The Norwegian aquaculture analysis 2017
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The Norwegian aquaculture analysis: an overview

We are pleased to present EY 2017 analysis of the Norwegian aquaculture industry. The analysis covers companies within the value chain from technical solutions to production and export of salmon and trout.

EY, as a multidisciplinary provider of professional services to leading companies within the industry, possesses insights in each segment of the value chain with EY professionals located in numerous seafood clusters and marketplaces.

When analyzing the developments in the aquaculture industry, global megatrends and the challenge of disruptive innovations are of great importance. Underlying forces of disruption are technology, globalization and demographics. Our research has further identified the following key megatrends that will affect the global food, and salmon in particular, industries:

- Growing world population and need for nutritious food
- Health conscious consumers
- Increased focus on sustainable food production
- Increased urbanization

This perspective puts the demand side of Norwegian aquaculture industry into a larger global framework with implications greater than creating local value. By responding quickly and proactively to these trends, new business opportunities and value creation will emerge throughout the whole value chain and not only within farming. The latter is currently experiencing volume constraints due to biological challenges, regulations and need for technology development. For salmon farming, which represents as little as 1.5%-2% of the global fish and marine farming, the potential transfer value of know-how and technology applied to other species and agriculture sector is considerable.

For the sake of completeness and due to the fact that the majority of the 2017 financial statements are not yet public, the analyses in this report are based on financial reporting as per 2016. However, we have taken into account the positive developments in the industry and periodic reports during 2017, when we have made our assessments and analyses.

The export value of sea farming has more than doubled since 2006. According to the Norwegian Seafood Council, Norwegian companies’ export of salmon and trout were valued NOK65.2b and NOK67.2b in 2016 and 2017, up from NOK49.9b in 2015. The key driver was the price growth in 2016-17 following the decline in salmon harvest volumes in Norway and Chile in 2015-16. Other drivers were the favorable exchange rates due to a strengthened competitiveness for Norwegian goods and services abroad, and low domestic interest rates.

Throughout 2016-17, the industry again experienced record high export value and revenue levels and the profitability (EBITDA margin) was slightly above the most profitable year, 2010, at 15.1%. However, had it not been for the significant rise in operating
costs in the period, which has been mainly driven by the increasing challenges with sea lice and diseases, the profitability could have been even higher. In 2016, there is also an increase in opex as more focus is put on mitigating factors.

The feed and sea farming segments retain their positions as the strongest contributors to value creation. Within these segments, the industry has managed to develop large industrialized business units. However, there are forces reducing the margins and the strategic strength of the traditional feed producers, calling for business repositioning and core product development.

Furthermore, the fish health segment has shown a relatively stable profitability over time, whereas there has been a negative and volatile development in the egg and spawn production as well as in the processing segment. In 2016, the margin in the egg and spawn production segment showed an upward trend, as opposed to smolt production that delivered stable margins on rising revenues as a result of larger smolt being sold.

Wellboat businesses continued to be very profitable, with an all-time high revenue and EBITDA margin in 2016. We do, however, expect consolidations in this segment going forward.

The technical solutions segment is still fragmented, but has, throughout 2016 and 2017, experienced several mergers and acquisitions, giving rise to companies of a more optimal size. Hence in the future, we expect to see accelerating innovation and product development. The focus on adaption of insights and technology from the sectors such as subsea, offshore and shipping will further stimulate applied solutions to the aquaculture industry and give rise to market opportunities in the aquaculture sub-segment other than salmon production. We are, therefore, still of the opinion that this segment is increasingly important to follow.

Given the positive development of the salmon aquaculture industry in the recent years we have seen an increased interest for this industry among investors and financial institutions, but also players entering the aquaculture value chain. Industry representatives recognize this positive attitude by the way of industry sentiment surveys. However, by nature, such measures are biased and tend to underestimate the efforts needed to manage challenges and realize opportunities in an industry exposed to biological risks, consumer disruption and strong competition from a range of products and substitutes. Reputational risk related to sustainable production, fish health and sound production may represent the greatest market risk for the industry.

I hope you find our annual analyses both interesting and enlightening. If you have any comments or questions with regard to the analyses, please don’t hesitate to contact us to discuss the aspects of this exciting industry.

