choosing projects:

> *We have built up equity and reserves in good times that we can now use to survive. We have chosen to adapt the capacity to the market in time so that we have not enslaved our own production capacity – by chosen projects with the greatest possible margin potential and gone after project quality rather than quantity. We have also adapted the resource input according to expected market development. We did this long before the pandemic, already from 2015 onwards* (**Ulstein Group**).

When comparing the pandemic with earlier crises, respondents argue that the impact of the 2008 financial crisis was even smaller as it was hardly noticeable. However, the oil crisis in 2014 was more severe for the cluster than the COVID-19. The respondents believe the pandemic is a temporary crisis that will pass, unlike the offshore crisis, which required major restructuring from oil and gas.

ÅKP argues that the timing of the pandemic is unfortunate because it came in the middle of a change away from oil. And the cluster expert argues that the oil crisis was much tougher because the pandemic is something one expects to go over, whereas the oil crisis never ended. Green Yard Kleven also mentions that the oil crisis was the toughest, and Ulstein Group says that the oil crisis was more severe and forced companies to restructure towards different segments:

> *The oil crisis in 2014 was dramatic and required major restructuring. The market fell more or less overnight. We had two opportunities. One was to close down because the market disappeared or try to adjust to new market segments. The latter was the only real option for us, where we switched to the exploration cruise segment, which consisted of completely new types of ships and customers. However, it cost an enormous amount to adapt. We also established ourselves in offshore wind* (**Ulstein Group**).

Moving forward

When asked how the respondents believe the cluster should adjust to this pandemic, the common theme was that the companies must restructure towards new areas. The cluster expert thinks the change will be about finding other segments that can replace the old ones. According to ÅKP, some companies have already started looking at new areas. They also mention that shocks like COVID-19 reinforced the cluster to restructure, which can be a positive thing because it would eventually need to happen anyway:

> *Some companies have started looking at other areas. What I think is interesting is that COVID actually came in and reinforced something that had to happen. You cannot have a cluster with such capacity where everyone builds offshore ships or builds cruise ships. Being this specialised makes us so vulnerable* (**ÅKP**).

One area the cluster is moving towards is getting involved with the whole life cycle of shipbuilding. According to ÅKP, the circular economy makes a lot of sense, with the green shift becoming an increasingly important theme. A company that has already begin looking at this segment is Green Yard Kleven. They argue that it is crucial to adjust to the green shift and start working on the entire life

cycle of ships. In fact, operating with several parts of the ship's life cycle makes them less vulnerable:

> *The new strategy is the entire life cycle of shipbuilding, everything from building new ships to ship recycling. So we have three legs to stand on now. Firstly, we have new construction, and then we have rebuilding, repair and maintenance, and lastly, recycling. We started with the recycling of ships by removing old tonnage in a green way. Also, the technology in old ships is outdated, and many ships can be rebuilt greener, for example, by inserting a battery pack or other innovative solutions. There is a lot of discussions about which fuels will be attractive in the future, and shipowners are a little unsure of what to invest in* (**Green Yard Kleven**).

Apart from building technology that can contribute to more environmentally friendly shipping, Kongsberg Maritime and the cluster organisation believe offshore fish farming can be the future for the maritime cluster. Kongsberg Maritime also believes in offshore wind power, not only for equipment suppliers but also for shipyards who can take advantage of their knowledge from offshore:

> *I think food from the ocean is key going forward because the world needs more food, and we have enormous offshore resources that can be exploited in a sustainable way. I think we will see more technology from equipment suppliers like us being used for offshore wind power and offshore farms. Harvesting energy and food from the sea and more sustainability for shipping are probably the big drivers we see ahead. I also think wind and food are the right way to go for shipyards. There is also a lot of knowledge transfer from offshore-to-offshore wind power, which is valuable* (**Kongsberg Maritime**).

Ulstein Group believes in a rising market after the pandemic, with a need and demand for boats and the development of the marine economy. Like Kongsberg Maritime, the Ulstein Group believes the demand for renewable energy, food, and aquaculture will rise. They also think new solutions for tourism will be needed when we see some normalisation. ÅKP believes the need for environmentally friendly cruise ships will come eventually, and Skipsteknisk states that the cruise industry is something the cluster should have faith in after the pandemic:

> *To adjust to this pandemic, I believe the cluster should not slow down on cruises and that type of industry. It has had a complete stop during the pandemic, but it will pass. Tourism is something that will return if we just wait a bit* (**Skipsteknisk**).

The cluster might also have to change its employment structure to tackle the issue of high dependency on foreign workers. After experiencing lockdowns and travel restrictions during the pandemic, the cluster organisation ÅKP believes that the cluster should have a larger number of Norwegian employees:

> *This will be the "century of the pandemic", so therefore you should try to be as robust as possible. I think one should have a larger share of Norwegian workers instead of constantly topping the capacity by hiring foreign labour.* (**ÅKP**).

