MENON ECONOMICS

REPORT

GCE BLUE MARITIME: CLUSTER PERFORMANCE AND MARKET PROSPECTS 2021

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Introduction

GCE Blue Maritime is one of three Global Centers of Expertise in Norway – the highest level in the hierarchy of Norwegian Innovation Clusters. To become a GCE, a cluster must prove that it has established a systematic collaboration between the participating companies, a partnership characterized by dynamic relations with innovative power. The GCE-clusters must also have a strong potential for growth in national and international markets and together form a robust innovation system.

Menon Economis has for six consecutive years studied the competitiveness of the Blue Maritime cluster, measured by key economic performance, both in absolute terms and compared to the rest of the maritime industry in Norway and to international competitors. In this year's report, we place more emphasis on the market prospects of the cluster, as a function of expected growth in different market segments and the Blue Maritime cluster position in these markets.

The report is structured as follows: We first provide a short summary of main findings of the report. Then, in the chapter "Key performance", we take a closer look at the economic indicators of the cluster. We divide the maritime value chain into four parts: shipping companies, yards, equipment suppliers and maritime services (including ship design). A selection of the leading companies within the four areas is shown in the figure to the right to illustrate the width of activities in the cluster. The analysis in this chapter is based on accounting data from the companies, together with primary data gathered from the companies through a tailor-made questionnaire. We proceed with analyzing the market potential for the cluster in 6 key segments. These segments are offshore oil and gas and wind, cruise and expedition cruise, aquaculture, fisheries, ferries and fast ferries, and short sea cargo vessels.

The four segments in the cluster with company illustrations.

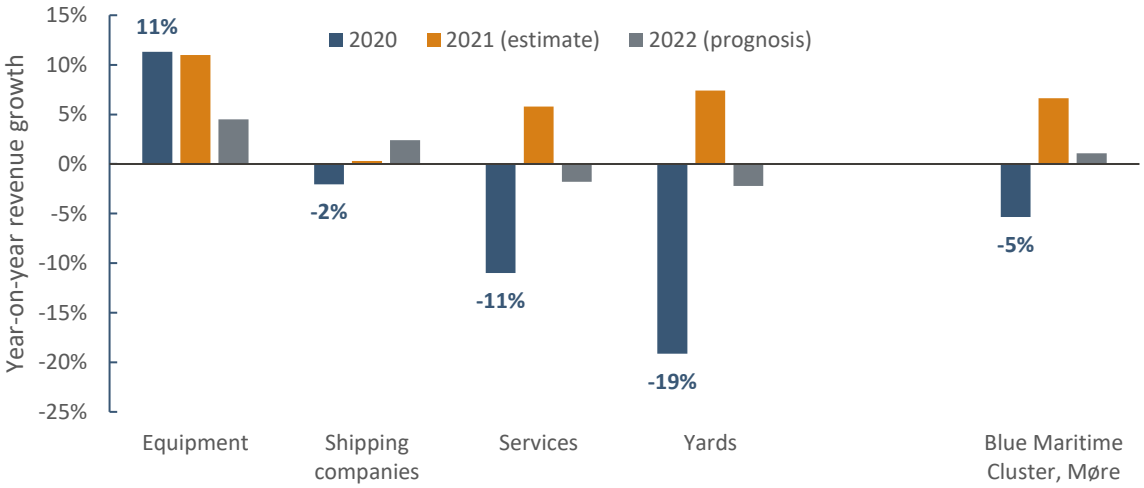
Summary

Equipment suppliers stand out with positive revenue growth in 2020 – slowing the activity drop in the Blue Maritime Cluster as a whole

As for most of the world economy, 2020 was a challenging year also for the maritime cluster in Møre. Overall revenue among maritime companies in the Møre region decreased by 5 percent, compared to 2019. However, not all parts of the maritime cluster experienced falling revenues in 2020. The equipment suppliers had a revenue increase of as much as 11 percent and thus surpassed the shipyards as the biggest segment (measured by revenue) in the cluster in 2020. Excluding the equipment suppliers, the overall year-on-year revenue decrease in the cluster would have been close to 12 percent in 2020 – a one-year drop not seen since the height of the offshore crisis in 2016.

Figure 1 – Overall revenue in the Blue Maritime Cluster 2017-2020. Below: Revenue growth rates by the four groups in the cluster, 2020-2022. Source: Menon Economics

Total revenue			
2017	2018	2019	2020
43.0 NOK bn	45.8 NOK bn +7%	51.9 NOK bn +13%	49.2 NOK bn -5%



From the data, we see that an equal amount of equipment suppliers experienced increased revenues as decreasing ones in 2020. Equipment suppliers' overall strong revenue growth is tied to the size of the companies. We see that the biggest equipment suppliers in the Møre region (by revenue) had far stronger growth than the median for the group as a whole (median growth in 2020 was -2.4 percent among this group).

As is clear from Figure 1, it was mainly the yards that experienced revenue loss in 2020. However, these same companies do expect revenue growth in 2021. Estimates for revenue growth in 2021 and the prognosis for 2022 are calculated based on replies to a survey recently conducted among cluster members. We find that cluster members expect business to improve in 2021 (though only slightly among shipping companies) and mixed expectations for 2022. Equipment suppliers stand out by expecting considerable revenue growth in both 2021 and 2022.

A clear improvement in the short-term outlook compared to last year

Like last year, we also this year conducted a survey among members of the Møre cluster, asking them about their view on the short-term business outlook. At the time of last year's survey, the world economy had been living with the Covid-19 pandemic for half a year, no vaccine had been verified and distributed yet, and the overall uncertainty in business as well as in daily life was enormous. Looking at last year's survey results, we see that 2020 turned out far better than expected in August 2020.

The same picture holds for 2021: Members in the Møre cluster are considerably less pessimistic with regards to the overall growth in 2021 this year compared to a year ago. The difference in estimates for total revenue in 2021 between the 12-month period of the two surveys amounts to almost 10 billion NOK. This is equivalent to almost 20 percent of the maritime cluster's overall income in 2020.

The maritime cluster is becoming more diversified

Income growth in the Møre cluster in both 2018 and 2019 was to a large extent driven by a surge in the cruise segment. The growing international demand within tourism for high standard and close-to-nature cruise experiences, combined with a small base of vessels to meet this growth in demand, are the critical explanations for the past years' growth within newbuilding of expedition cruise vessels. The Møre cluster's expertise within the equipment, services, and assembling needed to build such ships has resulted in the cluster now holding a considerable market share in the expedition cruise market.

As with expedition cruise, the fisheries and aquaculture segment has also increased steadily in importance over the past five years and is in 2020 the most significant segment for the maritime cluster in Møre (though only marginally bigger than cruise). By revenue, fisheries and aquaculture has grown from NOK 9 billion in 2016 to NOK 13 billion in 2020 – a growth of more than 40 percent. The strongest growth is found in the aquaculture value chain, in particular building and operation of wellboats.

Overall, we see a trend towards **greater diversity** among segments in the Blue Maritime Cluster. Where the oil and gas segment and the cruise and ferry segment have had strong (but opposing) growth trends in recent years, segments such as fisheries and aquaculture and freight/shipping have risen steadily. With an increase in activity within the renewables sector going forward, which is expected to grow rapidly in the next decade, we expect a further strengthening trend of diversification of segments.

Two years of growth in value added – but still only half of value added in 2014

Following the continuous activity drop from 2015, the overall value added among the maritime companies in the Møre cluster started improving in 2019. As we now have accounting data for 2020 available, we can note that total value added has increased by 30 percent since 2018 and has surpassed 2016-levels.

Since 2018, we have seen growth in both wage costs and EBITDA, but it is primarily EBITDA that has contributed to the recent surge in value added. It is mainly strong growth in EBITDA among equipment suppliers and improvements in the overall EBITDA among yards that are the drivers behind this trend. As EBITDA has more than doubled since 2018, this is an important explanation for the improvement in the indicator of value added as a share of revenue. It is important to emphasize, however, that the EBITDA growth comes from an extremely low level. While the EBITDA share of value added was higher than 40 percent every year before the offshore crisis in 2015, it is still below 25 percent in 2020.

Another driver behind this recent trend is the relative growth of equipment suppliers within the cluster. As equipment suppliers has a far higher share of value added than yards, the overall share of value added increases over time when equipment suppliers experience a higher revenue growth than yards.

Exports constitute more than 50 percent of revenues in the cluster

From 2018 to 2019, exports from the maritime cluster in Møre increased significantly more than total revenue. Hence, the cluster's export share increased from 47 to 54 percent. This change was followed by a decrease in the share of revenues coming from the local/regional market from 18 to 15 percent. During the pandemic, however, the change was reversed, and the export share is estimated to 53 percent in 2020 and 52 percent in 2021.

For the cluster as a whole, these changes are quite small, but they hide large changes within the cluster. The export share of shipping companies has fallen dramatically from 2018 to 2019 and 2020. This is mainly because the offshore shipping companies in the cluster have faced a decrease in activity, particularly in export markets, while aquaculture shipping companies have grown rapidly, and their market is primarily domestic. The shipyards, on the other hand, have gone in the opposite direction. While most of their customers were regional or domestic when they built offshore service vessels, they had to approach foreign customers when they entered the expedition cruise market. Hence, they export share of yards increased from 32 to 59 percent in 2020.

For the equipment producers and service companies in the cluster, we see only minor changes in the export share over the last years.

Market outlook towards 2030 – maintaining and improving competitiveness is key

Looking towards 2030, we expect growth in most of the market segments the Blue Maritime cluster currently is involved in. Global growth in a market segment is, however, not equivalent to growth for the Møre cluster. One example is the recent growth in international orders for offshore oil & gas supply vessels. The share of these orders given to Norwegian yards is small (approximately 5 percent), and we do not expect this to change in the coming decade.

Aquaculture, fisheries and ferries and fast ferries

We expect an increase in orders for newbuilds within aquaculture, fisheries, and ferries and fast ferries in the short term. In all these segments, Norwegian yards and suppliers have a strong foothold and are well positioned to maintain and potentially increase their market share. However, competition is growing in all these segments. We see this by the percentage of the global orderbooks in the coming years that have been given to Norwegian yards. This share is currently lower than the yards' respective share of newbuilds in these segments in recent years for all three of the market segments mentioned.

Expedition cruise

The expedition cruise segment has been an essential market for the Blue Maritime cluster in recent years, following the downturn within the offshore oil & gas market in the mid-2010s. The building of expedition cruise vessels took off in 2016, and orderbooks are still quite big within this segment. The global pandemic has had a significant negative impact on the expedition cruise market, and no such vessels have been ordered globally since the Covid-19 outbreak in March 2020. However, the pandemic is not necessarily the sole reason for the stop in new orders. Even before the pandemic, key players in the market noted that the expedition cruise market was

entering a situation of oversupply. We support this view and believe the expedition cruise segment will not give grounds for much growth for the Blue Maritime cluster up until the late 2020s.

Freight/short-sea cargo

Compared to other big shipping segments, what characterizes the global short-sea cargo fleet is its overall old age. This, combined with relatively short-distance operations, makes this segment well suited for implementing new and greener propulsion systems (contrary to deep-sea shipping). Especially in the second half of the current decade, we expect the newbuilding of short-sea vessels to increase rapidly. A key driver for this growth in newbuilding is the segment's suitability for alternative fuels, energy carriers, and propulsion systems. In a world where regulations and taxation of emissions from the maritime sector are coordinated among countries and jurisdictions to an increasing extent, shipowners will have an incentive to rebuild or renew their fleet.

It must be noted that it is unlikely that Norwegian yards will be able to compete over orders in the short-sea cargo segment. Norwegian yards specialize in high-technology and innovative vessel segments. Generally, cargo segments are too standardized for Norwegian yards to compete with yards in Asia for such contracts. However, Norwegian equipment suppliers, ship designers and equipment producers are well-positioned to take part in the expected growth in the short-sea cargo segment.

Offshore wind

As with the short-sea cargo segment, we expect orders for specialized offshore wind vessels to increase rapidly in the coming 10-year period. However, also here we expect newbuilding to be ramped up primarily in the second half of the decade. The reason for this is that there is an oversupply of such specialized vessels in the short term (specialized vessels used in installations of foundations and turbines). However, this is expected to turn into an undersupply by 2025, and demand in 2030 is expected to be four to five times greater than the current demand.

As these vessels are being built for the installation of foundations and turbines, which in turn produce green energy, it is to be expected that the emissions in the whole value chain for offshore wind will be in focus by the industry when ordering offshore wind vessel services. As Norwegian maritime yards, equipment suppliers, and operators always have been at the forefront of the development of alternative propulsion systems, we believe the Norwegian maritime cluster has an advantage in the upcoming growth within offshore wind services.

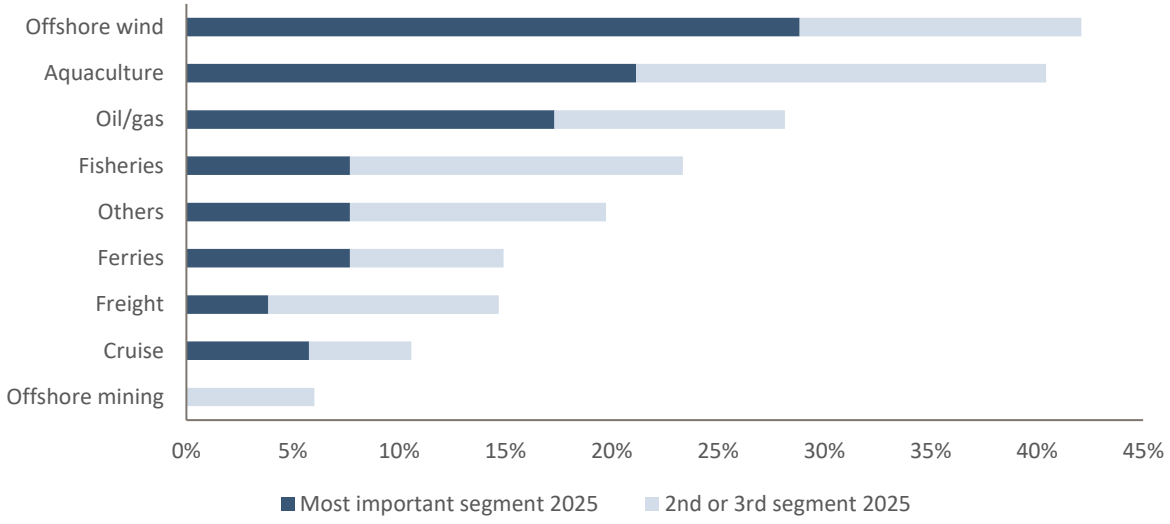
Cluster members expect offshore wind to become the most important market segment by 2025

Throughout the last decade, the maritime cluster in Møre has experienced huge changes in the relative importance of different market segments. For years, oil and gas was the by far most important segment, until this came to a halt in the mid-2010s. Expedition cruise then became a segment that many in the cluster looked to, but this market now seems to be cooling down.

When asked to rank market segments by their expected importance in 2025, we see that especially offshore wind stands out. Currently this is a negligible market segment for the cluster as a whole, but offshore wind is expected to see a strong growth globally in the next decade by most observers. We also see that markets that are important today, such as aquaculture and fisheries, are expected to remain important for cluster members in 2025. Oil and gas, a segment that long has been one of the cluster's most important market segments, is also expected to remain important. This is also the case with expedition cruise, but to a lesser extent. Only about five

percent of respondents expect cruise to be their most important market segment in 2025, while only an additional five percent ranks cruise as second or third in expected importance.

Figure 2 – Share of respondents ranking the expected importance of different market segments in 2025. Source: Menon Economics



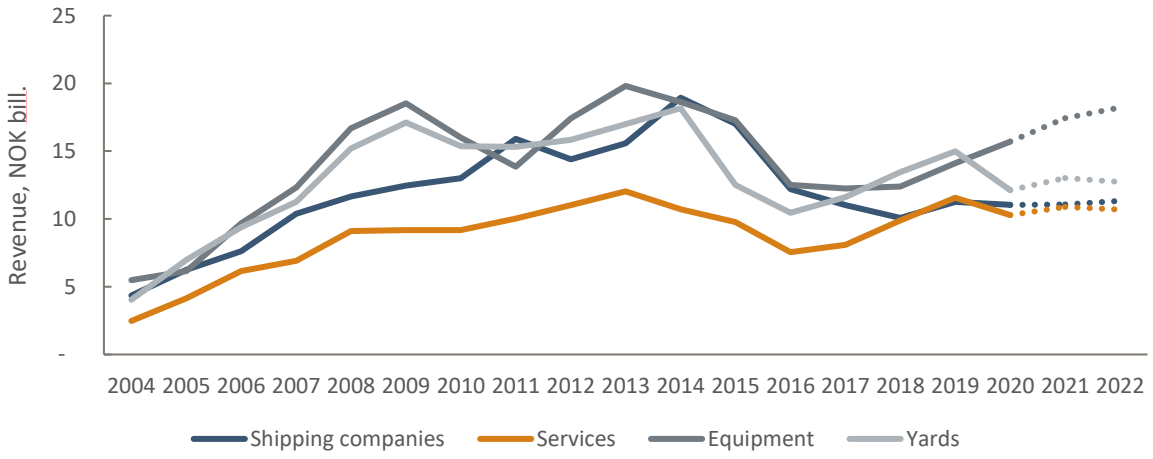
Economic performance in the cluster – key economic indicators

Drop in revenue in 2020, but positive short-term outlook

Overall revenue among maritime companies in the Møre region decreased by 5 percent in 2020, compared to 2019. Changes in activity from 2019 to 2020 were however not uniform between the different segments in the cluster. Most strikingly, the equipment suppliers experienced an *increase* in revenue of as much as 11 percent in the "Covid-19-year" of 2020 and by that surpassed the shipyards as the biggest segment (measured by revenue) in the cluster in 2020. Excluding the equipment suppliers, the overall year-on-year revenue decrease in the cluster would have been close to 12 percent in 2020 – a one-year drop not seen since the height of the offshore crisis in 2016.