Eirik Moe  
Sector Leader, Aquaculture and Seafood  
Ernst & Young AS
The aquaculture industry at a glance 2016 and 2017

5% decrease in harvest quantity of Atlantic salmon compared from 2015 to 2016: Despite favorable temperatures compared to that of preceding years, the potential for increased harvest was hampered by sea lice challenges. Total harvest quantity for 2016 equaled to 1,171,200 tons whole fish equivalent (wfe),* decreasing by 63,000 tons wfe.1

19% mortality

an increase from 16% from 2015 to 2016: This equals to 53 million salmon dying inside the cage. An important reason for the high numbers is the sea lice, which according to Cargill (EWOS AS), is costing the industry NOK10b every year.2

Big data and artificial intelligence

were introduced in the Norwegian aquaculture industry in April 2017. Big data shared by large industry players makes NCE Seafood Innovation Cluster’s AquaCloud able to successfully predict sea lice two weeks in advance. The platform – powered by IBM’s Watson – also evaluates financial and biological effects of proposed actions.5

29% increase in total export value and all-time high margins

for Atlantic salmon compared from 2015 to 2016 values: The Norwegiansalmonfarmersexperiencedhighprices throughout 2016, on average up almost 40% compared to 2015. This led to a total export value of NOK61.5b (NOK63.5b including trout). The high prices more than balanced increasing costs in the industry leading to an EBIT per kg (large companies) of NOK20.86, which is more than double compared to NOK9.62 in 2015.1

Export value of salmon and trout in 2013-2016

In October 2017, the Norwegian Government introduced a new initiative for predictable and sustainable growth in the aquaculture industry — the traffic light system.

The initiative dives the Norwegian coast line into 13 production areas, and labels them green, yellow or red, depending on their lice and disease situation. If a given area is green, fish farmers are offered a 6% growth opportunity every second year. Yellow areas are kept constant, while red areas are not allowed to grow and can lead to a 6% reduction in maximum allowed biomass (MAB) depending on the conditions. Farmers in red areas who can document zero lice (e.g., through closed systems) may still be offered growth.1

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1 Whole fish equivalent (wfe) is a standard weight denomination (after gutting) and corresponds to a conversion factor of ~6%–8% from live weight.
Welcome to the second edition of EY’s annual review of the Norwegian aquaculture industry. In this report, we focus on recent developments within the sector and analyze the possibilities that arise from digitalization and use of big data.

The Norwegian aquaculture industry has witnessed a tremendous development through recent years, with a total revenue growth of almost 300% in the last 10 years, and an approximately 18.5% growth in 2016. Prices have increased continuously following the growing demand in existing markets and evolution of new markets. In addition, volumes decreased in 2016, contributing to the price growth.

Both the industry as a whole and the different segments of the value chain attract a lot of attention. With this report, EY sets out to give you the big picture and a better understanding of the financial performance of the aquaculture industry.

In this edition, we focus on the key developments within the last financial year 2016, together with our views on the possibilities that arise as digitalization and use of big data become more and more widespread. With a database including more than 700 Norwegian companies, we can provide insights based on large amounts of data.

Inclusion criteria
A company is defined as a Norwegian aquaculture company if both of the following criteria are met:
• At least 50% of its turnover is generated in the aquaculture industry.
• It is a Norwegian-registered legal entity

Value chain segments
• Technical solutions
• Biotechnology
• Production
• Distribution
• Processing

Company size definition
• Large companies: revenues above NOK1b
• Medium-size companies: revenues between NOK100m and NOK1b
• Small companies: revenues below NOK100m

Methodology
In order to analyze the financial activity by geographic locations and across the value chain, we have gathered information from stand-alone financial statements of individual legal companies. For companies operating with divergent financial periods, adjustments have been made to present the data on a calendar-year basis.

Many of the identified companies have activities in several geographic regions and offer products and services in more than one segment of the value chain. However, in this analysis, each company is linked to only one geographic region, based on its main business address, and to only one segment of the value chain, based on its main activity. This simplification could result in subsegments being over- or understated compared to the actual total. For larger industrial conglomerates with multiple subsidiaries, each entity is allocated to its respective best fit segment.

The methodology does not capture or eliminate intercompany transactions or revenues in holding companies registered abroad.