COVID-19s impact and effect on future challenges

Looking at the impact COVID-19 has had on the cluster, the way they approach the future challenges identified earlier in the paper may have changed. The main challenges found earlier were; adapting to the green shift, attracting and developing talented workers, and maintaining a complete cluster, maritime environment, and culture in the area. Looking at the interviews, it seems as if the main impact of COVID-19 on the cluster has been a temporary halt in order intakes, delaying plans and development. Thus, it has disrupted the cluster's process of adjusting towards the green shift. Additionally, furloughs and layoffs may have hampered the process of attracting and developing more competence.

However, as ÅKP said, although the pandemic may have caused delays and stops in operations, it seems to have reinforced some things that needed to happen and positively affected the cluster. The cluster has become aware of the vulnerability of being too specialised in certain areas and have started exploring new areas such as restructuring towards greener markets. One could therefore argue that the pandemic has persuaded the cluster to tackle their main challenges more proactively. It has also increased awareness of the high dependency on foreign workers. Thus, the pandemic could have enforced the processes of attracting and developing more Norwegian talent to reduce this reliance. Further, as the

pandemic has not led to any significant bankruptcies or shutdowns, the cluster has managed to maintain its complete cluster, maritime environment and culture.

7.2.2 Challenging conditions and threats

Apart from the COVID-19, other challenging conditions and threats which can disrupt the cluster's ability to face future challenges have been identified. By analysing responses from interviewees, three main factors which could inhibit the cluster from successfully tackling the cluster's future challenges were found.

Unrealistic expectations

According to respondents, one of the main challenges in terms of adjusting towards the green shift is unrealistically high expectations from the Norwegian Government. As mentioned by ÅKP, organisations such as IMO set specific environmental goals, but the government demands these achievements within a much shorter time frame. This creates challenging conditions for the cluster, as they must rush to achieve the goals, and the economy will struggle to keep up if the pace of the shift is too high:

> *The green shift is an opportunity, but the problem is if the pace is so high that the economy does not keep up. Politicians are rushing forward but not willing to see that there is a huge bill. Restructuring takes time and is very expensive, and no one wants to take the bill* (**ÅKP**).

There is also the customer's expectations of environmentally friendly solutions that the cluster must meet. According to Skipsteknisk, this could, in turn, have economic consequences for the cluster:

> *Many believe that the green shift can happen on a large scale in a short time. The oil business is bad, and it will not last forever. Like a private person refusing to buy a diesel car today, a shipowner will refuse to order a boat that has diesel engines in the future. If the shipowner has to drift at sea for months, then that is the only solution. Such things can lead to a reduction in investments.* (**Skipsteknisk**).

Uneven playing field

As mentioned earlier, regulatory bodies such as IMO and the Norwegian Government must create equal competitive conditions. At the moment, other

countries bend the rules, while the Norwegian Government follows them strictly. This uneven playing field hampers the pace at which the cluster can evolve, as competitors from other countries outprice Norwegian companies. According to Green Yard Kleven, foreign companies continuously win bids for support funds by the government due to this:

> *Innovation Norway gives a lot of support money to companies to build ships and develop its technology. If they are giving 50-100 million NOK support to build a ship on Norwegian tax money, then they should at least be built in Norway instead of Turkey, Spain or other countries. There should be a set of rules here so that we develop and keep competence here and not abroad* (**Green Yard Kleven**).

Oil dependency

Respondents see the end of oil dependency as one of the biggest threats. According to the cluster expert, the high oil dependency in recent years is critical because the oil economy is about to fail. When talking about the cluster's greatest threats, Green Yard Kleven mentions the importance of realising that the oil period is over. They argue that the prices companies could get on ships 5-10 years ago will not happen again. Ulstein Group agrees that the end of the oil period is a great threat to the cluster, especially with the lack of competence in the cluster. However, they do argue that the oil sector will continue to be important in the near future. When asking, "What are the cluster's biggest threats"? they replied:

> *The oil price is, of course, an important parameter, especially in the oil and gas sector, which will continue to be important for Norway in the years to come but will decrease in importance. Today, losing the skills needed to develop solutions to the future low carbon community and the maritime area is perhaps the most critical for the cluster* (**Ulstein Group**).

7.2.3 Main differences

There were some minor differences from respondents on how COVID-19 has affected the cluster. While respondents mostly believed that the cluster was robust for unexpected shocks like COVID-19, some respondents, like the cluster expert, believe the cluster is more robust for temporary shocks yet more vulnerable to big shocks that significantly impact the markets. Other respondents, such as

Skipsteknisk, believes the cluster is more vulnerable to short term shocks than long term shocks. Meanwhile, ÅKP stated that the cluster is incredibly strong because it is so specialised, but that was also what made it vulnerable.