Figure 3 – Revenue in the Blue Maritime cluster 2017-2020. Below: Revenue by the four groups in the cluster, 2004-2022. Source: Menon Economics

Total revenue			
2017	2018	2019	2020
43.0 NOK bn	45.8 NOK bn +7%	51.9 NOK bn +13%	49.2 NOK bn -5%

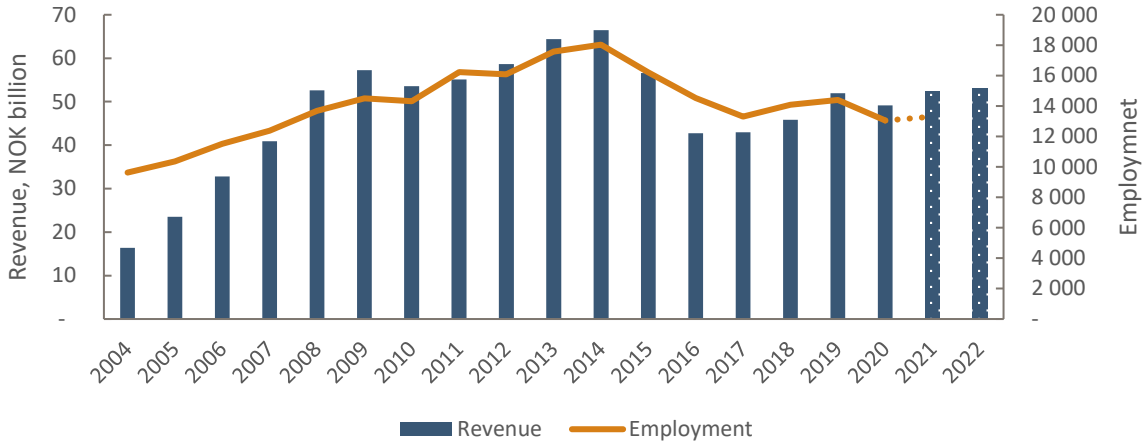


From the data, we see that about the same number of companies among equipment suppliers experienced increased revenues as decreasing ones in 2020. Equipment suppliers' overall strong revenue growth is hence tied to the size of the companies. We see that the biggest equipment suppliers in the Møre region (by revenue) had far stronger growth than the median for the group as a whole (median growth in 2020 was -2.4 percent among this group).

The yards were the group that contributed most negatively to growth in 2020, with a drop in revenue of as much as 19 percent, compared to 2019. Note however that this group on aggregate (like the other three groups) does expect positive revenue growth in 2020.[1]

[1] *Estimates for revenue growth in 2021 and prognosis for 2022 are calculated based on replies to a survey recently conducted among cluster members.*

Figure 4 – Aggregate revenue and employment in the Blue Maritime Cluster, 2004-2020. Estimates for 2021 and prognosis for 2022 (revenue). Source: Menon Economics

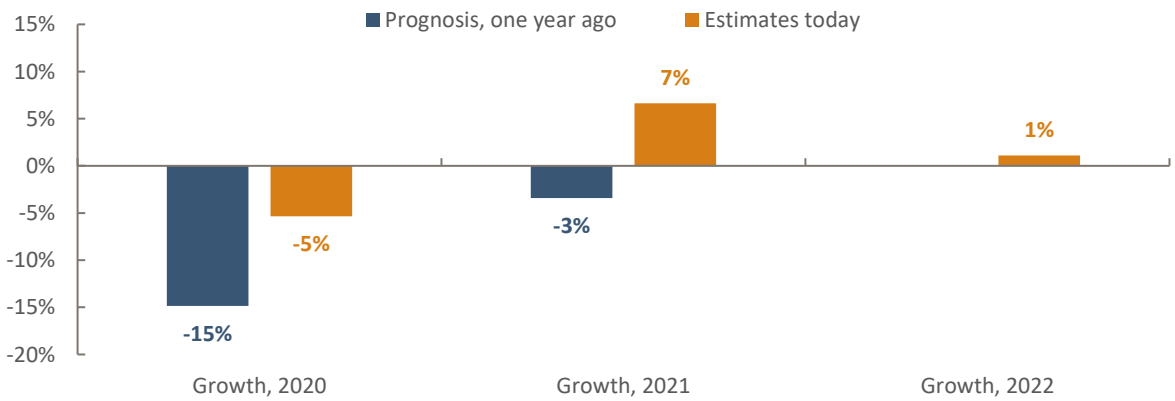


As is evident from Figure 4 we expect the cluster to deliver positive revenue growth in both 2021 and in 2022. Both estimates for 2021 and the prognosis for 2022 are based on a recently conducted survey among cluster members. As with growth in 2020, we find that it is equipment suppliers in particular that contribute to the positive growth outlook in the nearest future.

Significant improvement in the short-term outlook

Like this year, we also asked cluster members to report their short-term revenue expectations in last year's survey. Comparing this year's results with the equivalent results from last year we see a clear positive shift in expectations. Last year (August 2020), cluster members on the aggregate expected revenue in 2020 to drop by as much as 15 percent, compared to 2019. As is evident from the figure below, the actual revenue drop in 2020 ended up being just one third of this. Similarly, cluster members last year expected that the downturn would continue in 2021, with a drop in revenue (year-on-year) of 3 percent. 12 months later we see that cluster members are far more positive, and they are now expecting revenue growth in 2021.

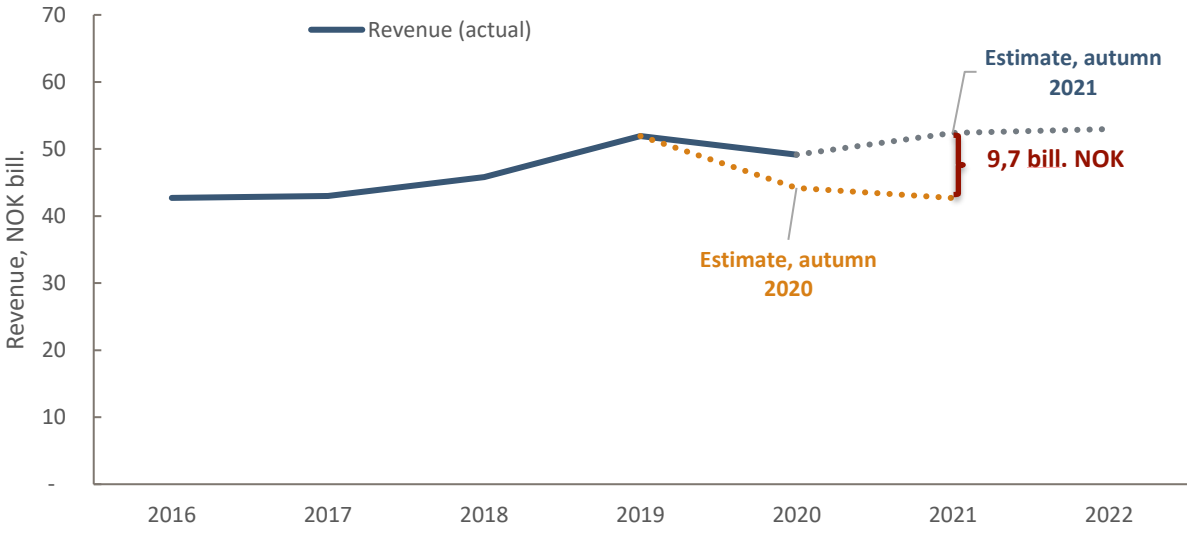
Figure 5 – Revenue growth rates, year-on-year, from August 2020 and August 2021. Source: Menon Economics



An alternative way to illustrate the positive upswing in expectations since last year is in terms of revenue *levels*. If we compound the expected growth rates from 2020 and 2021 and calculate the different growth paths in terms of total revenue, we see that the difference from one year ago is huge.

The difference in estimates for total revenue in 2021 between the 12-month period of the two surveys amounts to almost 10 billion NOK. This is equivalent to almost 20 percent of the maritime cluster's overall income in 2020.

Figure 6 – Revenue in the maritime cluster in Møre (2016-2020) and estimates for revenue growth in 2020 and 2021 collected in August 2020, and for 2021 and 2022 collected in August 2021. Source: Menon Economics

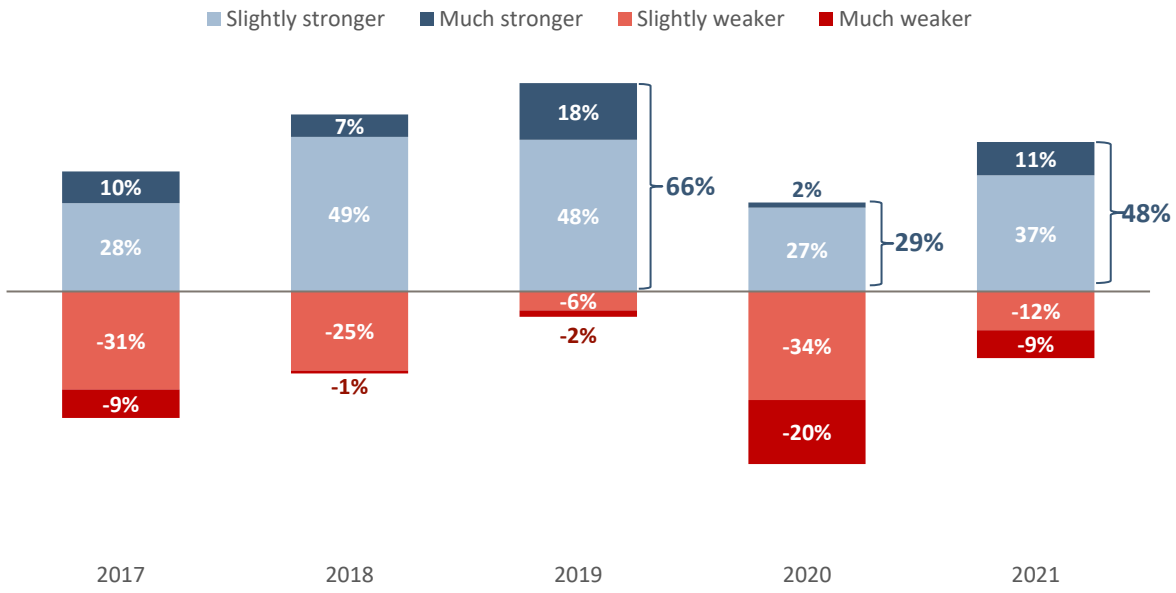


Increased profitability expectations, but not yet back to 2019-levels

The pandemic did not just affect expectations of revenue growth for members of the maritime cluster in Møre. Expectations regarding profitability were also drastically reduced at the height of uncertainty during the pandemic in August 2020. Last year more than 50 percent of cluster members expected profits to be slightly or much weaker compared to the previous year.

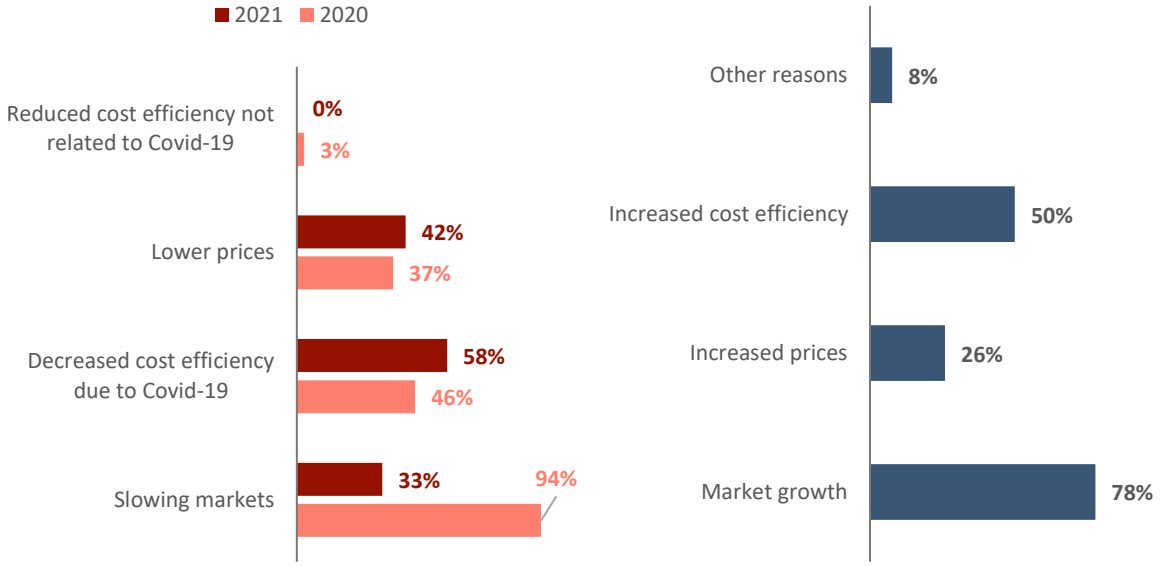
As is evident from Figure 7 the pandemic had a significant impact on profitability expectations among cluster members. The share of members expecting an improvement in operating profits dropped from 66 percent in 2019 to only 29 percent in 2020. As with revenue expectations, members have a considerably more positive view on profitability in this year's survey, compared to last year. Almost 50 percent of members expect operating profits to improve in 2021 and just 19 percent expect profits to fall. However, profitability expectations for 2021 are still notably less positive than the equivalent expectations in 2019.

Figure 7 – The cluster members' profitability expectations: "How do you expect operating profits to develop this year compared to last year?" Source: Menon Economics



What is then the main reason for these improvements in the short-term outlook? We see among members that expect a weaker profitability in 2021 (compared to 2020) that there is a significantly lower share that points to slowing markets, compared to last year's survey. This implies that demand in general has returned to (close to) normal levels far quicker than the companies believed one year ago – at the height of the pandemic. There is however an increase in the share of members pointing to decreased cost efficiency due to the pandemic as a reason for weakening profits. One source of this decreased cost efficiency may be high costs of input factors and difficulties with the access to foreign labor working on temporary contracts, due to the pandemic.

Figure 8 – Reported reasons for expected reduced (left side) and improved (right side) profitability in 2021, compared to 2020. Source: Menon Economics.

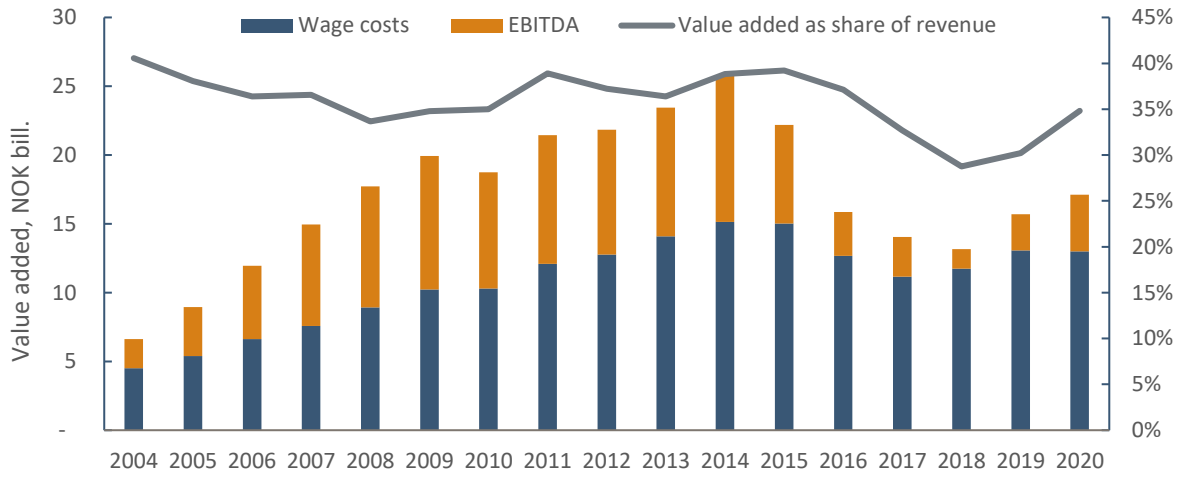


Among members that expect a strengthened profitability in 2021 (compared to 2020), we note that the main reason for this is market growth. Almost four out of five respondents report that this is a source of improved profitability. As only 26 percent mention increased prices, it seems that there is sufficient capacity in most segments to meet this increased demand without this putting a positive pressure on prices.

Two years of growth in value added – total increase of 30 percent from 2018

Following the continuous drop in activity from 2015, the overall value added among the maritime companies in the Møre cluster started improving in 2019. As we now have accounting data for 2020 available, we can note that total value added has increased by 30 percent since 2018 and has surpassed 2016-levels.