Please note that the analysis is limited to the domestic aquaculture industry. Thus, foreign units owned by Norwegian companies are not reflected in the analysis. This may give a somewhat misrepresentative picture, particularly for the companies noted on the Norwegian Stock Exchange, as many of them have a substantial part of their business outside Norway.
Key findings

Increased revenues in 2016

The year 2016 was great for the aquaculture industry. All segments and subsegments experienced revenue growth from 2015 to 2016, and the aggregated revenue increased from NOK161.5b to NOK212.7b, representing a 31.7% growth year-on-year. However, approximately NOK14b of the revenue growth is driven by a reorganization within the aquaculture industry. The trading segment, which in 2015 was an integrated part of the production company Marine Harvest Norway AS, was carved out into a separate company (Marine Harvest Markets Norway AS). This revenue was in 2015 and previous years eliminated in the combined revenue for the aquaculture industry, as it was reported as part of the production company.

The main driver behind the revenue growth in 2016 is undoubtedly the price for farmed Atlantic salmon. A combination of increased demand and a 5% reduction in the Norwegian salmonids’ harvest volumes contributed to the average price increase of almost 40% from 2015 to 2016.

While the companies in the sea farming subsegment were the ones which most benefited from the price increase, the increase has had positive spillover effects on most of the companies operating within the Norwegian aquaculture industry.

EBITDA and EBITDA drivers

In 2015, despite the aggregated revenue growth, the aquaculture industry experienced a slight margin reduction for the second year in a row. This margin reduction was mainly accredited to the sea farming subsegment and the increased cost level associated with sea lice and diseases.

Due to continued biological challenges and high feed costs, the general cost level in the sea farming subsegment continued to increase in 2016, both in absolute and relative terms. However, in 2016 the significant price increase for farmed Atlantic salmon outweighed the sustained increasing cost level, contributing to a record high EBITDA margin of 37.2% for this subsegment in 2016.

The cost for the other segments in the aquaculture industry also increased in 2016, however, at a slower pace than what was observed in 2015. On the other hand, for most of the segments, the revenue growth was well above the cost increase, resulting in improved EBITDA margins in 2016 compared to that of 2015. The aggregated EBITDA for the aquaculture industry increased by NOK14.2b (79%) from 2015 to 2016, and the EBITDA margin increased from 11.1% to a record high 15.1%.

Given the relatively large size of the production segment, it is no surprise that the EBITDA margin for the aquaculture industry is closely linked to the performance of this segment. In the production segment, there is a clear correlation between the development in the EBITDA margin and the development of the average salmon price. And, as reflected by EBITDA-bridge below, the same applies for the EBITDA margin for the entire aquaculture segment.

We will take a closer look at the key drivers per segment on the next page and later in this report.
Segment distribution

The profits are unevenly distributed among the different parts of the value chain, and as commented in the previous section, the production segment is generating the largest share of the aggregated EBITDA level in the Norwegian aquaculture industry.

From the “Segment distribution” chart provided, it is also evident that the production segment’s share of the aggregated EBITDA is closely linked to the change in the average salmon price—from as low as 51% of total aggregated EBITDA in 2012 to 81% of the total EBITDA in 2016.

The production segment was not the only segment having a positive development in 2016. With the exception of some of the “downstream” subsegments (i.e., trading, processing and packaging), all subsegments experienced EBITDA growth and increased EBITDA margins.

Technical solutions segment

The growth in the technical solutions segment can largely be attributed to the development in the sea farming subsegment. Salmon producers have, for instance, invested in new technologies, new software and more modern and efficient equipment to bring down the cost and increase efficiency.

Biotechnology segment

The growth in this segment is positively influenced by higher salmon prices and a higher demand for both healthy and efficient fish feed and fish vaccines and medicines.

Production segment

While the smolt production subsegment has generated relatively stable margins, egg and spawn production and sea farming recognized significantly higher margins in 2016 compared to that of 2015. As previously noted, the significant increase in the average salmon price is the driving factor behind the sea farming EBITDA margin growth. The same applies for the egg and spawn producers, which, in 2016, experienced strong revenue growth attributed to the sale of mature salmon grown on the egg producers’ own licenses, as opposed to egg and spawn.

Distribution segment

Whereas transportation at sea and slaughtering experienced stable or a slight increase in EBITDA margins in 2016 compared to that of 2015, the trading subsegment experienced negative EBITDA margins in 2016. Trading companies struggled to push through the increased salmon prices to international consumer markets. Also, fixed price contracts with prices significantly lower than the purchase price (i.e., the spot price) had a material negative impact on some of the trading companies.