Differences were also found in terms of how COVID-19 has affected the companies in the cluster. While some companies in the yards, like Green Yard Kleven and Ulstein Group, mentioned that they experienced significant effects from the pandemic, other companies, like the equipment producers and ship designers of Kongsberg Maritime and Skipsteknisk, said that they were not affected much. Further, Kongsberg Maritime and Ulstein Group opted for the strategy of lowering costs to adapt to the pandemic, while others such as Skipsteknisk and Ulstein Group started investigating different markets.

7.2.4 Conclusion of cross-case analysis

From the in-depth interviews, we have identified how COVID-19 has affected the cluster, how they adapted to the pandemic, and what impact the pandemic had in meeting their future challenges. We further identified other obstacles for the cluster when facing these challenges.

First, the cluster's robustness and vulnerability to external shocks like COVID-19 were identified, with respondents believing the cluster is somewhat vulnerable, with disagreements regarding what types of external shocks the cluster is most vulnerable/robust to. In terms of the pandemic's effect on the cluster, the interview analysis shows that the cluster overall was not heavily affected by COVID-19 in the long term but caused some short-term delays and disruptions. The big shipyards took the greatest hits, but smaller shipyards and the equipment- and design companies mostly kept up performances. Further, the pandemic had a more significant effect on companies like Ulstein, who had just finalised a long restructuring process. When adapting to the pandemic, different cluster members opted for different types of strategies. While some tried to lower costs to save the bottom line, others started exploring diversification through various markets.

COVID-19's impact and effect on the future challenges have mainly been a temporary disruption of the cluster's restructuring process of adjusting towards the green shift as well as hampering the attraction and development of

competence due to furloughs and layoffs. However, the pandemic has raised greater awareness on the importance of restructuring towards the green shift. Thus, it can be argued that the pandemic has had some positive impact on the cluster as it might have enforced the inevitable transformation, which might lead firms to accelerate the transition to more sustainable markets and vessels. Also, the cluster has become more aware of the high dependency on foreign workers and the need to attract and develop domestic talents due to the shortage of qualified labour during the pandemic.

Other obstacles for the cluster when facing the main future challenges were also identified, namely unrealistic expectations from the Norwegian Government in terms of how quickly the cluster can restructure itself towards the green shift, unequal competitive conditions for local owners against foreign owners, as well as the high oil dependency. Yet, as the restructuring process towards the green shift is seen as one of the main future challenges, the cluster members hope to transform sooner to decrease their oil dependency.

In conclusion, the respondents believed that the pandemic's effect was not so dramatic in the long term as the economic ripple effects have not yet caused any significant bankruptcies in the cluster. However, it caused some short-term delays and slowing markets, in which the big yards got hit hardest. Most companies adapted to the pandemic by either lowering their costs or exploring other new markets. COVID-19's has further caused a temporary disruption in facing future challenges regarding the restructuring process as well as a loss in competence, i.e., making it more difficult to attract and develop competence due to furloughs and layoffs. Yet, the pandemic has created some positive effects by enlightening cluster members about the urgent need for change.

8.0 Main findings

In the following section, the authors will draw conclusions based on the analyses conducted throughout this study. The authors will first present the main findings from the Emerald model (part 1) on the cluster's attractiveness and competitiveness. Then, the main findings from the in-depth interviews (part 2) will be highlighted as well as answering the research question. In the end, the authors will present some limitations of the study and areas for future research.

8.1 Conclusion

The purpose of this study was to understand how COVID-19 has affected the performance of the maritime cluster in Møre, its competitive position, and future challenges by talking to several cluster members and using publicly available sources. Thus, the study aimed to examine several aspects of the cluster's environment by determining its attractiveness and competitiveness from the Emerald model before discussing our main findings from the cluster members.

Throughout the analysis, it has become evident that Møre has an attractive and competitive maritime cluster. Part 1 showed that the cluster had a strong Emerald that revealed high attractiveness in the pillars of *Cluster-*, *Ownership-*, *Dynamics-*, *Environmental-*, *R&D and Innovation Attractiveness*, and slightly lower on *Talent-* and *Educational Attractiveness*. Overall, the cluster has a complete value chain that spans the entire life cycle of shipbuilding, with companies from all value configurations holding both horizontally- and vertically structures, facilitated by a cluster organisation. The cluster is concentrated in a small geographic area, allowing synergies, labour mobility, knowledge sharing and proximity to suppliers and domestic customers, being surrounded by deep fjords, making it possible for large vessels to be built and docked. It is also very internationalised, operating in the global market, with many FDI and private funding opportunities for R&D and innovation projects, as well as favourable tax conditions, subsidies, and other financial services. Where firms collaborate, compete, and work tightly with institutions, promoting innovation and efficiency.

Despite being an attractive and competitive cluster in the maritime industry, there are some weaknesses. First of all, the cluster is still dependent on high oil prices,

which creates periods with low and high activity and cyclical demand for resources. Further, the employment in the maritime industry is very male-dominated and cyclical since it is so dependent on oil price fluctuations, exchange rates, the freight market, trade agreements, and the world economy, preventing talents from choosing maritime education and settlements in the region. We also identified a lack of English taught study programs, which creates a barrier for international students to choose Møre as their location.