Figure 9 – Value added split by wage costs and EBITDA. Source: Menon Economics

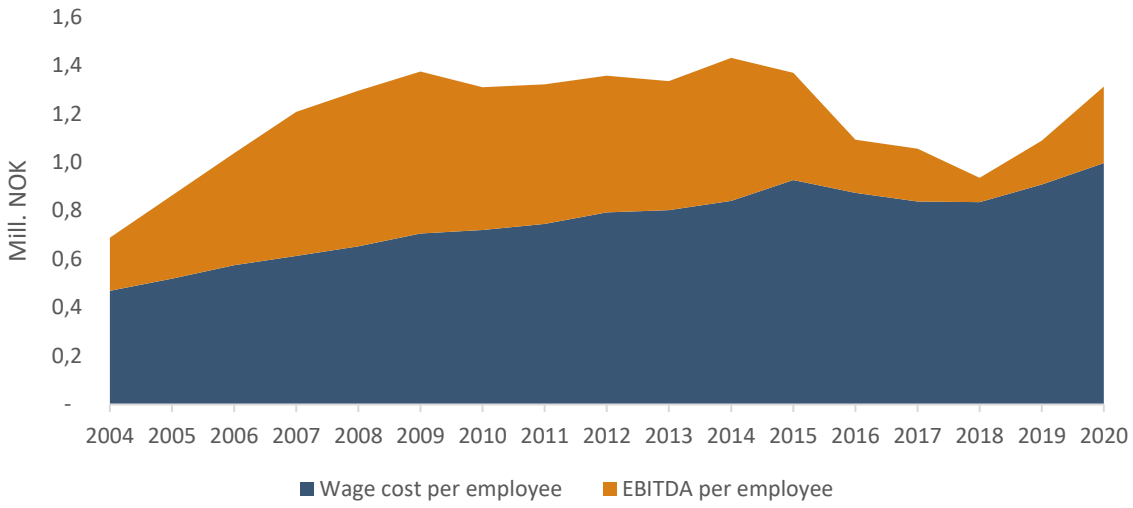


Since 2018 we have seen growth in both wage costs and EBITDA, but it is primarily EBITDA that has contributed to the recent surge in value added. It is mainly a strong growth in EBITDA among equipment suppliers and improvements in the overall EBITDA among yards that are the drivers behind this trend.

As EBITDA has more than doubled since 2018, this is an important explanation for the improvement in the indicator of value added as a share of revenue. It is important to emphasize, however, that the EBITDA growth comes from an extremely low level. While the EBITDA share of value added was higher than 40 percent every year before the offshore crisis in 2015, it is still below 25 percent in 2020. This can be seen in figure 14 below.

From Figure 10 we also see that value added per employee – a common measure of labour productivity – has increased more from 2018 to 2020, than value added in total (ref. Figure 9). Most notably we see that there has been a continuous increase in wage costs per employee in the past two years. This stands in difference to wage cost in total, that was nearly unchanged from 2019 to 2020. Looking at the numbers, we see that there was an increase in value added per employee of 20 percent from 2019 to 2020. Value added in total increased by less than half – just above 9 percent. This implies that labor productivity has picked up in the Møre cluster over the past two years.

Figure 10 – Value added per employee (in mNOK) in the Blue maritime cluster, broken down to wages and EBITDA. Source: Menon Economics

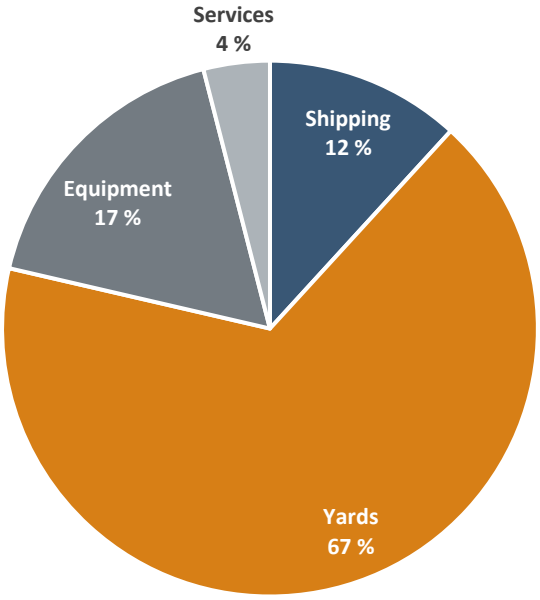


Another driver behind this recent trend is the relative growth of equipment suppliers within the cluster. As equipment suppliers has a far higher value added per employee than yards, the overall value added share increases over time when equipment suppliers experience a higher revenue growth than yards.

Shrinking order books – but still 13 months' work

Total order books are estimated to 53 billion NOK in September 2021. If we think of the cluster as one single company, this would be enough to employ the entire workforce for 13 months. Two years ago, in 2019, the order books were 87 billion NOK, a decrease of 40 percent in two years.

Figure 11 – Estimated orderbooks in the Blue Maritime cluster September 2021. Based on data from a sample of firms that cover 62 percent of total revenues in the cluster. Source: Menon Economics



Two third of the orderbooks are in the yards. It is important to emphasize, however, that part of these orderbooks will be conducted by service companies that are subsidiaries of the yard corporations.

The orderbooks of the equipment producers are surprisingly small, given the fact that these companies have experienced quite high growth in 2020 and 2021. Two years ago, the orderbooks of equipment producers were almost 50 percent higher.

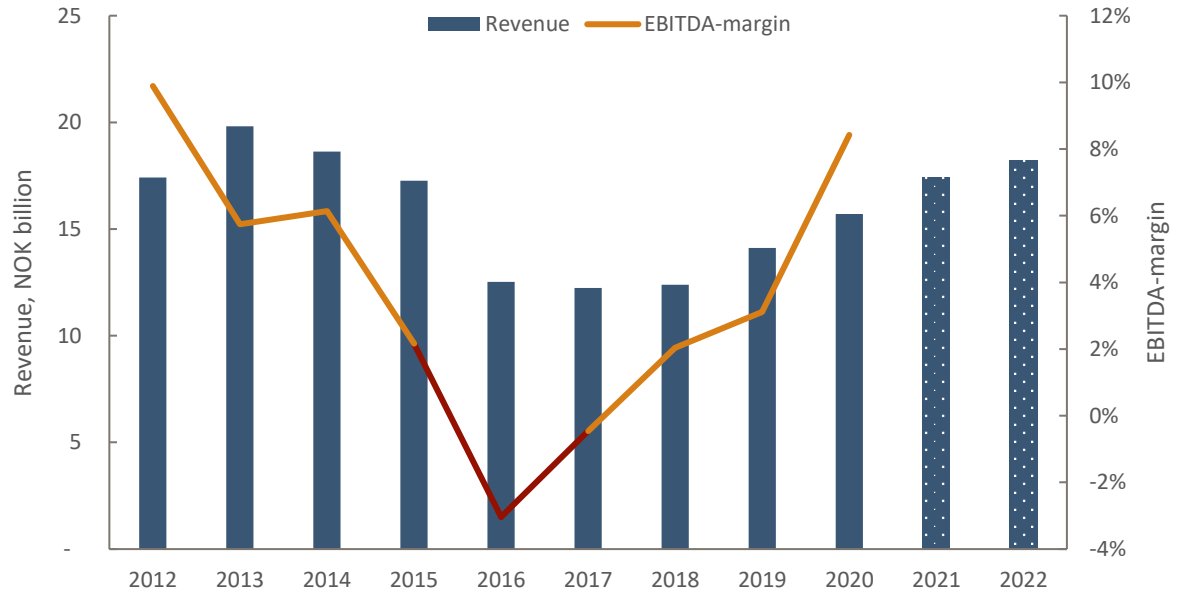
The largest decline in orderbooks from 2019 to 2021 are found among the shipping companies. While their orderbooks were estimated to 20 billion NOK in 2019, they have dropped to only 6,5 billion NOK in 2021.

Key numbers for the four maritime groups

Equipment producers: Strong growth in revenues and profit

As all parts of the cluster, equipment suppliers also experienced a significant drop in activity and profitability following the "offshore bust" in the mid-2010s. Revenue decreased by almost 40 percent from 2013 to 2017 and EBITDA-margins fell to a low point of -3 percent in 2016 – in large part driven by a few big companies.

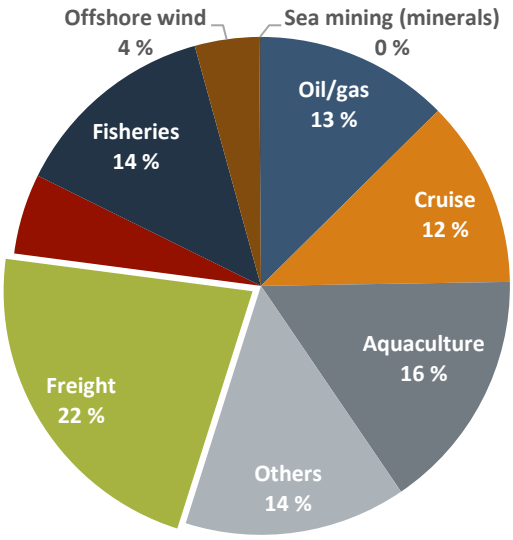
Figure 12 – Revenue and EBITDA-margin (earnings before interests, taxes, depreciation and appreciation) among equipment producers companies in the blue maritime cluster from 2012 to 2020. Estimates of revenues in 2021 and 2022 based on reported information from companies. Source: Menon Economics



Since the 2016 the situation for the Møre-based equipment suppliers has improved continuously. Revenue in 2020 was just 10 percent lower than 2015-levels and the aggregate EBITDA-margin stands at almost 8,5 percent – a significant improvement from 2016.

The outlook for the equipment suppliers also looks positive. The companies themselves expects revenue growth in the short term – in 2021 of as much as 11 percent measured on the aggregate. We do not make specific estimates or prognosis for profit margins, but we see no good reason for these to decline in the short term.

Figure 13 – Revenue by market segments for the equipment suppliers in the Blue Maritime Cluster in 2021. Source: Menon Economics



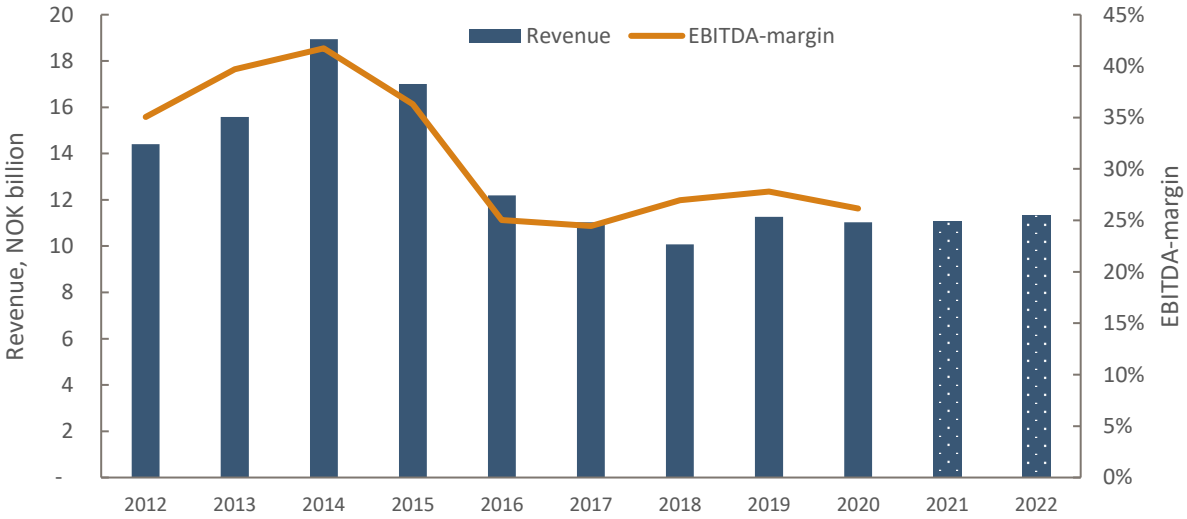
A key characteristic of the equipment suppliers in the Blue Maritime Cluster is how diversified, in terms of market segments, they are. As is evident from Figure 13 the single biggest market segment for the equipment suppliers is Freight, but this only constitutes 22 percent of the group's total revenue. As we discuss later in this report, we expect a considerable growth in global orders within freight in the next decade. As Aquaculture and offshore wind also are segments in growth, the overall outlook for the equipment suppliers looks positive.

Although the equipment producers as a whole are quite diversified, it might be that each company within the group is specialized towards a specific market segment. However, the diversification of equipment producers holds even on single company level. While shipping companies in the cluster on average serve only 1,5 market segment, and service providers operate in 3,8 market segments, equipment producers on average serve 5 market segments. For ship yards, the number is 4,3.

Shipping companies: Revenues dropped 50% from 2014 to 2018 – huge difference between market segments

Following a close 50 percent drop in revenue from 2014 t0 2018, the shipping companies' aggregate income has been less volatile. Average year-on-year growth from 2018 to 2020 was 4,7 percent.

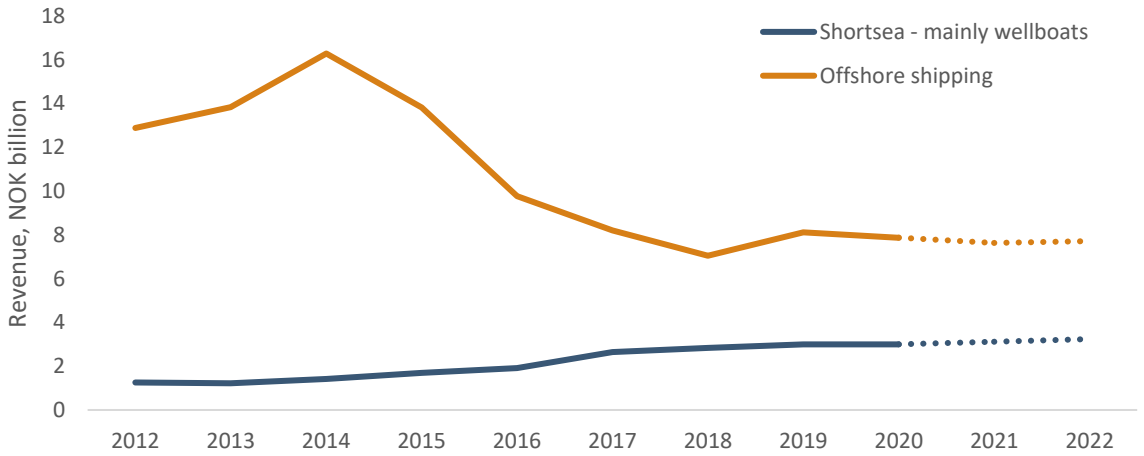
Figure 14 – Revenue and EBITDA-margin (earnings before interests, taxes, depreciation and appreciation) among shipping companies in the blue maritime cluster from 2012 to 2020. Estimates of revenues in 2021 and 2022 based on reported information from companies. Source: Menon Economics



The recent years' development among Møre-based shipping companies is to a large extent the history of offshore supply companies. Their total income decreased by almost 60 percent from 2014 to 2018. Being by far the biggest segment among shipping companies up until the oil crisis, this drop in income dominates the development for the group as a whole. Other segments have, however, had an opposite development in recent years. From Figure 21 we see that the shortsea segment, that consists mainly of wellboats, has experienced a continuous revenue growth since 2013. Between 2014 and 2018, where the offshore shipping companies experienced a drop in revenue of close to 60 percent, the shortsea shipping segment doubled their revenue.

The figure illustrates that the curves have approximately the same slopes after 2019, which implies that offshore shipping will be the most important market for shipping companies in the cluster in 2022, and probably also when we approach 2025.

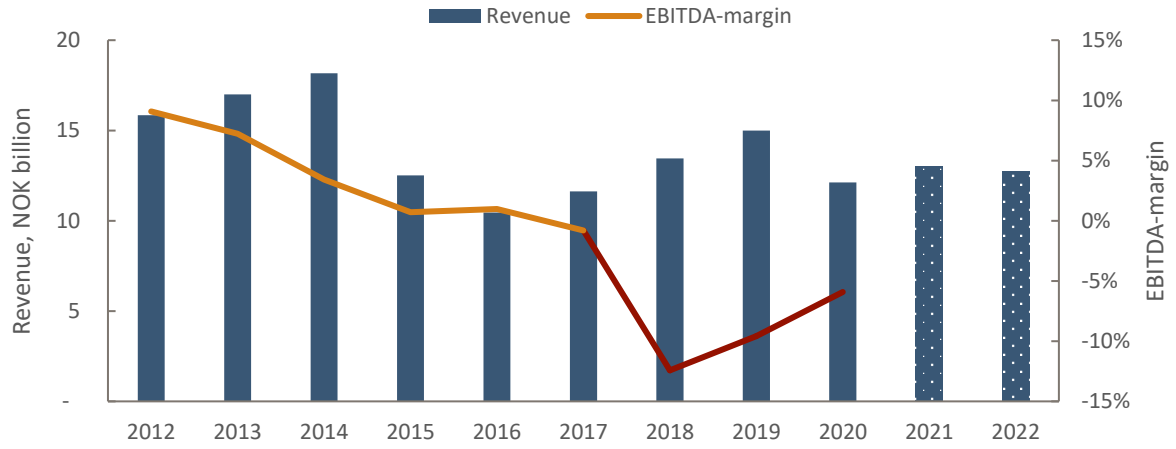
Figure 15 – Revenue of the two main shipping segments in the blue maritime cluster from 2012 to 2021. Estimates of revenues in 2020 and 2021 based on reported information from companies. Source: Menon



Ship yards: Profit margins still negative – but slowly improving

The turn in segment focus from offshore supply vessels to (mainly) the expedition cruise segment among Møre-based shipyards resulted in revenue growth in the whole period from 2017 to 2019. This turn of market focus did however entail huge profit losses. This is evident from Figure 16 where we see that the aggregate EBITDA-margin was negative in all years since 2016, even with a revenue growth of more than 40 percent from 2016 to 2019.