Processing segment

The same trend observed for the trading subsegment is relevant for the processing subsegment. While the revenue is positively impacted by the increase in average salmon prices, the processing companies are not able to fully transfer the effect of increased salmon prices to the end customer.
The development license system aims at facilitating evolution of technology for solving both environmental and territorial challenges in the aquaculture industry.
New regulations from 2017
The Ministry of Trade, Industry and Fisheries has implemented the following rules to regulate the new growth system, effective from October 2017.
• An entity with licenses in one area can apply to move a share of its capacity to an adjacent area. Thus, all entities could produce in two areas with a joint MAB allowance.
• Entities meeting certain environmental requirements regarding sea lice will be offered growth regardless of the status in their production area.

Further, the coast is divided into 13 different areas each with a corresponding color (traffic light system). Green areas will be offered growth; red areas will eventually get reduced MAB, starting in 2019. In yellow areas, the allowances are frozen for now. Total long-term MAB growth for all areas is expected to be slightly less than 3% (24,000 metric tons MAB).

Development licenses
The development license system aims at facilitating development of technology for solving either environmental or territorial challenges in the aquaculture industry. The system is a temporary arrangement that offers licenses to certain projects based on innovation and resource requirements, and it requires sharing of developed technology in order to generate industry-wide improvements.
In 2017, the following development licenses have been issued:
• Nordlaks Oppdrett AS - Havfarm: Ocean-based farm
• MNH Produksjon AS - Aquatraz: Semi-closed farm technology
• AkvaDesign AS: Closed farm technology
• Marine Harvest Norway AS - Egget: Closed farm technology

The application deadline was 17 November 2017. There are still 75 applications not yet processed, implying we could expect more issuances in 2018.

Green licenses
Green licenses were issued in 2014 based on five (mainly) environmental and territorial challenges. There have been no changes in green licenses in 2017.
Digitalization
Digitalization will bring new challenges and unique opportunities

We believe that the sector as a whole will change materially and grow in the coming years as a result of sustainable innovations and investments in digitalization. These changes will bring new revenue streams and opportunities for economies of scope and scale. The players succeeding at digital innovation will be in a strengthened position.

Emerging opportunities
• New data-based business models and partnership models
• Production optimization through cross-value-chain, data-driven analysis and predictive models for growth, feed or pathogenic factors
• Optimized operations and traceability through digital supply chain and blockchain
• Reduced maintenance costs and operational risk through integrated operations, sensor- and camera-based monitoring, UAV and UUVs and data-driven predictive maintenance
• Reduced downtime and supply cost using on-site 3-D printing for replacement parts

Challenges to manage
• New competencies required across both individual organizations and the sector to operate new technology and realize benefits from analytics
• Stricter demands for data accuracy as data becomes a more valuable asset
• Increased operational risk as technology reliance increases

Digitalization is not IT. Successful companies will be able to innovate to increase revenues, reduce costs, risks and environmental footprint.
Global perspective

A global perspective of the Norwegian aquaculture industry

Megatrends supporting the continued growth of the aquaculture industry

- A growing world population needs an increasing amount of high-protein, nutritious food
- Focus on climate change and a resourceful planet requires sustainable food production
- Health conscious consumers and growing health needs will drive demand for healthy food
- Increasing urbanization will raise household incomes, affecting the types and timing of food product demand

Norway - the world’s leading salmon supplier

Norway contributes more than 50% of the global salmon production and, despite low volume growth forecasts, is expected to maintain this market leading position in the years to come.

About 95% of the salmon produced in Norway is exported. The demand for farmed Atlantic salmon is increasing, and according to the Food and Agriculture Organization (FAO) of the United Nations (UN), Norwegian salmon is expected to grow its market share in key markets in the coming years.

The aquaculture market is expected to grow with a CAGR of about 5% between 2016 and 2020, reaching 2.6 million tons in 2020.1

The share of aquaculture in global fish production is estimated to increase from 44% in 2013-15 to 52% in 2025, surpassing capture fisheries.2

Another interesting observation is that Norway contributes only about 1.7% of the global seafood farming volume, all species included, which shows that salmon farming is still a small industry in the global perspective.3

World production of Atlantic salmon (rw 1,000)

Source: Pareto, Kontali 2017

Further export opportunities

Norwegian technical suppliers to the aquaculture industry have, in our view, an untapped potential to further leverage their competency, experiences, products and services to markets outside Norway.

With inspiration from the international journey of the Norwegian oil service segment and improved financial strength from new owners and investors, the technical supplier segment should aim to increase its global footprint in the years to come.