Further, one limitation of the Emerald model was the theoretical framework's lack of intention to analyse unexpected shocks. Thus, the authors included the element and model of a cluster's life cycle in *Cluster Dynamics* that could explain or show the phases the Møre cluster went through during crises. It underlined the cluster's ability to adapt to unexpected shocks by restructuring itself and diversify towards new markets, which we see as a strength and hallmark of the cluster.

Regarding COVID-19 and its effect on cluster performance and competitiveness, we find that the pandemic's ripple effects have disrupted the turnover, profitability, and growth expectations due to slowing markets and temporary higher costs, where the yards were hit hardest from their transformation from offshore to exploration cruise market. The pandemic has resulted in 900 employees being laid off or fired in the cluster, as well as restricting international students to study in Møre. Nevertheless, we think that the cluster's current competitive position is temporarily weakened from the pandemic due to lower demand and fall in income, which creates an uncertain period with higher costs, less profits, and risk of potential bankruptcies.

Nevertheless, it seems that the pandemic has been a wake-up call for a sustainable future. This has affected the cluster's competitive position in a positive way since more customers, firms, institutions, and people demand more environmentally friendly energy solutions, which might accelerate the shift from the fossil fuels market to more sustainable markets like solar, hydro and wind farms, as well as hybrid and fully electric ships. As the Norwegian maritime industry leads climate and environmental technology development, it could create an opportunity for the cluster to excel and be a leading pioneer in transitioning to a greener economy. If the cluster succeeds, it could obtain a competitive advantage for decades.

Further, we identified two main future challenges from the Emerald model. The first challenge is the potential reduction in qualified labour that choose to stay and work in the cluster – two out of three students taking higher education in other regions do not return to Møre due to finding vacancies in other more prominent cities. Additionally, there is a risk of a reduced supply of maritime competence as more people are getting older, together with the historically low birth rate. The second main future challenge is the risk and costly restructuring process related to adapting to new environmental regulations and international framework conditions. E.g., the government's proposal of introducing a carbon tax increase by 5% each year to meet their goal of halving shipping emissions by 2030. This will push companies to look at greener markets and alternative energy sources in ships, which requires heavy investments in R&D and innovation, production efficiency, developing the home market, as well as stimulating more exports and competing with other global maritime hubs. Yet, several maritime export companies struggle with high costs and prices when competing with foreigners due to high wages, prices on inputs, and low productivity.

The main findings from part 2 and the in-depth interviews revealed that the main future challenges for the cluster are adjusting towards the green shift and attracting and developing Norwegian talents, as respondents believe the country lacks competence while the need for it will only increase. Also, maintaining a complete cluster, maritime environment, and culture is crucial for the future competitiveness of the cluster. To tackle these challenges successfully, certain conditions which must be in place were identified. The government must support the cluster by improving educational institutions to increase the availability of competence and offer financial support when needed. Also, regulating bodies in the maritime industry such as IMO and the Norwegian Government must ensure equal competitive conditions.

COVID-19 was found to have temporarily disrupted the cluster's development and restructuring process. With the green shift being both time-consuming and expensive, restructuring has been somewhat delayed. A sudden stop in order intakes has caused some economic issues, especially in equity for bigger shipyards. Further, lockdowns, furloughs, and layoffs have threatened the cluster's ability to adjust towards the green shift due to the loss of competence needed to

handle the restructuring successfully. The interviews revealed that the cluster was not heavily affected overall by the pandemic in the long run but caused some temporary delays. On the other hand, the pandemic has motivated the cluster to pursue a more urgent restructuring process towards the green shift. As ÅKP mentioned, the pandemic may have reinforced some restructuring that was needed. Another positive effect of COVID-19 is that it has raised more awareness regarding the high dependency on foreign workers. The cluster has gained a more significant realisation of the need to attract and develop more Norwegian talents. Although the pandemic may have raised awareness regarding this need, it has yet to show an effect on attracting talents.

Other challenging conditions and threats identified from part 2 were unrealistic expectations regarding how quickly the cluster can restructure towards the green shift. The Norwegian government has set environmental goals with too short deadlines. Also, the high expectations from the market for environmentally friendly solutions is a threat to the cluster as it could lead to reduced investments. Further, the uneven competitive conditions have led to the cluster losing bids for Norwegian funds to foreign competitors. Lastly, the high dependency on oil was seen as one of the major threats to the cluster. However, with the green shift being one of the main future challenges, the cluster hopes to restructure as soon as possible to decrease the oil dependency further.