Figure 16 – Revenue and EBITDA-margin (earnings before interests, taxes, depreciation and appreciation) among yards in the blue maritime cluster from 2012 to 2020. Estimates of revenues in 2021 and 2022 based on reported information from companies. Source: Menon Economics



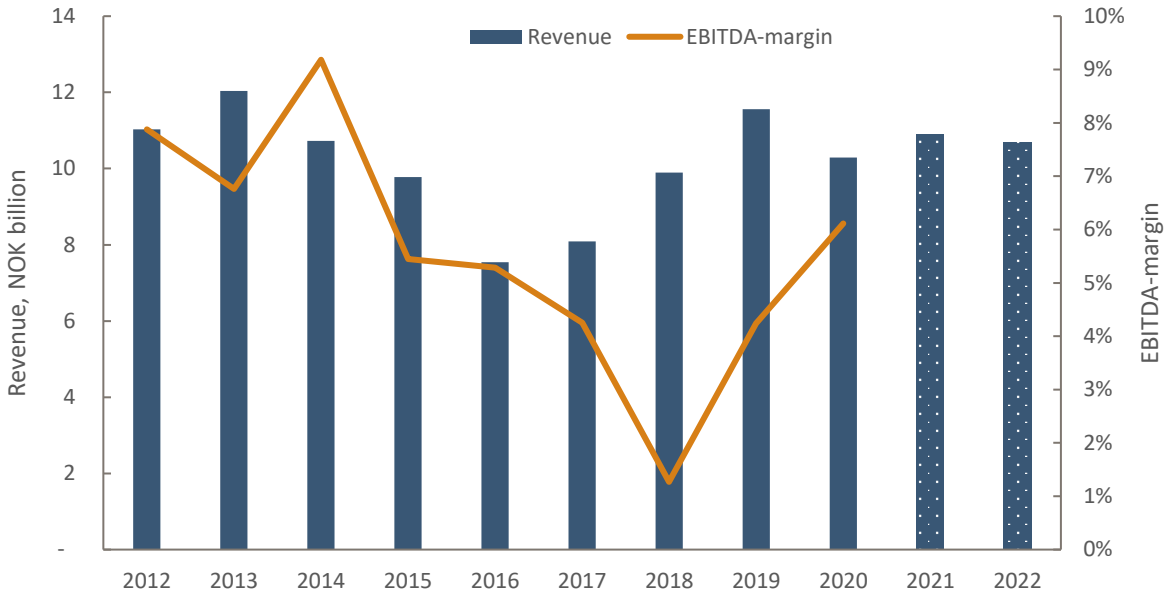
Though still negative, the aggregate profit margin for the ship yards has improved in two consecutive years. One reason for this could be that years' working within expedition cruise have become more experienced and hence more efficient. In other words, the shipyards have moved down the learning curve during the transition.

Another reason for the improvement, is the development among yards that build other types of vessels, such as well boats and ferries. These yards were to a lesser extent hit by the sudden halt in orders for offshore ship in 2014-2015 and have consistently been building vessels within other segments. In recent years there has been a particularly high activity within the aquaculture segment, which in turn have resulted in improved profit margins.

Ship design and other services

Maritime services comprise of a broad set of sub-segments, ship design being the most important. The diversity within this group makes it difficult to identify an unambiguous reason for the group's development in revenue and profit margin over the recent ten years. However, since the service providers are closely connected to the yards, their activity to a large extent follow the development among ship yards. Hence, also companies within maritime services were hit by the offshore crisis in 2014-2015. Revenue fell by almost 40 percent from 2013 to 2016, and profit margins kept declining up until 2018.

Figure 17 – Revenue and EBITDA-margins (earnings before interests and taxes) among maritime services providers in the blue maritime cluster from 2012 to 2020. Estimates of revenues in 2021 and 2022 based on reported information from companies. Source: Menon



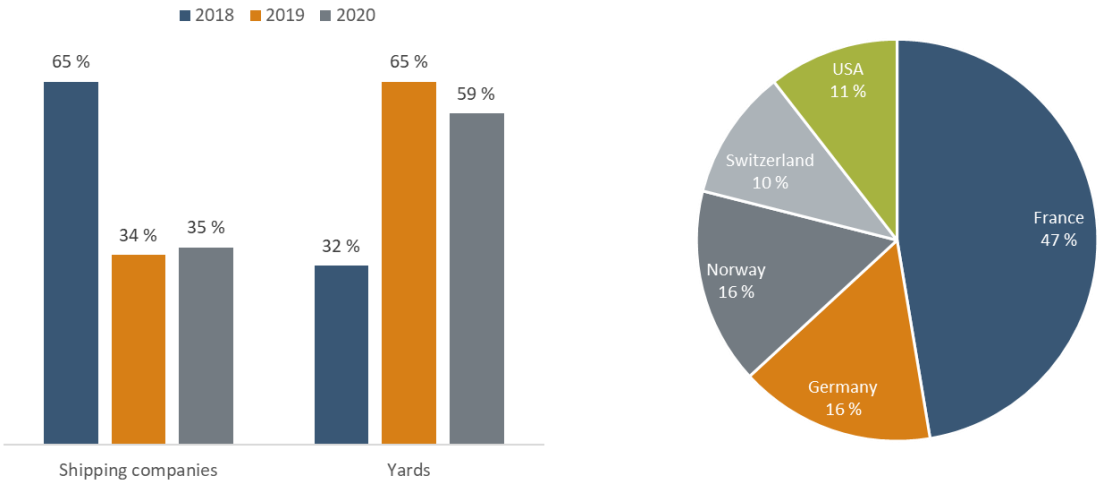
From Figure 17 we see that maritime services rather quickly managed to return to positive revenue growth following the drop in the offshore segment. The growth trend in both revenue and profit margins from 2016 to 2019 among maritime services is very similar to what we see among the ship yards. Both groups experienced revenue growth of around 50 percent in these years, and both groups have had rising profit margins since 2018. The apparent parallel recent growth history has to be understood in light of the tight collaboration between yards and the local maritime service companies. The ship yards procure services from the local maritime service providers and contracts are to a large extent set up in such a way that risk is shared. Hence, in the period where the Møre-based ship yards moved into the expedition cruise segment, the maritime service providers followed. This resulted in consistent revenue growth but also (initially) falling profit margins.

Exports constitute more than 50 percent of revenues in the cluster

From 2018 to 2019, the export share in the maritime cluster in Møre increased significantly more than total revenue. Hence, the cluster's export share increased from 47 to 54 percent. This change was followed by a decrease in the share of revenues coming from the local/regional market from 18 to 15 percent. During the pandemic, however, the change was reversed, and the export share is estimated to 53 percent in 2020 and 52 percent in 2021.

For the cluster as whole, these changes are quite small, but they hide large changes within the cluster. As illustrated in figure 6, the export share of shipping companies has fallen dramatically from 2018 to 2019 and 2020. This is mainly because the offshore shipping companies in the cluster have faced a decrease in activity, particularly in export markets, while aquaculture shipping companies have grown rapidly, and their market is primarily domestic. The shipyards, on the other hand, have gone in the opposite direction. While most of their customers were regional or domestic when they built offshore service vessels, they had to approach foreign customers when they entered the expedition cruise market. Hence, they export share of yards increased from 32 to 65 (59) percent in 2019 (2020).

Figure 18 – Left: Estimated export shares for shipyards and shipping companies in the Blue Maritime Cluster, 2018-2020. Source: Menon Economics. Right: 19 expedition cruise vessels build on ship yards in the Blue Maritime cluster since 2015 – divided into the country of the owner (cruise shipping company). Source: Clarkson/Menon Economics.

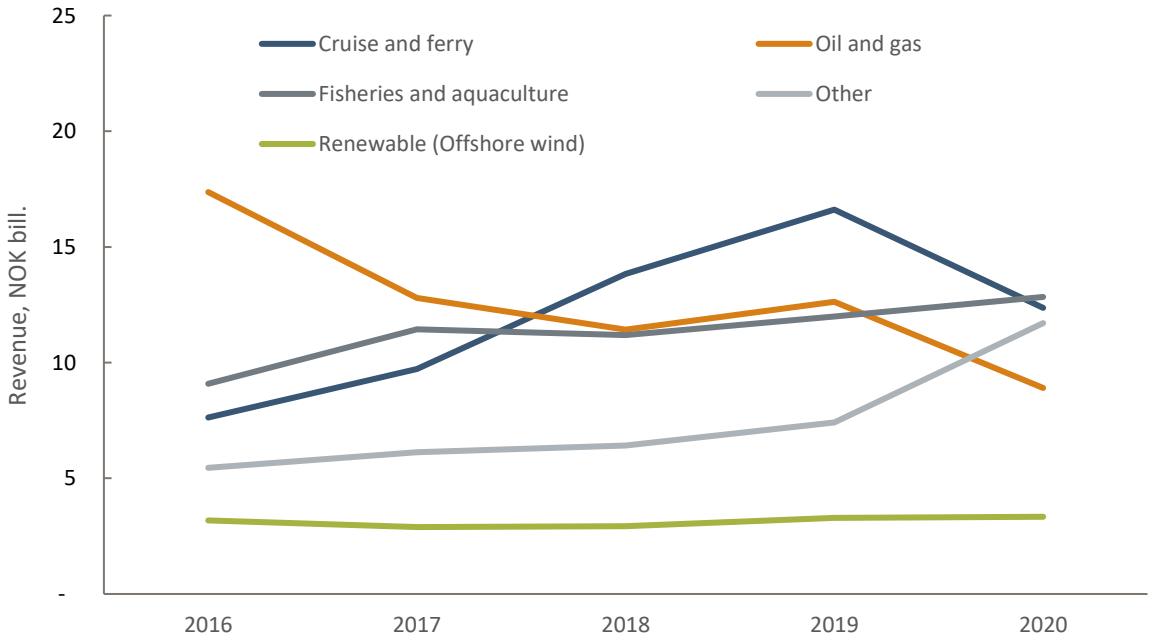


For the equipment producers and service companies in the cluster, there are only minor changes in the geography of customers.

Market segments: From oil to cruise to diversification

Income growth in the Møre cluster in both 2018 and 2019 was, to a large extent, driven by a surge in the cruise segment. The growing international demand within tourism for high-standard and close-to-nature cruise experiences, combined with a small base of vessels to meet this growth in demand, are the critical explanations for the past years' growth in newbuilding of expedition cruise vessels. The Møre cluster's expertise within the equipment, services, and assembly needed to build such ships have resulted in the cluster now holding a considerable market share in this market.

Figure 19 – Revenue by market segment in the Blue Maritime Cluster. 2016-2020. Source: Menon Economics



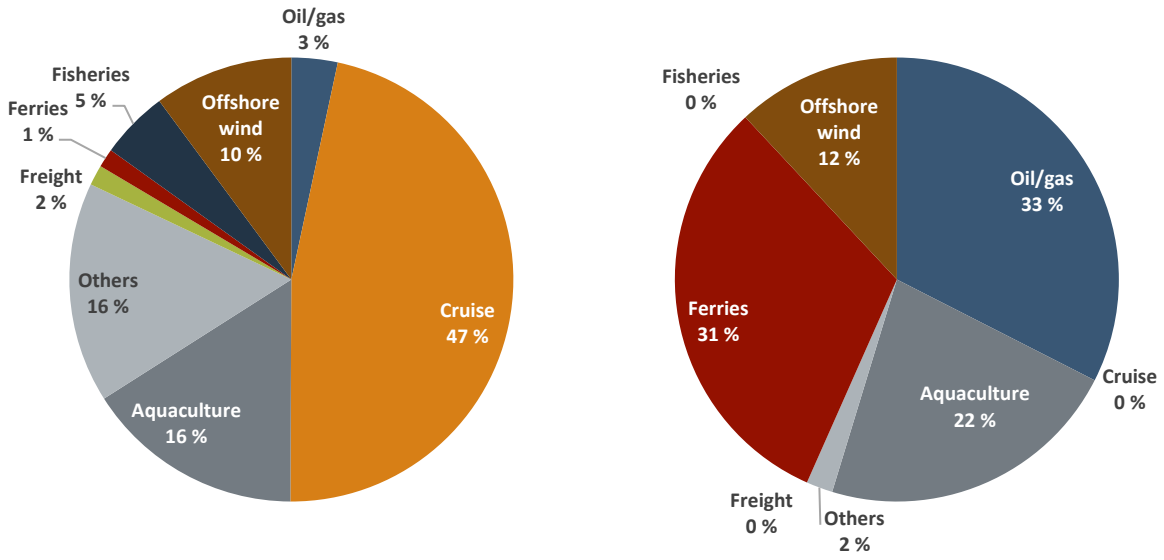
As with expedition cruise, the segment of fisheries and aquaculture has also increased steadily in importance over the past five years and is in 2020 the most significant segment for the maritime cluster in Møre (though only marginally bigger than cruise). By revenue, fisheries and aquaculture has grown from NOK 9 billion in 2016 to NOK 13 billion in 2020 – a growth of more than 40 percent. It is mainly aquaculture, and the building of wellboats, this growth has come from.

From Figure 19 it is evident that the segment with the highest growth in 2020 was "Other". This segment comprises a big variety of sub-segments, also including land-based ones, with the most important being sales to customers in freight (deepsea/shortsea cargo). An important reason for the growth in the "Other" segment in 2020 is the income growth among Møre-based maritime equipment suppliers. Companies in this group generally have customers in a far more comprehensive range of segments than other parts of the cluster. For instance, there are barely any freight vessels being built in Møre-based yards today. For equipment suppliers however, this segment is an important source of activity and income.

Overall, we see a trend towards greater diversity among segments in the Blue Maritime cluster. Where the oil and gas segment and the cruise and ferry segment have had strong (but opposing) growth trends in recent years, segments such as fisheries and aquaculture and freight/shipping have risen steadily. With an increase in activity within the renewables sector going forward, which is expected to grow rapidly in the next decade, we expect a further strengthening trend of diversification of segments.

Another way to illustrate how the maritime cluster in Møre has become more diversified in market segments in recent years is to compare market segmentation between groups. Illustrated below, we see how revenue in shipyards and shipping companies respectively is distributed among market segments.

Figure 20 – Revenue from different market segments in 2020 from shipyards (left) and shipping companies (right) in the maritime cluster in Møre. Source: Menon Economics



Most notably, we see a clear difference in the reliance on the cruise market. Whereas almost half of all revenue among shipyards in the Møre region comes from the cruise segment, there are no Møre-based shipping companies with any activity in this segment. Also striking is the difference in how much the different groups rely on the oil and gas sector. Where one third of all revenue among shipping companies comes from oil and gas, only three percent of revenue among shipyards comes from this market segment.

Implications of diversification in the cluster

The Blue Maritime cluster was for many years a tight **vertically** structured cluster with one primary market – oil & gas. The value chain consisted of shipping companies that served oil operators and oil services. The shipping companies ordered the offshore vessels from local yards, that built the vessels based on local design, to a large extent local equipment, and with local services. The companies in the cluster were internationally competitive in all parts of the value system.