Global footprint of Norwegian sea farming companies

This analysis only includes Norwegian registered companies; however, the reach of the Norwegian aquaculture industry goes far beyond that. Many companies, sea farming companies in particular, have extensive business through foreign entities too. The revenue and results of these entities are reported in the consolidated group accounts of the Norwegian parent companies, but excluded from this analysis.

Of the total volume produced in 2016 by the largest Norwegian sea farming groups, almost a third of the reported volume was produced abroad. In other words, Norwegian companies are the key drivers behind a significant part of the volumes produced in countries such as Chile, Canada and the UK as shown in the above graph.

In our view, the global footprint of Norwegian sea farming companies could, to a larger extent, serve as a gateway for more technical and other aqua-related suppliers into international markets.

1 Source: Pareto
Norwegian companies have an untapped potential to supply products and services in the global market.
The value chain
When discussing the aquaculture industry, we primarily talk about the end product — salmon and trout — but there are many other stages and actors in the industry. The aquaculture value chain includes broodstock (egg and spawn), smolt, edible fish, fish processing (based on farmed fish), export and trade, and suppliers of goods and services.

For analytical purposes, the value chain and the value creation can be presented in different ways.

In particular, there are three groups of suppliers, namely technical solutions suppliers, biotechnology suppliers and distributors, which can be challenging to present in a common value chain. These three can also be perceived to work in tandem or as parallel activities.

It is apparent that technical solutions suppliers are needed at every stage of the value chain (see “The Atlantic salmon life or production cycle”). Hence, presenting them as just one segment can be misleading.

Biotechnology suppliers, who deliver a wide range of products including feed, vaccines, medicines and cleaner fish, face the same challenge. The common denominator for these products are the biological or pharmaceutical raw materials. The biotechnology manufacturers supply both egg and spawn producers, smolt producers and sea farmers.

The distribution phase is also complex. Sea transportation is needed for both transporting smolt from freshwater to cages in seawater, and transporting harvestable fish to processing plants. In addition, we have traders and exporters who purchase fish from sea farmers and provide it to the end consumers, either slaughtered or processed.

The primary value creating activity in the industry is production. The production cycle is about three years. During the first year, eggs are fertilized and the fish are grown to 100 grams in controlled freshwater environments. Subsequently the fish are transported into seawater cages where they are grown to about four to five kilos. This growing process takes 14-24 months, depending on the seawater temperature.

Despite the methodological challenges, we have decided to present technical solutions, biotechnology and distribution together with production and processing in one single value chain. This is to make the analysis easier to follow and interpret.
Technical solutions
Increased M&A activity in the technical solutions segment

About the segment
The technical solutions segment includes companies with approximately 50% or more of its business linked to the aquaculture industry, but which are not directly linked to any of the other segments. Hence, there is a large variety of products and services provided by the companies in this segment.

The largest companies within this segment are producers of technical solutions and services specifically developed for the aquaculture industry, e.g., barges, wellboats, feeding systems, cages, mooring systems, sea lice treatments and software.

Segment highlights
• The year 2016 was another great year for the technical solutions segment with record high revenue and margin levels. Revenue grew by approximately NOK2b (+18%), and the EBITDA margin increased from 9.7% in 2015 to 11.6% in 2016.
• Record high earnings driven by price increase, but no volume growth, biological challenges and a general increase in production cost.
• All these factors have a positive spillover effect on the technical solutions segment. High cash flows combined with no volume growth have given the salmon producers incentives to invest in more modern and efficient equipment.
• Further, the increase in production cost also provides incentives to invest in new technologies and software to bring down the cost, for instance, by improving the feed conversion ratio or monitoring the biomass to bring down mortality rates.
• The biological issues have also positively contributed to the growth in the technical solutions segment, where several companies have developed new and alternative solutions for battling sea lice, for example.
• As we mentioned in our first edition of the Norwegian aquaculture analysis, the technical solutions segment is fragmented and still dominated by small- and medium-sized companies. In 2016, there was an increase in the M&A activity in this segment, and has continued throughout 2017. We anticipate continued growth in the number of mergers and acquisitions due to high interest from industrial and financial investors.
Biotechnology

Revenues continue to grow with increased salmon prices and focus on fish health

About the segment
The biotechnology segment includes companies offering services and products related to feeding, medicines, vaccines and cleaner fish (e.g., different wrasse species and lumpsuckers eating lice off the salmon).