To answer the research question from parts 1 and 2: *What are the main future challenges for the maritime cluster in Møre, and what impact has COVID-19 had in meeting these challenges?*

The authors found that the main future challenges for the maritime cluster in Møre are the restructuring process towards the green shift, i.e., the transformation to more sustainable markets and vessels, which involves substantial risk and costs. Attracting and developing Norwegian talents, the potential reduction of qualified labour, and maintaining a complete cluster, maritime environment, and culture is also seen as main future challenges. COVID-19 has impacted the cluster primarily by temporarily disrupting the restructuring process with lower shipping orders and slowing markets. At the same time, the furloughs and layoffs may have restricted the process of developing competence. Still, the pandemic has had a positive

effect on the cluster as it raises more awareness of the need to restructure towards the green shift and acquire Norwegian talents.

8.2 Limitations

In this case study, the authors aimed to interview as many cluster members and stakeholders as possible to maintain a high level of reliability and gather data from multiple sources to create some sort of triangulation and increase the study's validity. Yet, some limitations need to be clarified and addressed.

The thesis's limitations are the generalisability and replicability related to primary data collection. Thus, the generalisability of the findings to the wider population can be questioned regarding the number of representatives interviewed. The primary data collection consisted of eight respondents from seven interviews, but the sample only consisted of four cluster companies. Even though the companies represented the entire value chain, the authors felt that an interview with a pure shipping company would strengthen the study as well as providing more insights on how the cluster and shipping companies were affected by COVID-19. Thus, the challenge of this research was related to the access to adequate interview candidates, and one might have obtained different data and results if more interviews were conducted. The authors also acknowledge that a different researcher with other participants on a different occasion may uncover different results, which question the study's replicability.

There are further weaknesses in the methodology regarding non-probability samplings, such as no control for investigator bias when selecting the sample (Straits & Singleton, 2017). Yet, for practical reasons, flexibility, and the aim to interview targeted samples from the population, the authors find non-probability sampling an appropriate technique. Moreover, the role of an interviewer is important when assessing the reliability and quality of the obtained data. Thus, the authors' behaviour and interaction could have influenced the respondent's answers. However, under the interview process, the authors tried to behave neutral and appropriate to avoid biases. Also, the interview candidates may have been subject to bias themselves, as they might not disclose information that can damage the reputation or negatively impact their organisation.

Lastly, the theoretical framework analysis is subject to the authors' subjective opinions, such as the grading scale or score system from the Emerald model on the attractiveness pillars or dimensions. However, the authors believe that the value is found in the analysis that led to the score, not the score itself. Further, the main future challenges presented in part 1 from publicly available sources are also subject to the authors own subjective opinions and somewhat prone to bias.

8.3 Future research

Based on the findings, the authors will highlight some suggestions for further research. Since the pandemic only occurred over a year ago, limited data and information available prevent the authors from seeing if COVID-19 causes a long term downturn or just a temporary situation in the maritime industry. Thus, it would be interesting to do a similar study in the future, some years the pandemic, to understand its long-term effect on the cluster, e.g., the value creation, building activity, employment, or competitiveness. Moreover, a follow-up study near the year 2030, when the government's ambition of halving emissions has occurred, would be interesting to see how the cluster has restructured itself from the offshore market and petroleum fuelled vessels to greener solutions.

Furthermore, this study only focused on the maritime cluster in Møre. Thus, it could be challenging to obtain generalised findings as the authors cannot compare the findings with other leading maritime clusters. Therefore, the authors suggest conducting a similar study with in-depth interviews of other maritime clusters with Global Centre of Expertise statuses such as GCE Node or GCE Ocean Technology or other foreign maritime clusters to identify differences and patterns in the responses. Another interesting point for future research is to see how other global maritime hubs within shipbuilding have been affected by COVID-19 and how they adjusted to the pandemic.

In the end, it could be of interest to conduct a quantitative study with questionnaires and surveys on all the cluster companies in the value chain of the Møre cluster to generalise the findings for the population as a whole. Or by combining qualitative and quantitative data in a complementary way to achieve triangulation, to strengthen the study's validity.

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17!8!2016!8!2015!8!2014!8!2013!8!2012!8!2011!8!2010!9!dep_id%3D1!9!sem
ester%3D3!9!nivakode%3DB3!8!B4!8!HK!8!YU!8!AR!8!LN!8!M2!8!ME!8!M
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10.0 Appendix

Exhibit 1. The Emerald Model
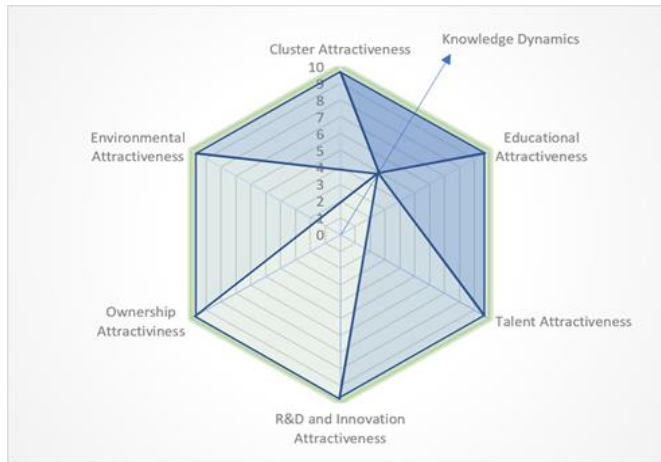
Source: Inspired by the model adopted from Reve & Sasson (2012)

Exhibit 2. Interview guides

Adjusted interview guide for GCE Blue Maritime (45-60min.)