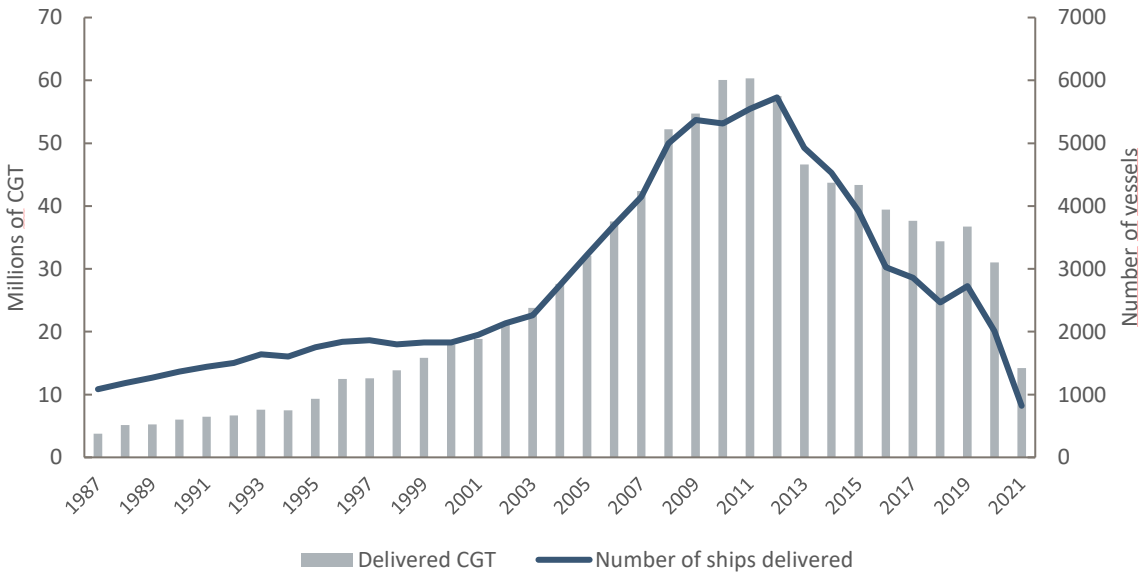
However, from 2015 onwards, there have not been many new orders for offshore service vessels. Reduced orders from offshore shipping companies mean that market relations and innovation impulses from the shipping companies to the rest of the cluster were cut off, thus weakening the internal linkages in the cluster. The cluster has partly reinvented itself, with new value chains and linkages. The new transition towards exploration cruises was demanding and costly and had not yet become profitable when the coronavirus arrived and effectively stopped all new orders of cruise vessels. As a result, the cluster might be forced to reinvent itself once again in a period where it was supposed to reap the rewards from its last reinvention.

The question then is to what extent it is possible to build one **integrated** maritime cluster, or whether there will be **several specialized value chains** within the cluster. If the latter will be the future, then the following question will be how the different value chains can share synergies with the cluster.

Looking forward – market potential for the Møre cluster in key segments

The global newbuilding market has been in decline in the last years, and global orderbooks are currently historically low. The key explanation for this is the inherent cyclicality in the shipping market – newbuilding was very high up until the financial crisis. Also, the general uncertainty with regards to international climate regulations makes shipowners wary of ordering new complex ships (at least in certain segments).[2]

Figure 21 – Global ship building throughout the last 34 years. Measured by number of ships (right axis) and compensated gross tonnage (left axis). Source: Clarksons World Fleet Register



Another persistent trend in the global maritime market has been the gradual growth of newbuilding and maritime manufacturing in Asia over the last 50 years. The region has won market shares in nearly all segments of the maritime sector, also at the expense of the Norwegian maritime cluster. Today Asian yards build almost all ships with low complexity and are increasing their share of the building of more complex ships.[3]

Looking towards 2030, we believe the trend of the recent decade will turn, and global demand within newbuilding and retrofit will increase, with growing markets for maritime technology and services in general. This is due both to increased global political pressure on this sector to become "greener", and because of the high and increasing average age of vessels in many big segments within global shipping.

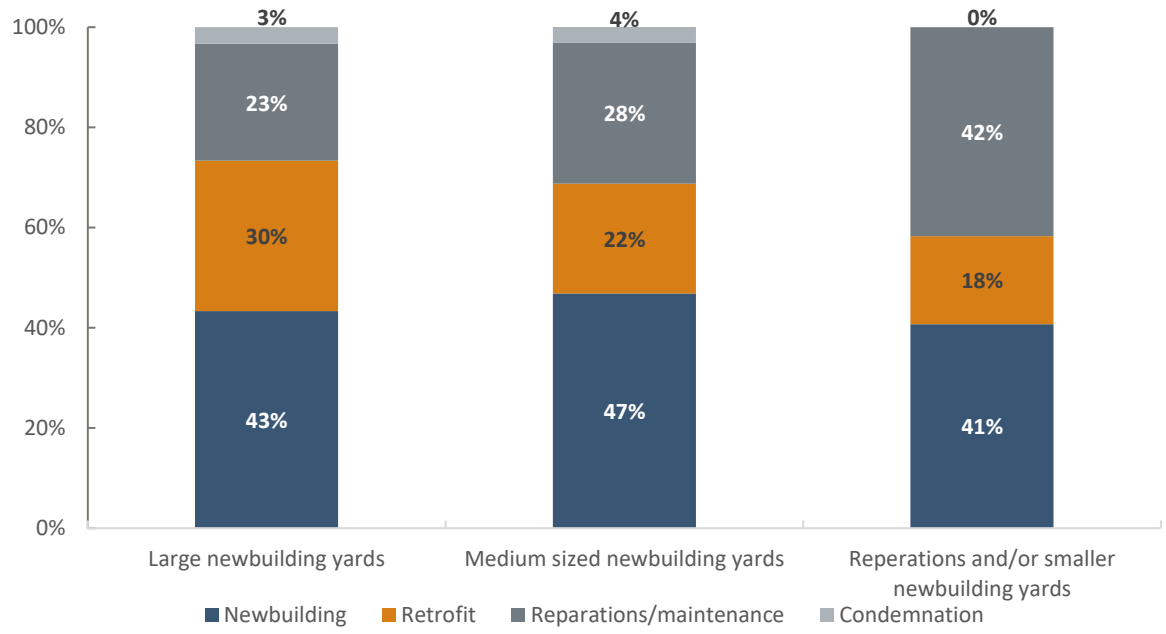
The expectation that retrofitting and maintenance will represent a significant share of the maritime industry's revenue in the following years is confirmed by a recent survey among Norwegian yards. Among yards of all

[2] *Strategier for grønn maritim eksport (Menon, 2021)*

[3] *Norske skipsverft – aktivitet, konkurransesituasjon og rammebetingelser (Menon og BCG, 2021) – kap. 2.1.1.*

categories, retrofitting and maintenance is expected to account more than 50 percent of total revenue in the next five-year period.

Figure 22 – Survey among 20 Norwegian yards, conducted in 2020. Question: What share of revenue do you expect will come from the following activities in the next five years? (Average of responses among different types of yards). Source: Menon Economics



The Norwegian maritime sector has its competitive advantage, and biggest market shares, within segments characterized by technological innovation, new solutions and designs, and small volumes. It is within niche segments of high complexity, such as advanced offshore supply vessels, expedition cruise and wellboats, that the Norwegian maritime cluster has its biggest market shares.

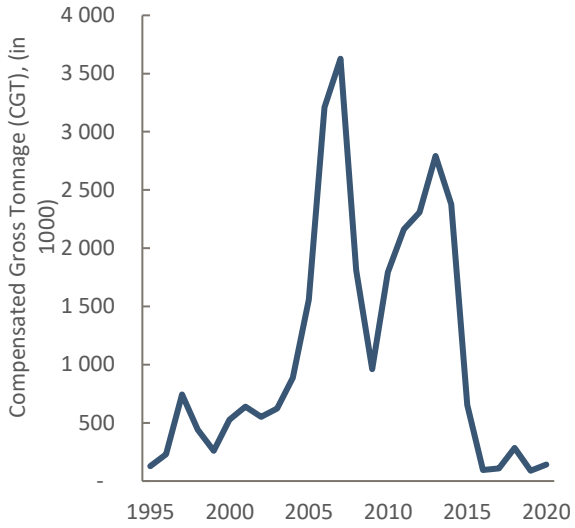
The proven strong level of adaptability and high technological competence in the Møre cluster makes the cluster well positioned in the expected restructuring/conversion to green technology and propulsion systems in shipping. However, the high cost level in Norway and the big yards' weak financial position are a challenge for the cluster as a whole. The big yards are a key component of the cluster's competitiveness, which in turn is essential to maintaining and taking further shares of the global maritime market.

Next, we discuss the market outlook in five key maritime market segments for the Møre cluster, looking towards 2030.

Offshore vessels

As opposed to the cargo segments (both shortsea and deepsea), offshore supply vessels stayed in high demand also after the financial crisis. The offshore supply market is dominated by petroleum activity, and the consistently high oil price level in the years following 2008-2009 drove offshore petroleum investments into ever deeper and more complex offshore fields. These investments required more complex vessels, which in turn drove contracting and newbuilding of offshore supply vessels.

Figure 23 – Global contracting volume of offshore supply vessels, measured in 1000 CGTs. Source: Clarksons World Fleet Register and Menon Economics



Following the drop in the oil price in 2014, contracting of offshore vessels came to a halt. However, due to the high orderbooks new offshore supply vessels kept being delivered from shipyards in the years after 2014. The market for offshore supply vessels has in the last 6-7 years been characterized by oversupply, low rates and lay-ups.[4] The development in global contracting volume, shown in Figure 21, clearly illustrates this.

Table 1 below shows the global newbuilding activity in the offshore fleet, and the position of Norwegian shipowners and yards in this segment. Between 2011 and 2015 almost 10 percent of all offshore vessels in the world were built by shipyards in Norway. From 2016 to 2020 however, the effect of the oil price fall starts showing and both the number of newbuilds and Norwegian yards' market share in the segment start falling. Although Norwegian shipyards have historically had a strong position in this segment, the competition has become tougher as the shipyard industry in Asia in general, and China in particular, has grown in size. There has for example been a consistent trend that contracts for new offshore vessels put in by Norwegian shipowners to an increasing extent have been awarded to Asian yards throughout the last decade.

Table 1 – Market for offshore newbuilds, including offshore wind. Source: Clarksons Research & Menon Economics

	2011-2015	2016-2020
Global market, total number of vessels built in offshore segment	2167	775
Norwegian customers' share of total newbuilds	9%	4%
Norwegian yards' market shares	7%	5%

Looking ahead, there are several different trends that impact the short to medium term demand for offshore supply vessels and associated equipment and services. On a global basis, an increase in decommissioning on mature petroleum fields is expected to lead to an increase in demand for offshore vessels. At the same time,

[4] *As of August 2020, there were about 180 offshore vessels being laid-up in Norway (see Meld. St. 10 (2020-2021))*

new deepwater exploration and production on complex fields is expected to pick up. However, this trend is primarily expected in other regions than in the North Sea (Africa, Middle East and Asia-Pacific).[5]

Another trend is an increased demand for dynamic positioning (DP) rigs, in drilling operations. With the use of such technology on rigs, there is less need for Anchor handling vessels (AHT/AHTS) – a sub-segment of offshore supply vessels. However, an increase in demand for DP technology is positive for the outlook for certain maritime equipment suppliers in the Møre cluster, such as Kongsberg Maritime.

The growing political and societal pressure to take into account the climatic and environmental effects of carbon emissions is expected to impact the offshore supply market. Limiting emissions and increasing operating efficiency drives a trend of fitting vessels with battery technology. Retrofitting offshore vessels with battery-hybrid power systems is a potential area of growth for the Norwegian maritime industry. Retrofitting is expensive for shipowners not only due to the cost of the retrofitting as such, but also because the vessel that is being retrofitted is taken out of operation. For this reason, we see that even big upgrades such as retrofitting are usually done at yards close to where the vessels operate, to minimize the time vessels are out of operation.

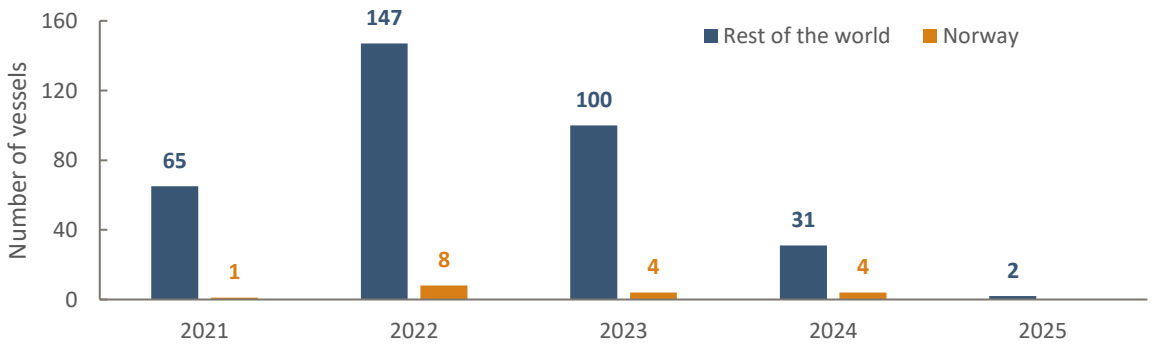
We believe the Norwegian maritime cluster has a competitive advantage in the market for retrofitting offshore supply vessels. This is due to the location of yards and suppliers, but also because Norwegian yards are known to deliver according to schedule even in projects with high insecurity (high level of tailoring).

Offshore Wind

According to a recently published analysis from Rystad Energy, there has for the past five years been an oversupply of specialized vessels used within installation of offshore wind foundations and turbines. In Europe in particular this oversupply has been apparent.

However, as an increasing number of offshore wind projects is being built and planned for the upcoming years, the market situation for offshore wind vessels is expected to tip into undersupply by 2025. In turn, this will push up rates and order volumes for offshore wind installation vessels. According to Rystad Energy, demand for offshore wind installation vessels in 2030 will be four to five times greater than the current demand. If this prognosis holds true, we can expect a significant growth in ordering of offshore wind vessels in the coming years, as well as conversions of heavy-lift vessels initially built for operations in the offshore oil and gas market.

Figure 24 – Number of offshore vessels including offshore wind in orderbooks, Norwegian shipowners and shipowners in the rest of the world. Source: Clarksons Research & Menon Economics



[5] *Offshore support vessels market – growth, trends, covid-19 impact, and forecasts (2021-2026), Mordor Intelligence*

Figure 24 illustrates the current volume of ordered offshore vessels, by year of delivery. Note that these figures include vessels built for both oil and gas and wind activities. However, although the majority of offshore orders are for the oil and gas industry, zooming in on countries like Norway and the United Kingdom we see that a big proportion of orders come from offshore wind companies. In fact, at least 80 percent of the vessels ordered by Norwegian shipowners in this segment are ordered by offshore wind companies.

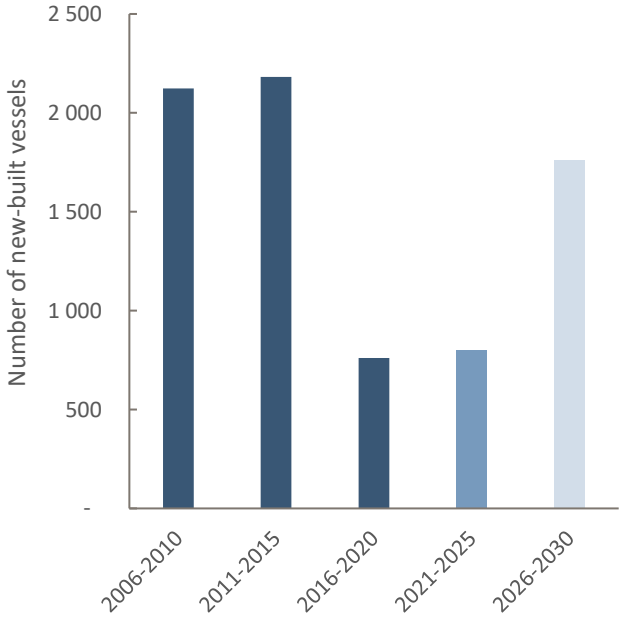
Another trend in this market also affecting the outlook for orders of offshore wind installation vessels, is the technological evolution within turbine size. As manufacturers build ever larger wind turbines, there are fewer vessels that have the capacity to lift and install these.[6] According to Rystad Energy, only four out of 32 turbine installation vessels could handle the largest turbines on the market by the end of 2020.

Offshore vessels being built with the purpose of installing wind turbines, which in turn produce green energy, it is to be expected that the greenhouse gas emissions in the whole value chain of offshore wind will be in focus by the industry when ordering offshore wind vessel services. As Norwegian maritime yards, equipment suppliers and operators always have been at the forefront of the development of alternative propulsion systems, we believe the Norwegian maritime cluster has an advantage in the upcoming growth within offshore wind services.[7]

Prognosis

Although the short-term outlook for specialized offshore wind vessels is looking good, this market segment only represents a small share of the total global offshore supply market. In general, there is still an oversupply in the global offshore fleet market and the age of the fleet is still quite young compared to other ship segments. However, there is reason to expect that some of the offshore vessels built for operations in the oil & gas market, will be converted to offshore wind operations.

Figure 25 – Number of offshore supply vessels (both oil and gas and wind specific vessels) being built in in the last 15 years, and equivalent prognoses for the upcoming 10-year period. Source: Clarkson Research & Menon Economics



We believe that activity (in terms of building) of new offshore vessels globally will be at a similar level in the upcoming five years (2021-2025) as in the previous five-year period. However, from 2026 and onwards we expect a considerable shift in both building and ordering of offshore supply vessels. This is driven by the continuous technological development of ever more cost-efficient green solutions in the maritime sector, a growing age of the world fleet and a strong global growth in demand for vessels specialized for installation of foundations and turbines within offshore wind.