We have divided the segment into two subsegments:
1. Fish health
2. Feed

Segment highlights
• Biotechnology is vital in maintaining healthy fish stocks at low prices, by contributing to both nutritious feed and prevention of diseases. Diseases represent the largest risk factor in the aquaculture industry, and the cost of feed is the most prevalent cost component in fish farming.
• The Norwegian Biotechnology Advisory Board has participated in introducing the “digital salmon,” stating that in 20 years, it might be prohibited to do experiments on living species without having modeled potential effects beforehand. The “digital salmon” is a data modulated salmon to be used to discover effects of different fish feed before testing it in real life. This opens possibilities for new effective research in the field of feed-related biotechnology.
• Aggregated revenue in the biotechnology segment has, not surprisingly, continued to grow from 2015 to 2016 with an increase of NOK3.7b (+14.9%), ending on NOK28.4b in 2016. The growth is positively influenced by higher salmon prices and higher demand for both healthy fish feed and fish medicines and vaccines.
• Revenue growth is primarily driven by a few large companies. The five largest companies accounted for 75% of total revenues in 2016. Of these five companies, only one belongs to the fish health subsegment, the rest to the feed subsegment.
• There is a large spread in EBITDA margins across the segment. While the large feed-producing companies are operating at high volumes and low margins, some of the small companies, typically operating in the fish health subsegment, operate at much higher margins.
  • Small companies had an average EBITDA margin of 22% in 2016, a 7 percentage points (pp.) increase compared to that of 2015.
  • Medium companies had an average EBITDA margin of 15% in 2016, a 2pp. increase compared to that of 2015.
  • Large companies had an average EBITDA margin of 9% in 2016, a 4pp. increase compared to that of 2015.
Biotechnology (contd)

Revenues continue to grow with increased salmon prices and focus on fish health

Fish health

- A key risk factor affecting the salmon farming industry is fish health. Contrary to common belief, antibiotics are not the most applied medical treatment of farmed fish. Antibiotics as treatment has declined almost 100% since the 1980s. The development of new and more efficient vaccines and treatments for fish has been an important contributor to the growth and development of the industry.

- Many diseases are prevented through vaccination as early as in the freshwater stage. There are, however, still major battles to be fought. Currently, sea lice represents the biggest threat to Norwegian salmon farming, but there are risks of other illnesses as well, e.g., pancreas disease (PD), heart and skeletal muscle inflammation (HSMI) and infectious salmon anemia (ISA).

- Sea lice causes damage by eating mucus, skin and blood. This can lead to other infections such as bacterial, fungi and suboptimal salt balance. The sea lice challenge in the sea farming phase and the development of drug resistance calls for new innovative solutions. The Norwegian Government has addressed this need through the introduction of research and development licenses. These licenses have built-in incentives for different solutions managing sea lice and disease challenges.

- The Norwegian Directorate of Fisheries released a new regulation regarding PD in August 2017 with the purpose of reducing consequences and preventing spread of the disease. It has established a strengthened border between the PD zone (Jæren to Nord-Trøndelag) and the surrounding surveillance zones to reduce risk of spread.

- Significant investments have been made monitor and prevent diseases in fish. For example, Cermash's individual farming concept iFarm was found to be within the scope of the Norwegian R&D licenses system in October 2017.

- The fish health subsegment has experienced continuous revenue growth and generated NOK3.9b in revenues in 2016, an NOK0.2b (+5%) increase compared to that of 2015. Increased awareness on fish health is driving demand in the Norwegian market as well as in overseas markets in Europe, North and South America and Asia.

- The subsegment’s EBITDA margin has been relatively stable for 10 years, and growing since 2013. The EBITDA margin increased by 2.4pp. to 14.4% from 2015 to 2016. This increase was primarily a result of higher gross margins

- The ROCE has been more volatile than the EBITDA margin. Capital employed has increased steadily, hence, EBIT has been the driver of the volatility in past year’s ROCE. ROCE decreased by 1.7pp. to 24% from 2015 to 2016, derived from relatively stable EBIT and continued growth in capital employed.