I Introduction
- ❖ Introduce ourselves
- ❖ Present the study – the purpose and aim of the research
- ❖ Inform about confidentiality and provide a consent form
- ❖ Ask for permission to record the interview
- ❖ Ask the participant to tell us a bit about themselves and the organisation/company
    - a) Ask about their occupation
    - b) Role within the organisation/company
    - c) A description of the organisation/company

II Questions
1) What makes it so attractive to be located in Møre versus other places?
    - a) What factors makes companies choose to be located right here?
    - b) Why is it important for companies to be a part of a cluster?
    - c) What are the benefits of being part of the cluster?

2) How has COVID-19 affected the value creation in GCE Blue Maritime?
    - a) How have the cluster members adapted to the pandemic?
    - b) In comparison, do you think the cluster has adapted differently from previous crisis?

3) How vulnerable/robust is the cluster to external shocks such as COVID-19?
    - a) What are the cluster's biggest threats?
    - b) How do you think the cluster should adjust to this pandemic/threat/the green shift?
    - c) Are there any national or international conditions that are challenging for the cluster?

4) What are the most important conditions for the cluster to be competitive in the future?
    - a) What should the cluster do next to develop itself?
    - b) Do you think the cluster-core will grow beyond Møre by 2030?
    - c) Is there anything Norway/State/Municipality can do to strengthen the development and attractiveness of the cluster?

II Extra questions if enough time
5) What is the level of trust between the companies in the cluster?
    - a) Are there any high/low transaction costs due to extensive contract negotiations and monitoring between collaborating companies?
    - b) Will breaking trust have a big effect on the reputation of a company in the cluster?

6) Are there any intermediaries between the companies in the cluster to connect companies that initially would not cooperate?
    - a) E.g., universities, research institutions and business associations

7) Which companies in the cluster are the most industry-leading?
    - a) E.g., through investments in internationalization, innovation, training, or education

8) Do you have solutions for situations where companies that would benefit from cooperating do not do so due to conflicting interests?
    - a) E.g., of conflicting interest could be Oil & Gas supporters against renewable energy supporters.
    - b) Are there any collaboration agreements in the cluster, associations, or other initiatives to improve the community and promote collaboration?

III Ending
- ❖ Is there anything you would like to add?
- ❖ Are there any cluster members you know that we could contact, that would contribute to this research?
- ❖ Thank the participants for their time and contribution

    Note: 1-4: Main questions, 5-8: Extra question, a-c: Support questions

Adjusted interview guide for cluster expert (45-60min.)

I Introduction
- ❖ Introduce ourselves
- ❖ Present the study – the purpose and aim of the research
- ❖ Inform about confidentiality and provide a consent form
- ❖ Ask for permission to record the interview
- ❖ Ask the participant to tell us a bit about themselves and the organisation/company
    - a) Ask about their occupation
    - b) Role within the organisation/company
    - c) A description of the organisation/company

II Questions
1) What makes it so attractive to be located in Møre versus other places?
    - a) What factors makes companies choose to be located right here?
    - b) Why is it important for companies to be a part of a cluster?
    - c) What are the benefits of being part of the cluster?

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    - a) How have the cluster members adapted to the pandemic?
    - b) In comparison, do you think the cluster has adapted differently from previous crisis?

3) How vulnerable/robust is the cluster to external shocks such as COVID-19?
    - a) What are the cluster's biggest threats?
    - b) How do you think the cluster should adjust to this pandemic/threat/the green shift?
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4) What are the most important conditions for the cluster to be competitive in the future?
    - a) What should the cluster do next to develop itself?
    - b) Do you think the cluster-core will grow beyond Møre by 2030?
    - c) Is there anything Norway/State/Municipality can do to strengthen the development and attractiveness of the cluster?

III Ending
- ❖ Is there anything you would like to add?
- ❖ Are there any cluster members you know that we could contact, that would contribute to this research?
- ❖ Thank the participants for their time and contribution