[6] *E.g., GE's Haliade-X, with up to 14 MW capacity, and a 220-meter rotor blade diameter.*

[7] *Norsk Industri (2021), Leveransemodeller for havvind*

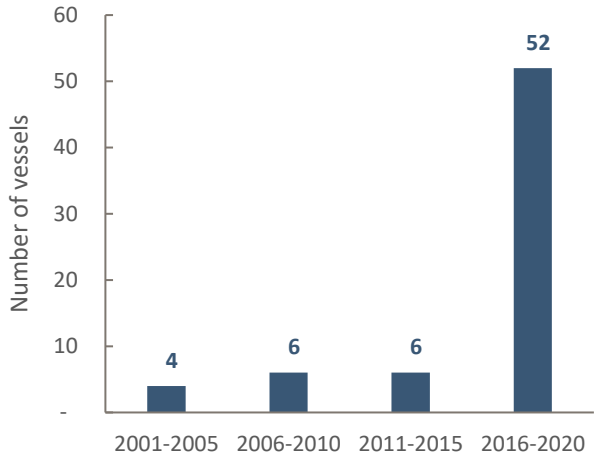
Note however that the prognosis shown here only includes newbuilding. Other types of maritime manufacturing activities, such as retrofitting, conversion and condemnation, are not included.

Cruise/Expedition cruise

Measured by both tonnage and number of vessels, most cruise ships in the world are built by European shipyards. For instance, measured by tonnage almost 90 percent of all newbuilt cruise ships built globally in the last years were built in Europe (75 percent measured by number of ships). As opposed to the trend within offshore supply vessels, orders of cruise ships globally have increased steadily throughout the last decade, culminating in an historically high number of such ships to be delivered in the years from 2021 to 2023.

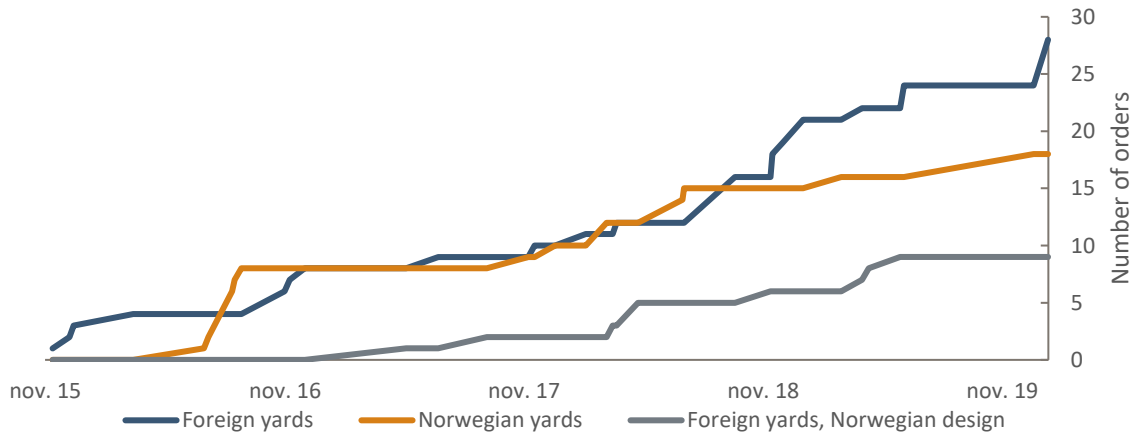
Shipyards in Norway do not build the largest cruise ships, but have experienced a tremendous growth in activity and orders within the sub-segment of expedition cruise vessels. These ships are smaller than the "classic" cruise line vessels and usually feature special designs and details. A growth in demand for high-standard and close-to-nature cruise experiences, combined with a small base of vessels to meet this growth in demand, are the key explanations of the past five-year period growth in orders. As is evident from Figure 24, more than three times as many new expedition cruise ships were ordered between 2016 and 2020 as the in the whole 15-year period from 2001 to 2015.

Figure 26 – Number of expedition cruise vessels ordered globally, in five-year intervals (by order year). Source: Clarksons Research & Menon Economics



Although the still ongoing pandemic has had dramatic effects on international tourism, and especially cruise tourism, the capacity in the expedition cruise market will continue to grow in the coming years. This due to the high level of orders globally of such vessels.

Figure 27 – Aggregated number of orders for expedition cruise vessels since November 2015. Orders to Norwegian and foreign yards respectively, and foreign yards with Norwegian ship design services. Source: Clarksons Research & Menon Economics.

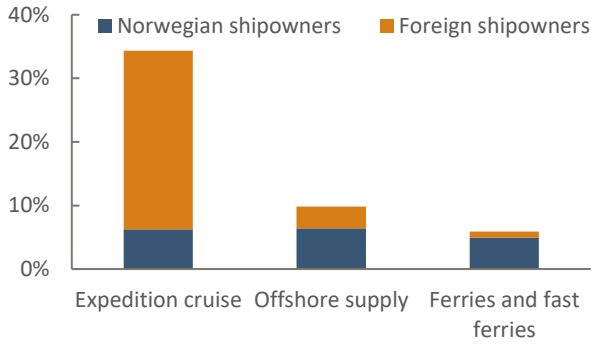


As opposed to the situation in the offshore supply market, Norwegian yards have built a considerable share of the total number of expedition cruise vessels throughout the last decade. One out of every three expedition cruise vessels that was delivered in the last ten years was built by a Norwegian yard. Especially VARD took a big market share in the expedition cruise boom that began in 2015-2016.

As made clear by Figure 27, Norwegian ship designers have also been an important contributor to expedition cruise ships being built by foreign yards in the past years, by delivering ship design services. Ulstein for example has designed seven such ships that are now being built in Chinese yards.

The share of new orders of expedition cruise vessels awarded to Norwegian yards has been in decline in recent years. We see two key reasons for this trend. Firstly, ship owners have prioritized to get their ships delivered in a short timeframe. Hence, Norwegian yards with little or no spare capacity in the short term have been at a disadvantage when competing over contracts. Second, the competition from foreign yards has picked up as more yards have seen the potential of the expedition cruise market which just a decade ago was minimal.

Figure 28 – Norwegian shipyards' global market share within three notable vessel categories and the distribution of Norwegian and foreign shipowners of the Norwegian built vessels. Source: Clarksons Research & Menon Economics

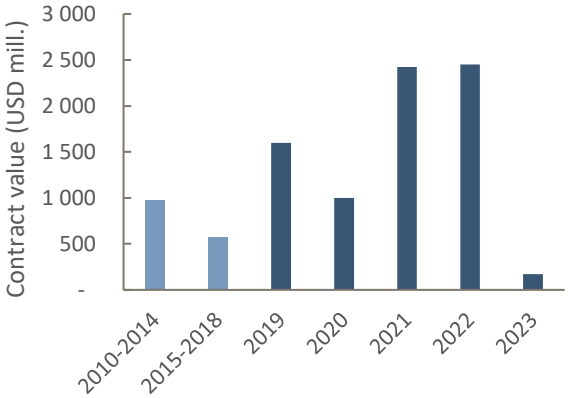


Another interesting feature of the recent years' surge in activity and orders within expedition cruise vessels in the Norwegian maritime industry is that the ordering shipowners within this segment are primarily foreign (illustrated in figure 22, previous chapter). More than 80 percent of the expedition cruise ships built in Norwegian yards in the last decade have been built on orders from foreign shipowners.

Prognosis

On a global level, a record number of expedition cruise vessels will be delivered in 2021. According to order data, also 2022 will be a year with high activity within this segment but following 2022 activity appears to fall abruptly. Currently, the last expedition cruise vessels in order books globally are due to be delivered in 2023.

Figure 29 – Contract value (USD million) of expedition cruise vessels. Delivered vessels and registered orders. Source: Clarksons Research & Menon Economics



The explosive growth in demand for such ships in the recent years is grounded in a shift in demand from big "classic" cruise tourism to small-ship/expedition cruise tourism – especially among high-end tourists. In addition to demanding luxury, another trait of tourists of this kind is a high awareness of the climate and environmental impacts of cruise travel. In turn, this is being reflected in shipowners' preferences and demands when ordering new ships and equipment for such vessels. Some examples are complex anchor-free

positioning systems (to minimize environmental impact), advanced wastewater treatment systems and the use of hybrid power.[8,9]

We expect the trend of an increased demand for low footprint yet luxurious expedition cruise tourism to continue as the world slowly returns to a post-covid reality. Notable cruise line operators within this segment report a ratio of return guests as high as 65 percent, which gives operators a solid base of guests to count on when expanding their fleet. Hence, we do not believe the pandemic will have a lasting impact on demand for small-ship expedition cruise tourism, and expect orders for such vessels to pick up globally with time.

However, it is evident from the data that a significant number of expedition cruise vessels have been ordered in recent years. Even before the pandemic, there were signs of a coming oversupply in this market, and with the pandemic having a significant negative impact on cruise tourism this looming threat has strengthened. In addition, the competition among shipyards has become tougher, as more yards have seen the potential in this market. Norwegian shipyards' market share has been reduced in recent years and we do not expect this trend to be reversed in the coming decade.

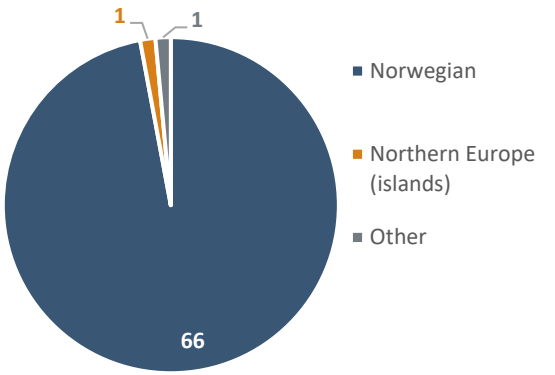
The high complexity and standard of expedition cruise vessels does however also entail a growth opportunity for Norwegian maritime equipment suppliers, many of whom are part of the Møre cluster. Kongsberg Maritime is for example a leading global suppliers of dynamic positioning systems, and Jets (a supplier of vacuum systems and toilets) estimates that they have a market share of about 50 percent. Both of these technologies help cruise vessels limit their local environmental impact by reducing the need for use of anchors and limiting wastewater, respectively.

Aquaculture

The fleet of Norwegian-owned wellboats has grown substantially throughout the 2000s. There were 11 wellboats operating in Norwegian waters in 2012, primarily in use for fish transport. In 2020 this number has increased to 71, and the wellboats now being built have become bigger and far more complex than in 2012.[10]

Nearly all deliveries of specialized vessels (and associated equipment) for use in aquaculture from the Norwegian maritime cluster are delivered to Norwegian clients. Out of 68 identified aquaculture vessels built in Norway since 2010 (including order books), all but two are built for Norway-based customers.[11] These vessels usually fall within the category of wellboats, although there are a few exceptions (specialized vessels meant for processing fish).

Figure 30 – Bigger vessels delivered to the aquaculture segment from Norwegian shipyards from 2010 to today (including order books), by the buyers' nationality. Source: Maritimt Magasin & Menon Economics

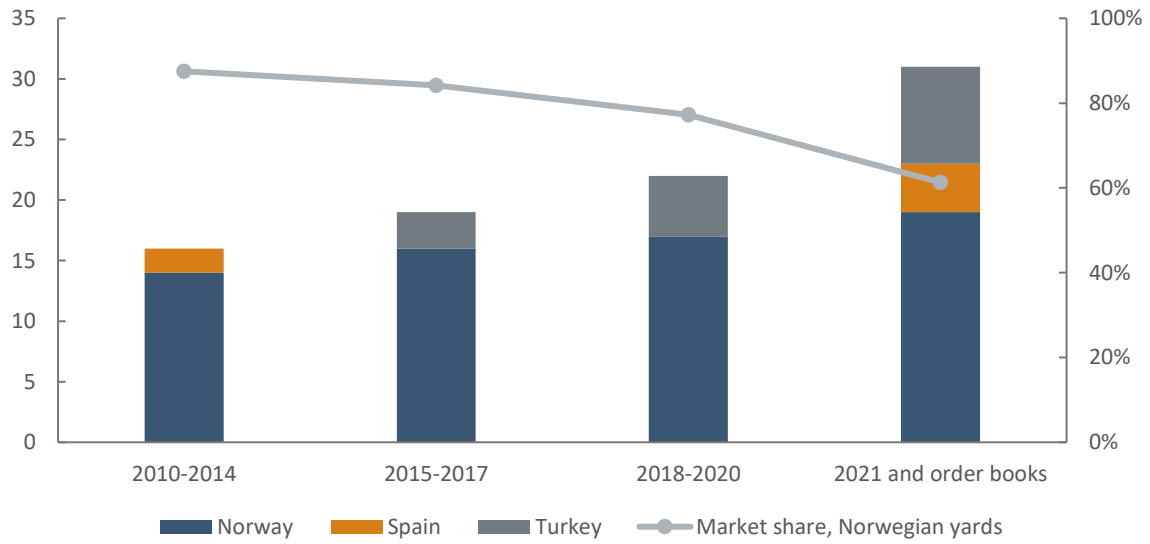


[8] *National Geographic Traveller, July/August 2019 ("The trend in small-ship expedition cruising")*
[9] *Travel Age West, March 15, 2021 ("What's behind the Post-Pandemic Expedition Cruising Demand")*
[10] *iLaks.no (22.01.2021)*
[11] *Note that we by «Northern Europe (islands)" include Iceland, Faroe Islands and Shetland.*

On a global scale, wellboats is to be considered a niche segment, with Norwegian shipyards dominating the market. More than 70 percent of all wellboats that have been built (globally) in the last ten years have been built by shipyards in Norway.[12]

Although the full width of the Norwegian maritime cluster (yards, equipment suppliers, service suppliers and shipowners) has a strong foothold in the wellboat segment, competition is increasing. We see this most clearly in how Norwegian shipyards' market share has developed throughout the last decade. As is evident from figure below, Norwegian shipyards' market share has fallen from close to 90 percent in 2010-2014 to just above 60 percent in 2021 (including current order books). It is primarily Turkish yards that stand for this increased foreign competition, but also Spanish yards have recently won contracts for delivery in 2021 or later. However, it should be noted that currently more wellboats than ever are being built by Norwegian yards, and these yards' order books on such vessels are solid. One reason for the drop in market share observed over the past decade is hence explained by capacity shortages in Norwegian yards in the short term as much as by foreign yards entering the market.

Figure 31 – Number of newbuilt wellboats being delivered to Norwegian shipowners by year and country of the yards that built the wellboats. Source: Maritimt Magasin & Menon Economics



Prognosis

The global market for wellboats is limited to the demand from the fish farming (aquaculture) industry. In the short term it seems unlikely that fish farming production volumes on a global scale will increase notably. This is due to the geographical limitations of where such production is feasible as well as the high and growing concerns about the environmental impact of fish farming. Hence, until new production methods such as closed fish farms or installations placed in the open ocean are fully implemented, we do not expect to see the same continuous growth in demand for wellboat services as we have seen throughout the last decade.

Fish production volumes are however not the only factor explaining the demand for wellboats and other specialized vessels in the fish farming industry. This is evident by how the growth rate of contracting, building

[12] *Norske skipsverft – aktivitet, konkurransesituasjon og rammebetingelser (Menon og BCG, 2021)*

and use of for example wellboats has been considerably higher than the growth rate of fish volumes produced over the last years. The fast and continuous technological development within this industry, and the increased use of wellboats within operations such as delousing and general fish welfare, are also critical for explaining the surge in demand for wellboat services in the aquaculture industry.

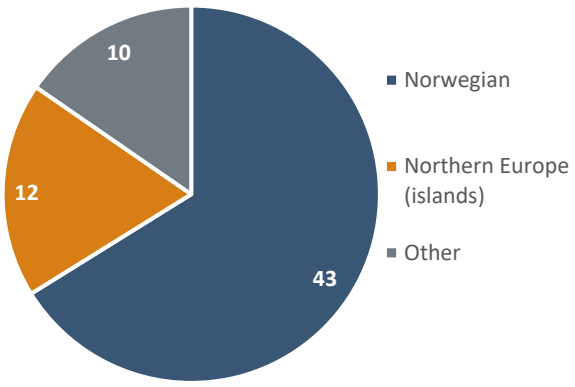
Although technological developments and an increase in the use of wellboats for delousing are important aspects, the by far most important factor when forecasting the market for wellboats is the expected future production levels of fish. As we do not expect any considerable increase in global production levels in the short to medium term, we expect the market for newbuilds of wellboats to cool down in the medium term. However, if this assumption were to be wrong, the Norwegian maritime cluster is very well positioned. The biggest challenge to maintaining the global market share for the Norwegian maritime industry within this segment in the short term might be production capacity, but also increased competition from shipyards in Turkey and maybe other European countries.

Fisheries

The level of competition in the market for yard services and associated maritime equipment and services within fisheries is to a large extent conditional on the *size* of fishing vessels. For smaller vessels, we see that shipowners tend to choose yards and suppliers in their own region or nation. As vessels become larger, the market becomes more international. It is the market prospects for bigger fishing vessels that we focus on in this chapter.

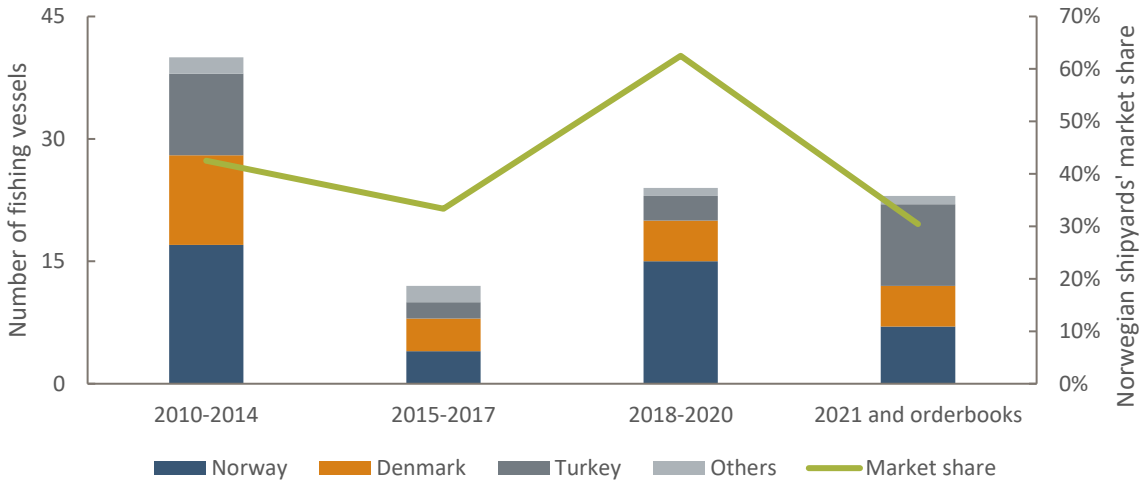
As opposed to the aquaculture segment, we see that a noticeable share of shipowners that have ordered newbuilds of bigger fishing vessels from Norwegian shipyards throughout the last decade are foreign. While almost all newbuilds from Norwegian yards within aquaculture have been for Norwegian owners, the share within bigger fishing vessels is two thirds. From Figure 30 we see that the remaining vessels are approximately evenly split between islands in Northern Europe (Iceland, Faroe Islands and Shetland), and other countries. In this last category, shipowners from Germany and the Netherlands dominate. The distribution indicates that the Norwegian maritime industry competes well with shipyards and equipment suppliers across Europe within the segment of bigger fishing vessels.

Figure 32 – No. of bigger vessels delivered within the fisheries segment from Norwegian shipyards from 2010 to today (including order books), by the buyers' nationality. Source: Maritimt Magasin & Menon Economics



Although one third of newbuilds of bigger fishing vessels built by Norwegian yards since 2010 have been built on behalf of foreign shipowners, we see that Norwegian shipowners in recent years to an increasing extent are ordering such vessels from yards in other countries. As we can see from Figure 33 there has been a clear trend since 2018 that Norwegian shipowners are increasingly choosing Danish and especially Turkish yards over Norwegian competitors. This indicates that the competitiveness of Norwegian yards within the segment of large fishing vessels has weakened.

Figure 33 – Fishing vessels ordered by Norwegian shipowners. Source: Maritimt Magasin & Menon Economics



Prognosis

In March 2021, the world's first bigger fishing vessel with a combination of natural gas and a battery pack as propulsion system was delivered to a Norwegian shipowner.[13] Historically, the Norwegian fishing fleet has been compensated for the cost of CO_2-taxes when purchasing diesel, due to the threat of "carbon leakages"[14]. However, these measures are gradually being reversed to incentivize a shift to "greener" propulsion systems in Norway. We expect similar measures to gradually be implemented in the EU. When diesel-based propulsion systems become relatively more expensive to operate, shipowners will be incentivized to invest in upgrades and equipment that increases fuel efficiency as well as to scrap existing vessels and invest in newbuilds with greener propulsion systems.

In addition to tighter climate regulations leading to an increase in demand for services from yards and equipment suppliers in general, we believe the Norwegian shipyards and equipment suppliers are well positioned to increase their share of the European market for maritime services within fisheries. Throughout the last five years, a range of hydrogen- and electric-based propulsion system-projects aimed at the fisheries segment in Norway has been initiated. In 2017 the Norwegian shipyard *Selfa Arctic* initiated the development of a small fishing boat running on hydrogen.[15] This year, the Norwegian *Ocean Hyway Cluster* initiated a project with the goal of developing a concept for zero emission larger fishing boats.[16] Recently a long list of Norwegian shipyards, shipowners, equipment suppliers and researchers announced plans to develop a system for hydrogen-electric fishery and aquaculture vessels. The project (*"ZeroKyst"*) has a budget of NOK 200 million and includes the development of a concept vessel, a supply system, and the retrofitting of 10 vessels. The project is organized by the renewable energy cluster *Renergy*.[17]

We believe tighter regulations regarding emissions will lead to an increase in both retrofitting and orders for newbuilds of fishing boats in the coming decade. The maritime industry in Norway is well positioned to take part

[13] *Libas, delivered to Liegruppen AS in Norway*

[14] *«Carbon leakage» refers to how differences in climate regulations, such as taxes, between countries or regions affects economic choices in a way that only moves emissions from one country/region to another.*

[15] *Tu.no (19.08.2017)*

[16] *Tu.no (04.02.2021)*

[17] *Renergy, «ZeroKyst»*

in this market growth, as the market for fishing vessels is more regional than many other similar market segments. However, we have seen an increase in competition from foreign yards in recent years. Most notable is the trend that Norwegian shipowners appear to increasingly choose foreign (specifically Turkish and Danish) yards when ordering newbuilds. A key advantage to succeed in this market going forward is the ability to offer vessels and technology that reduce vessel emissions. There are currently several Norwegian programs that seek to develop and commercialize such technology. That these projects succeed and that the technology is implemented by the Norwegian maritime industry will be important for the competitiveness within the market for bigger fishing vessels towards 2030.

Ferries and fast ferries

Norwegian shipyards operating within newbuilds of ferries and/or fast ferries are primarily building on behalf of Norwegian shipowners in both subsegments. These subsegments do however differ with regards to the shipyards' market shares of newbuilds. Whereas one out of every three ferries ordered by Norwegian shipowners in the last decade was ordered from a Norwegian shipyard, the equivalent share within fast ferries is 100 percent.

One reason for the complete dominance of shipyards specialized in fast ferries in the Norwegian market is their strong international market position. These yards have since 2010 delivered a substantial number of fast ferries to Chinese shipowners, as well to shipowners from several different European countries.

Table 2 – Market for newbuilds. Source: Clarksons Research & Menon Economics

	2011-2015	2016-2020
Global market, total number of ferries built	698	882
Norwegian customers' share of total newbuilds	6%	8%
Norwegian yards' market shares	5%	6%

Although Norwegian shipyards hold a solid market share in their domestic market, their *global* market share within ferries and fast ferries respectively is small. As shown in Table 2, out of a total of 1580 ferries and fast ferries that were built in the last decade, 7 percent were ordered by Norwegian shipowners. Similarly, only 5 percent of the newbuilds were built by Norwegian shipyards. This trend continues in the orderbooks too. Norwegian shipowners have 21 vessels in orderbooks to be delivered in 2021, 2022 and 2023.

Figure 34 – Ferries in global orderbooks, by shipowners' country. Source: Clarksons Research & Menon Economics

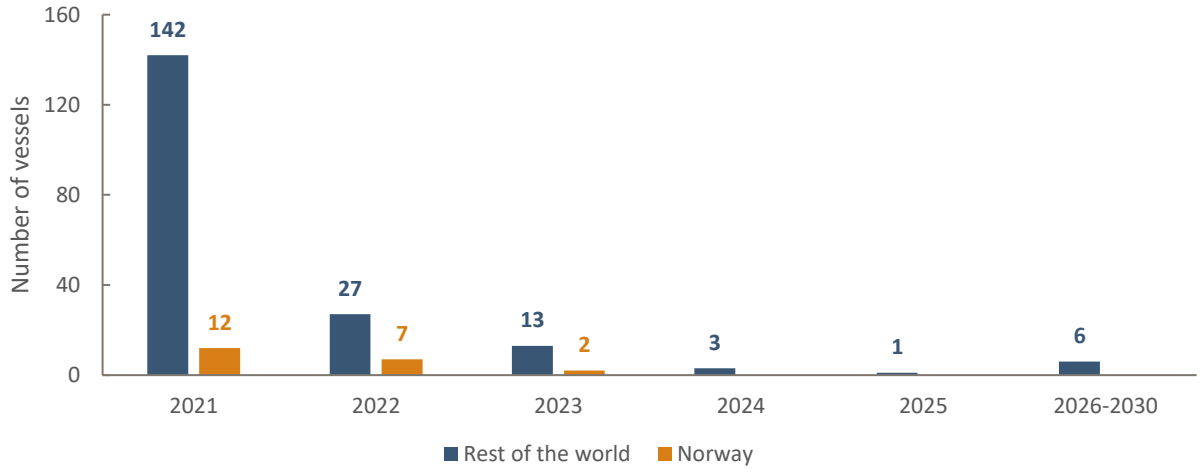
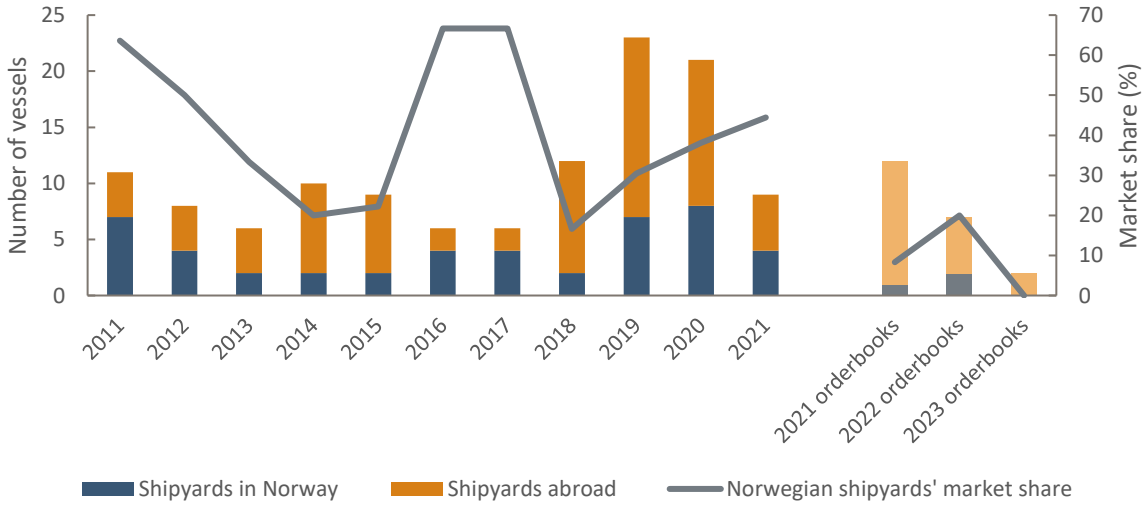


Figure 35 depicts the number of orders for newbuilt ferries and fast ferries from Norwegian shipowners in the last decade and in orderbooks by builders' country. Norwegian shipowners have ordered vessels from both Norwegian shipyards and shipyards abroad. From 2010 to 2013, almost all the ferries built abroad were built in Poland, whereas after 2014 Turkish shipyards have taken a strong position. Norwegian shipyards had an average market share of 38 percent throughout the last decade, fluctuating from year to year. As is evident from the figure, the yards experienced an increase in the number of contracts for newbuild ferries in the late 2010s. Although the uptake continues until 2021, the market share will fall to 23 percent when the vessels in the orderbook as of 2021 are due to be delivered.

Figure 35 – Ferries and fast ferries ordered by Norwegian shipowners since 2011 and orderbooks, by builders' country. Source: Clarksons Research & Menon Economics

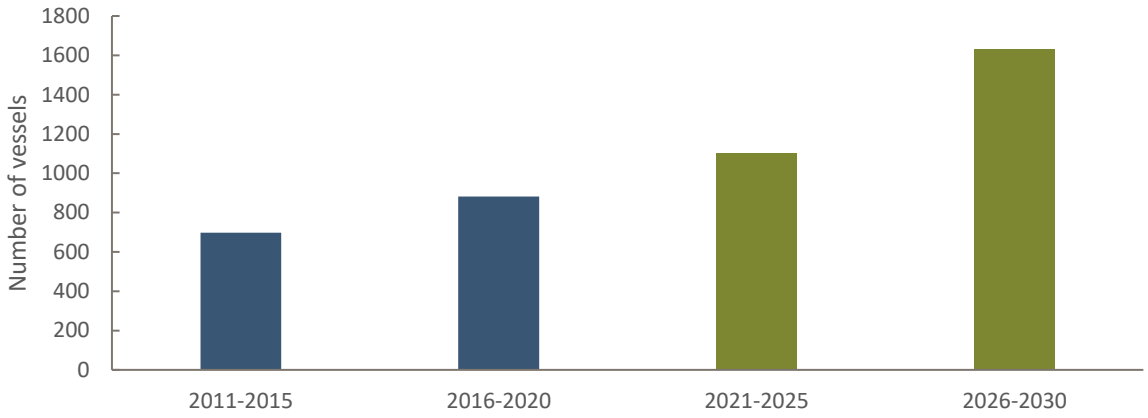


Prognosis

Passenger ferries are among the shipping segments with the biggest potential for decarbonization. Firstly, the global ferry fleet is relatively old, and hence there is a need to renew the fleet in the coming years. Secondly, the relatively short routes and predictable sailing schedules of this segment make it very well suited for electric solutions, both fully electrical and hybrid. The main drivers of decarbonization in this segment are technological

availability, political ambitions, and public procurement. As the Norwegian government has announced an ambition to reduce the greenhouse gas emissions from domestic shipping and fishing activities by 50 percent, and a significant share of ferry traffic is organized by national or regional authorities, we expect to see an increase in procurements of "green" vessels in this segment. Expected increase in newbuilds in this segment is depicted in Figure 36.

Figure 36 – Number of ferries and fast ferries built globally in in the last 10 years, and equivalent prognoses for the upcoming 10-year period. Source: Clarksons Research and Menon Economics



Regulations introduced by the government paired with subsidies to green projects give the Norwegian maritime industry an opportunity to increase their global market share in this market. Norway has an especially strong position in terms of design and building of vessels with alternative fuels with high complexity, as well as production of equipment for these types of ship (Valstad, et al., 2020). As of today, 45 ferries in Norway have hybrid and 21 have fully electrical propulsion systems. One of these hybrid ferries can use hydrogen as fuel and was built in Westcon shipyard, Norway – one of the first vessels using hydrogen as fuel globally. Moreover, 19 out of 21 ferries that are ordered by Norwegian shipowners in the orderbooks have battery propulsion systems, either hybrid or only battery propulsion.

Although Norwegian actors within the maritime industry are well positioned to seize the opportunity, only 3 out of 21 vessels ordered by Norwegian shipowners in this segment will be built in Norway as of today's orderbooks. The rest of the newbuilds that are contracted will be built mainly in Turkey, followed by Singapore and the Netherlands. While this could be a result of capacity problems and hence a temporary situation, it may also be an indication for increased competition from other shipbuilding nations and decreasing market share for Norwegian shipyards.

Short sea cargo vessels

In line with the rapid growth in world trade volumes, the 2000s were characterized by a steady growth in global newbuilding of short sea cargo vessels. This came to a halt when the financial crisis hit, and building activity has decreased consistently since then, except for temporary growth in specific subsegments.

Short sea cargo vessels are in general characterized by a low level of complexity, and hence, are primarily being built in Asia. In recent decades it is China, Japan and South Korea that have taken dominant positions in the building of these vessels. Table 3 provides a summary of the global market for newbuilds and the position of Norwegian shipowners and shipyards within the segment. As made clear by Table 3, Norwegian shipyards have

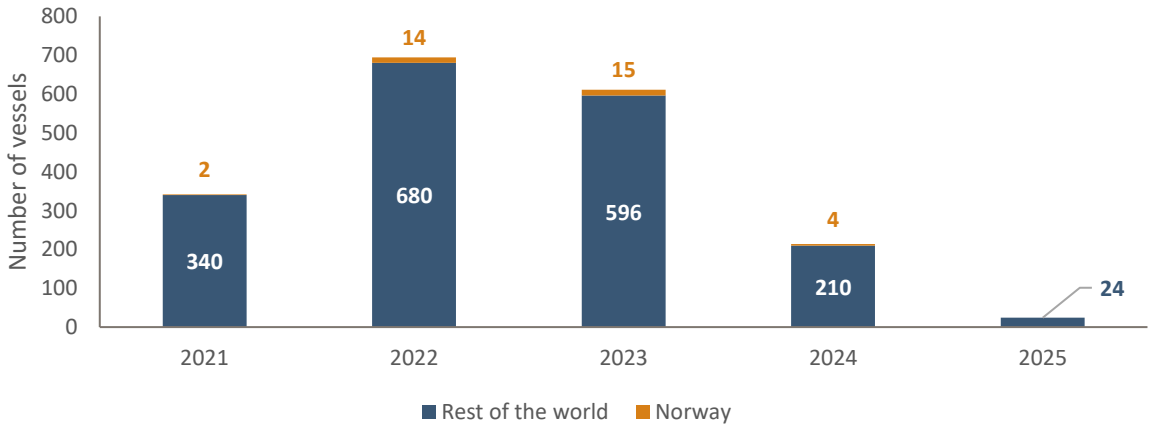
not been active in this segment in the last decade, with only two short sea cargo vessels built in the Norwegian shipyards. Similarly, a total of only 85 short sea cargo vessels were ordered by Norwegian shipowners in this period, which makes up 1 percent of the number of newbuilds in the last decade.