Note: 1-4: Main questions, a-c: Support questions

Source: Derived from theory and own reflection

GRA 19703

Exhibit 3. A selection of some of the biggest cluster members by revenue

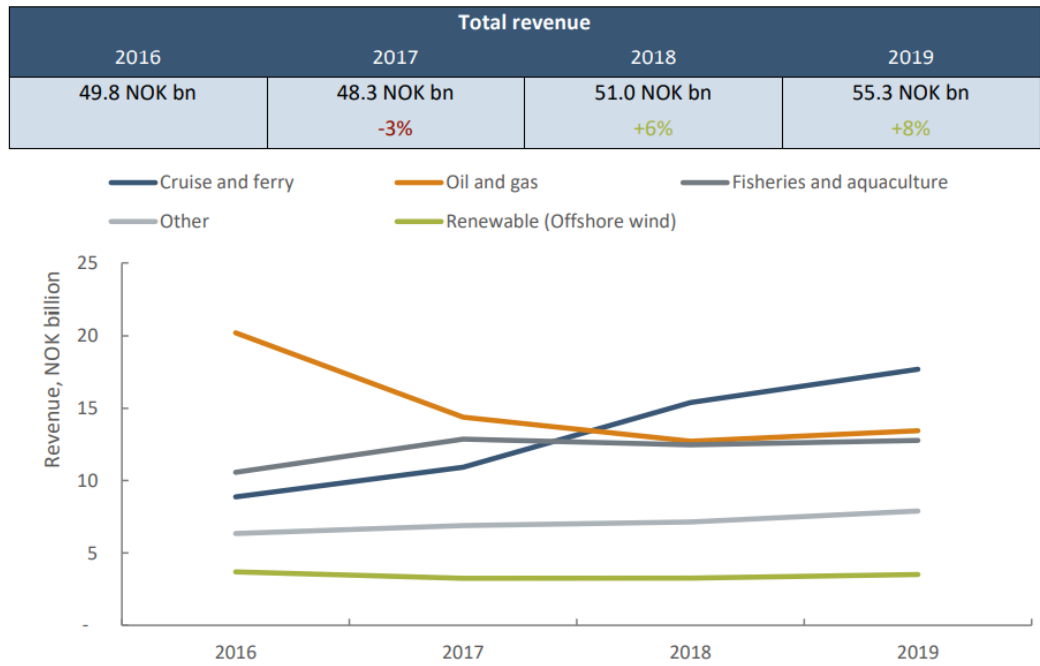| Firm	Activities	Revenues (in 1000 NOK)	Operating profit (in 1000 NOK	Employees	Year	Location
Vard Group AS	Shipbuilding/ Shipyard and shipdesign	7 938 430	-1 568 429	792	2019	Ålseund
Kongsberg Maritime AS avd Ålesund	Equipment, shipdesign and other services	6 293 803	-3 530	259	2019	Ålesund
Havila Holding AS	Shipping, fishing, and shipbuilding	4 137 015	460 838	430	2019	Fosnavåg
Ulstein Verft AS	Shipyard, shipdesign and equipment	2 199 201	-161 291	295	2019	Ulsteinvik
Kleven Prosjekt 401 AS	Shipbuilding and Shipyards	2 002 376	-337 737	0	2018	Ulsteinvik
Aas Mek Verksted AS	Shipyard, shipdesign and service	921 393	42 183	64	2019	Vestnes
Larsnes Mek Verksted AS	Shipyards within the fishing fleet	512 495	2 993	65	2019	Larsnes
Fiskerstrand Verft AS	Shipyards, repair and maintenance	428 032	22 257	139	2019	Fiskarstrand
Skipsteknisk AS	Shipdesigner on specialized vessels	133 002	19 936	51	2019	Ålesund

Source: Derived from proff.no (n.d.)

Exhibit 4. County distribution of value creation and employment in the Maritime industry in 2018 (do not include banking and financial services, or services related to extraction of crude oil and natural gas)

	Value creation	Employment
Viken og Innlandet	7 433 000	6 900
Oslo	14 111 000	7 400
Vestfold og Telemark	3 837 000	4 300
Agder	3 890 000	4 100
Rogaland	12 534 000	10 400
Vestland	18 481 000	17 500
Møre og Romsdal	8 508 000	12 700
Trøndelag	3 078 000	3 300
Nordland og Troms og Finnmark	3 542 000	6 100

Source: Regjeringen (2021)

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Exhibit 5. Market segmented revenue in the Møre cluster from 2016-2019

Total revenue			
2016	2017	2018	2019
49.8 NOK bn	48.3 NOK bn	51.0 NOK bn	55.3 NOK bn
	-3%	+6%	+8%

Source: Jakobsen, Helseth & Aamo (2020)