Table 3 – Market for newbuilds for short-sea vessels[18]. Source: Clarksons Research & Menon Economics

	2011-2015	2016-2020
Global market, total number of short sea cargo vessels built	3556	2219
Norwegian customers' share of total newbuilds	2%	1%
Norwegian yards' market shares	0%	0%

Today's orderbooks signal a similar position for Norwegian shipyards and shipowners for this segment, as depicted in Table 3. Norwegian shipowners make up a small proportion of the ordered short sea cargo vessels and just one percent of the total orders. Most of the short sea vessels in the orderbooks will be built in shipyards in China, South Korea, and Japan.

Figure 37 – Short sea cargo vessels in global orderbooks, ordered by Norwegian shipowners and shipowners from the rest of the world. Source: Clarksons Research & Menon Economics



Even though the Norwegian shipyards have stopped building this type of vessels long time ago, the newbuild activity is still crucial for the Norwegian equipment suppliers and specialized service providers. These include important members of the Møre cluster such as Kongsberg Maritime, Skipsteknisk and Ulstein ship design. Almost two thirds of equipment suppliers' production is exported directly, and another 22 percent is sold to Norwegian customers and then exported. We estimate that in 2020 the equipment suppliers and service providers got more than 20 percent of their turnover from shortsea and deepsea shipping customers.

[18] *Short sea cargo vessels are defined as dry bulk vessels, liquid bulk vessels and container vessels under 20 000 DWT.*

Prognosis

As shown in the figure below, the global short sea cargo fleet is old. Almost 75 percent of the small dry bulk vessels are older than 20 years. These are followed by small container ships with 60 percent and small liquid bulk vessels with 55 percent of the fleet older than 20 years. In the light of the existing fleet aging and increased pressure from regulators for decarbonization, the need for renewal of the global fleet is obvious. This is likely to be done both through newbuilds and retrofits.

Figure 38 – Age distribution of the global cargo fleet. Source: Clarksons Research & Menon Economics

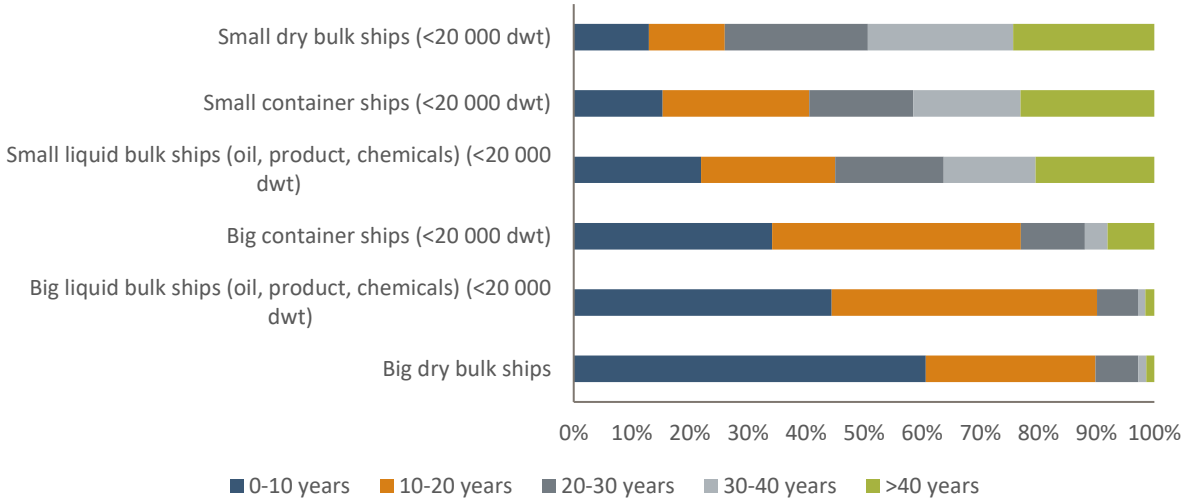
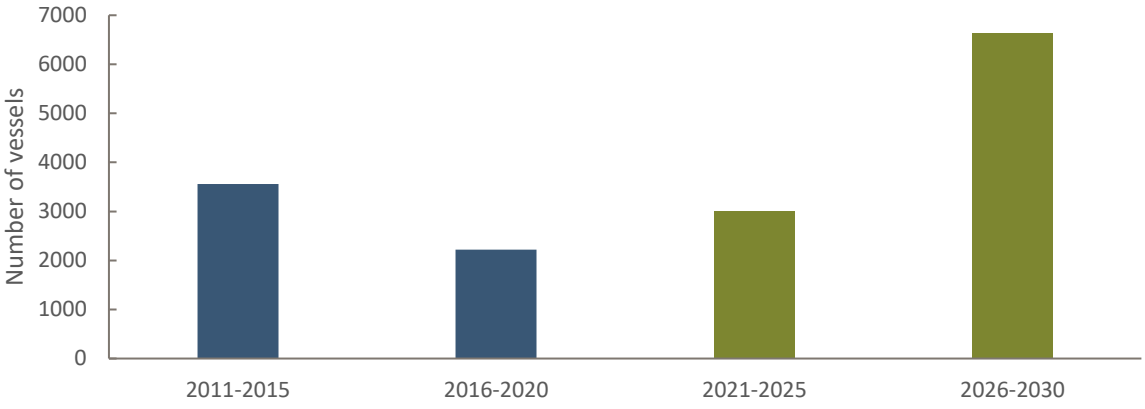


Figure 39 illustrates the newbuilding activity in short sea cargo segment in the last decade and expected number of newbuilds in the upcoming years. We expect to see a significant increase in the newbuilding activity especially in the second half of the next decade. Moreover, most of the newbuilds in this segment are expected to have low or zero emission propulsion systems and/or alternative fuels.

Decarbonization in the short sea cargo segment is crucial for the decarbonization in the shipping sector in several ways. Firstly, the global short sea cargo fleet is huge, and decreasing emissions in this segment will contribute notably to decreasing emissions from the global shipping sector. Secondly and most importantly, the segment is characterized by relatively shorter distances which makes it suitable for battery propulsion systems, both hybrid and fully electrical. Finally, short sea cargo vessels are suitable also for other types of alternative fuels and energy carriers such as LNG, biofuel, e-fuels, hydrogen and ammonia. Most of these fuel types are produced on a small scale, or do not have infrastructure in place to supply the sector as of today. There are only a handful of vessels that use hydrogen, and no vessels that use ammonia today. However, the short sea segment plays a crucial role in maturing these new technologies, in terms of both supply and infrastructure for fuels, but also propulsion systems and machinery in compliance with these. In the long run, these technologies and alternative fuel types will also be applied to deep sea vessels that have a significantly bigger power need and emissions.

Figure 39 – Expected increase in number of newbuilds for short sea cargo segment. Source: Clarksons Research & Menon Economics



Appendix: ACO_2-emissions for different ships segments in Norway – an overview

According to IMO, emissions from global maritime transport stand for 2,9% of global greenhouse gas emissions (IMO, 2020). Activity in the global shipping sector is expected to increase over the decades, and if current growth rates persist, the emissions from the shipping sector will double by 2050. Looking forward we expect to see an increased focus on solutions that decrease the carbon footprint of the shipping sector.

The change is driven by three main forces: regulations and policies, expectations of cargo owners and consumers, and access to investors and capital (DNV, 2021). On a global scale, IMO is seen as the biggest regulator. In 2020 the sulfur cap came into effect, which limits the sulfur content of fuel used to 0,5% and even lower in designated areas such as the North Sea. Moreover, IMO requires newbuilds to have a minimum energy efficiency level per mile, specified through the EEDI-scheme[1]. EEDI requirements came into effect in 2013 and the minimum efficiency threshold has been increased periodically ever since. The third phase for EEDI requirements, which is also the last phase, was planned to be introduced in 2025. However, this date was later pulled forward to 2022 for certain vessel types. IMO has also introduced regulatory schemes such as EEXI and CII, which are operational measures to improve energy efficiency of, and decrease greenhouse emissions from, existing vessels. These will enter into force as of 2023. On a regional level, the European Union's target for 55% reduction in greenhouse gases by 2030 and net zero emission target by 2050 introduces serious measures also for the shipping sector. Incorporation of maritime transport into the emissions trading system, FuelEU Maritime, and the taxonomy for sustainable finance will have significant effects in the next decade. The Norwegian government has also introduced a 50% reduction target for greenhouse gas emissions from domestic shipping and fishing activities. The government aims to achieve this goal through introduction of regulations for different ship segments and financial support schemes.

In the light of the recently introduced regulations and increased pressure to reduce emissions as soon as possible, it is important to identify the segments with the biggest emissions to in turn decrease emissions in a cost-efficient matter. Different ship segments have different characteristics and sailing patterns, and hence different needs and opportunities to achieve decarbonization. Vessels used for deep-sea shipping do for example sail very long distances and have a considerable energy need in turn. Ferries on the other hand operate on shorter distances and with predictable schedules. This in turn makes ferries and other ship segments with similar characteristics suitable for the use of batteries, which is an available technology with zero emissions today. As of today, there are 66 ferries in Norway that have fully electrical or hybrid propulsion systems powered by batteries, and this number is expected to increase in the upcoming years.

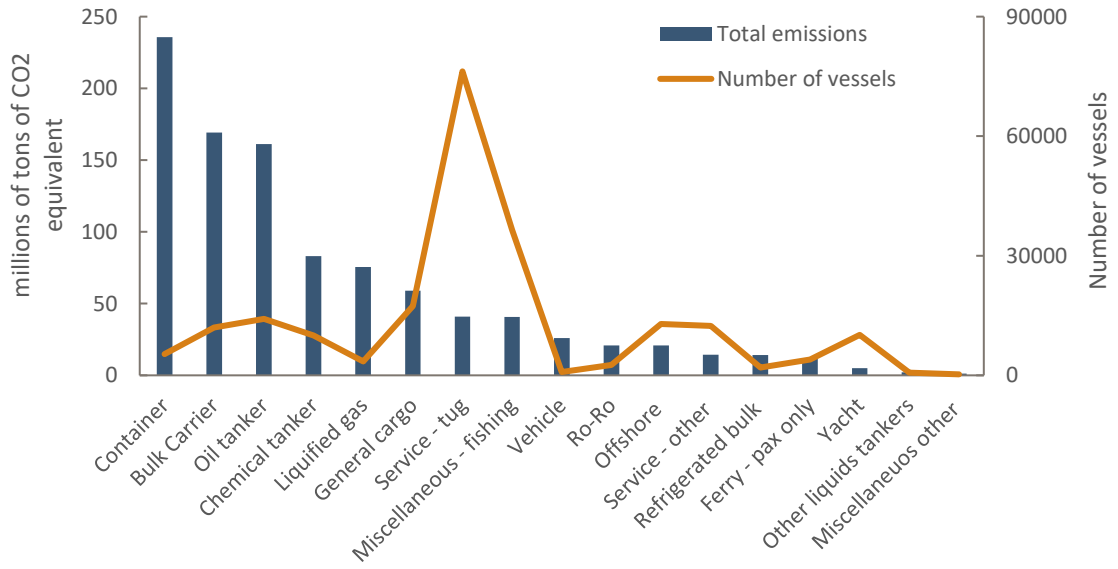
For vessels used for deep-sea shipping on the other hand, use of batteries is not a feasible solution. These types of vessels travel long distances without being able to connect to a charging facility. A currently viable fuel option with lower emissions is LNG, which has a 20% lower CO2 emission level compared to conventional fossil fuel sources. On the other hand, 20% reduction in emissions will not be enough if we are to reach the 50% reduction goal of IMO by 2030. In this case alternative fuels and energy carriers such as ammonia, hydrogen and biofuels have a greater potential to achieve net zero emissions from the shipping sector. Use of alternative fuel types is seen as a crucial component on the path to net zero greenhouse gas emissions. As of now these technologies are only in pilot phases and are mainly produced by using fossil fuels. However, we are likely to see these in the market by 2030.

CO2 emissions based on ship type

The 4th Greenhouse Gas Study from IMO (International Maritime Organization) provides estimations for the greenhouse gas emitted by shipping sector, per ship segment. The study employs two different calculation approaches, namely bottom-up approach, and top-down approach (IMO, 2020).

The bottom-up approach uses AIS data as its starting point. The operational activity is obtained from the AIS database and then combined with fuel consumption data for ships that are marked as active in HIS database. This methodology allows greenhouse gas emissions to be calculated per vessel, which later can be aggregated to obtain the global emissions from the shipping sector. The top-down approach employs a methodology to further allocate the emissions to global and domestic shipping activities. The bottom-up approach on the other hand employs the fuels sales statistics from IEA (international Energy Agency) as its main data source. The methodology examines three types of fuels that are most used (fuel oil, gas/diesel and natural gas) in domestic and international shipping and fishing activities. Finally, this methodology estimates emissions by using fuel consumption data and ship engine characteristics.

Figure 40 – Global CO2 emissions from shipping according to ship type

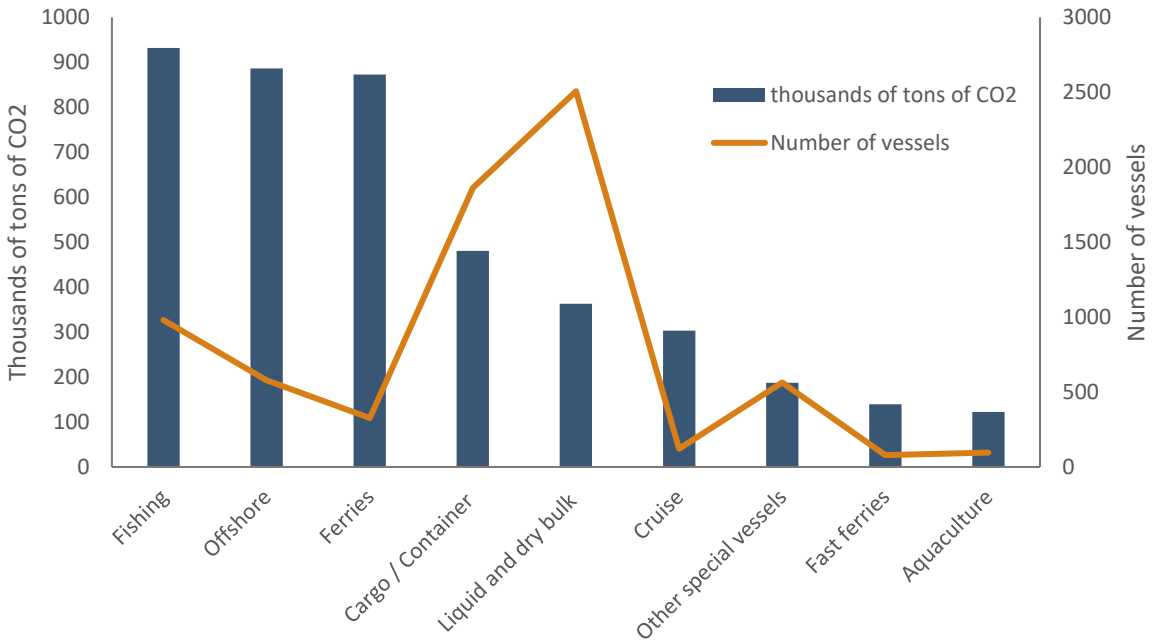


The study published the bottom-up calculation for each ship segment, according to size categories. Figure 40 illustrates the total CO2 emissions for each segment in millions of tons of CO2 equivalent (left axis) and number of vessels within each segment (right axis). As we can see from the figure, the container segment stands out with the highest emissions and with a relatively low number of vessels. Almost all the vessels in this category are smaller than 20 000 DWT, which is our classification criteria for short sea cargo vessels. As we have discussed in the market analysis, decarbonization potential is very high for this segment considering the relatively shorter routes they sail and the age of the fleet. Bulk carrier on the other hand includes mostly vessels bigger than 15 000 DWT, which indicates they can be used for deep sea shipping. This segment is the hardest to decarbonize since they sail long distances with limited bunkering opportunities. Low-emission propulsion systems or alternative fuels available as of today are not applicable to this segment. Bulkers are followed by tankers, which again have large emissions from a relatively small number of vessels. Tugs make up the biggest segment in terms of number of vessels, yet they are responsible for a relatively small volume of emissions.

Similar calculations were made in 2018 specifically for Norwegian waters (DNV, 2019). The study uses AIS data for all the ships that have sailed in Norwegian waters and the characteristics of these ship, such as size and fuel usage. The authors thereafter calculate the greenhouse gas emissions based on these parameters, taking the expected increase in fleet size into account as well. The goal of the research is to identify measures that will lead to a reduction in greenhouse gas emissions and are technologically available and realistic, at the lowest economic cost.

The study finds that more than 7100 ships with AIS signal systems sailed in Norwegian waters in 2018, emitting a total of 4288 kilotons of CO2. This is equivalent to 4 percent of the global emissions for the shipping sector as depicted above. 31 percent of the vessels depicted sail under the Norwegian flag (NIS/NOR) and are responsible for 35 percent of the emissions. The distribution of CO2 emissions with respect to ship type is presented in the figure below. Fishing boats, offshore ships and passenger ferries are the biggest contributors to domestic emissions from shipping in Norway. These are followed by freight and bulk ships. Vessels for the aquaculture segment contribute the least amount to domestic CO2 emissions with the second lowest number of vessels.

Figure 41 – Domestic CO2 emissions from shipping in Norway according to ship type



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