Exhibit 6. Reasons for weaker profitability in 2020
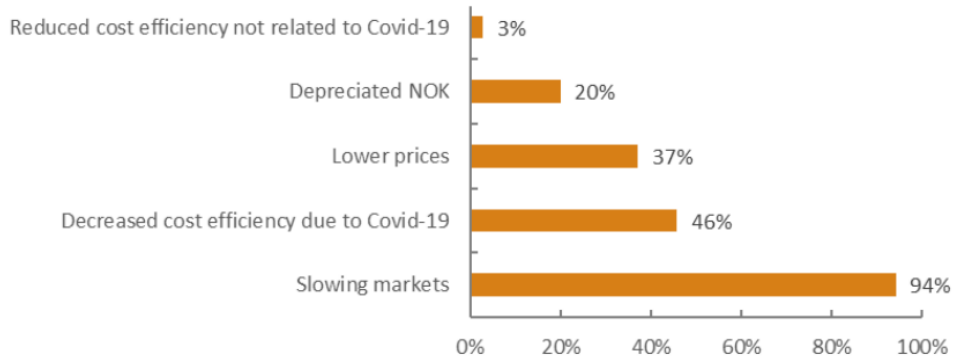
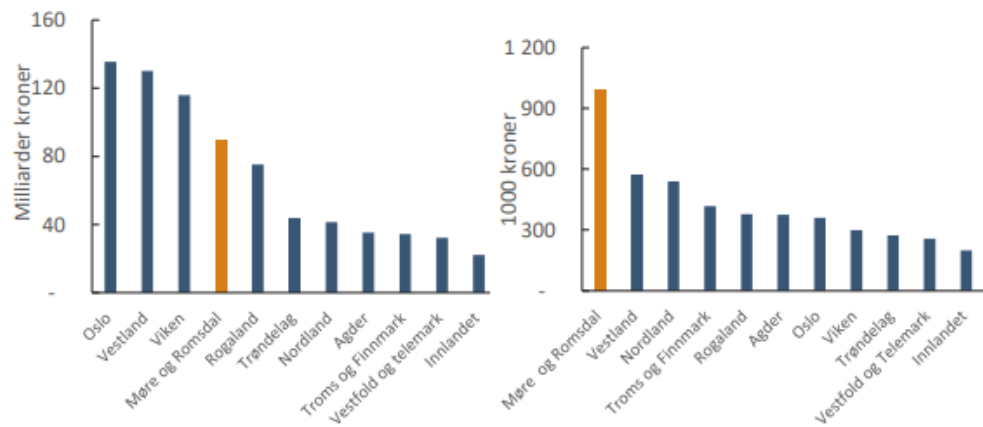**Source**: Jakobsen, Helseth & Aamo (2020)

Exhibit 7. Other explanatory reasons for weaker profitability in 2020

Source : Jakobsen, Helseth & Aamo (2020)

Exhibit 8. Left: Export divided by county. Right: Export per employee by county. Note: Oil & gas export is excluded.

Source: Fjose et al. (2020a)

Exhibit 9. Number of total graduates in Norway

Year:	2016	2017	2018	2019	2020
Graduates in the field					
Maritime	163	168	167	154	197
Engineering	2817	3130	2936	2747	2609

Source: Own spreadsheet derived from NSD (2021b)

Exhibit 10. Number of graduates NTNU (all campuses)

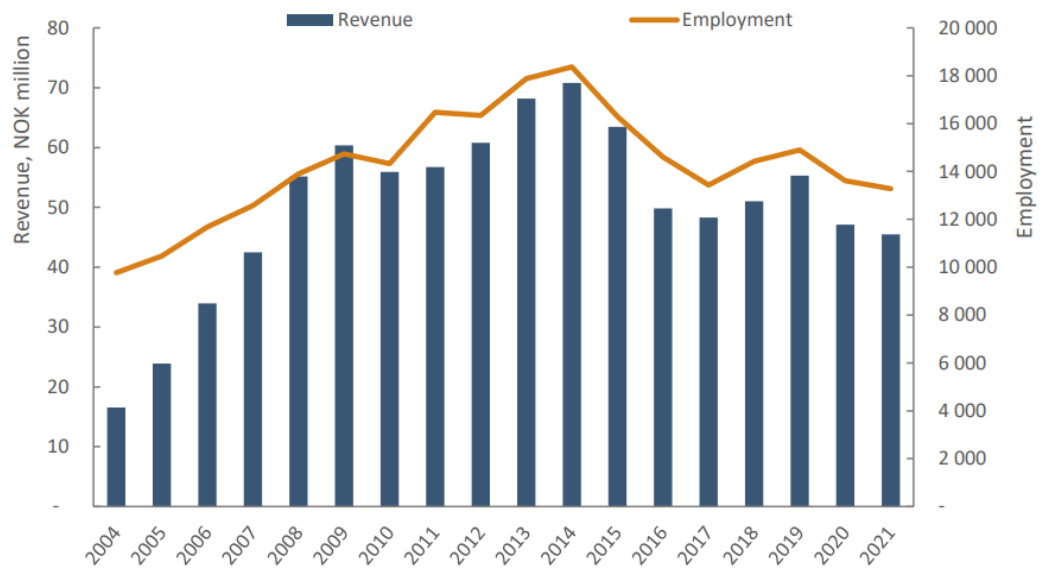| Year:	2016	2017	2018	2019	2020
Graduates in the field					
Maritime	75	70	75	50	80
Engineering	720	725	730	735	780

Source: Own spreadsheet derived from NSD (2021b)

Exhibit 11. International students at Høgskolen i Molde

Year:	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
International students	145	165	170	155	230	215	190	195	205	190	150

Source: Own spreadsheet derived from NSD (2021c)

Exhibit 12. Revenue and employment in the Møre cluster

Source: Jakobsen, Helseth & Aamo (2020)