Top five companies (2016 revenues)
1. Pharmaq AS
2. Europharma AS
3. MSD Animal Health Norge AS
4. Nofima AS
5. Veterinærmedisinsk Oppdragssenter AS

Key financials

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<th>Year</th>
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Segment composition (2016)

Use of antibiotics was almost abolished during the 1990s, while at the same time harvested volumes rocketed. Increased focus on fish health, new regulations and anticipated volume growth leads to expected continued worldwide growth in the subsegment. There are still several diseases with no available vaccines.
Fish health

Feed

- Feed manufacturers produced more than 1b tons of feed globally in 2016. About 4% of the produced feed was used in aquaculture. Of these 4%, about 11% constituted feed for salmonids.  
- Feed represents about half of the total production cost for salmonids, and is, as such, a key focus area in the industry.  
- Salmon feed consists to a declining extent of conventional marine raw materials. The shortage of marine resources has led to the exploration of new ingredients, both marine and nonmarine. Efficient feed utilization is crucial to ensure the sustainability of the aquaculture industry. The fish in – fish out (FIFO) rate has dropped dramatically from the 1990s, and BioMar reported a FIFO rate below one for the first time in 2016.  
- The EU Commission voted to open the aquaculture feed market to insect-derived proteins in mid-2017. It is an ongoing process to implement corresponding regulations in Norway. We already see examples of new companies (e.g., Voss-based InvertaPro) developing insect-derived feed ingredients.  
- Krill represents another more sustainable resource. Recent research shows that even the effects of pancreas disease might be reduced by introducing krill in fish feed.  
- The salmonid feed industry is still largely consolidated and consists of a few large producers controlling the majority of the salmon feed output. In 2016, the five largest companies accounted for approximately 90% of the revenues in the subsegment.  

We see a moderate correlation between salmon prices and EBITDA margins (correlation coefficient of +0.59). This could imply that margin effects of increased salmon prices are absorbed in this part of the value chain, to a moderate extent. It can be attributed to the bargaining power, increased biological insight and knowledge of the largely consolidated subsegment. This is, mainly, driven by an increased focus on the effect feed has on fish health and resistance. It is now questioned whether feed producers have utilized their potential.  

- Despite flattening harvested volumes, revenues are steadily increasing, with the subsegment generating NOK24.5b in revenues in 2016, a NOK3.5b (+16.6%) increase compared to 2015.  
- Cost of goods sold (COGS) is the largest cost driver in the subsegment, constituting about 85% of the total costs in 2016. As such, the EBITDA margin is largely driven by the development in gross margin, and represents an incentive for exploration of new cost-effective sustainable ingredients.  
- The ROCE has the same trend as the EBITDA margin, but is more volatile as capital employed is fairly small compared to EBIT.

Top five companies (2016 revenues)

1. Ewos  
2. Skretting AS  
3. BioMar AS  
4. Marine Harvest Fish Feed AS  
5. Aker Biomarine Antarctic AS

Key financials

Revenue (NOKb)

<table>
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</tr>
</tbody>
</table>

Segment composition (2016)

- Small: <NOK100m  
- Medium: NOK100m–NOK1,000m  
- Large: >NOK1b

With efficient technology and the exploration of new sustainable feed resources, the feed manufacturing industry absorbs margin effects of increased salmon prices. The industry must continue to develop new sources of ingredients to be able to deliver healthy feed at low costs as volumes are expected to increase.

---

Successful seafarming is dependent on high quality both in broodstock, eggs and handling and vaccination of fry during the freshwater stage.
Production
Record price levels drive all-time high profits, while operational concerns curb enthusiasm

About the segment
At the heart of the aquaculture industry is the production segment, consisting of the full chain of handlers of live fish, from cradle to grave—starting with breeding and fertilization of eggs, through the nurturing of fry to smoltification, and finally put to sea and grown to harvest size.

As such, we have divided the segment into three subsegments:
1. Egg and spawn production
2. Smolt production
3. Sea farming

While each subsegment contains specialized stand-alone companies, there is also a large degree of crossover ownership between the subsegments as well as into other segments mentioned in this report.

Successful sea farming is dependent upon high quality both in the broodstock or eggs and in the handling and vaccination of fry during the freshwater stage, as such, we see many sea farming entities expanding into these upstream (literally) activities to ensure access and high quality.

Segment highlights
- The segment has experienced substantial growth from 2007 to 2016, with a notable acceleration after 2012, driven by a significant increase in prices and favorable currency exchange rates for exports.
- Aggregated revenues increased by 30.2% from 2015 to 2016, reaching NOK 71.6 billion, with an EBIT of NOK 23.4 billion. The sea farming subsegment is the main contributor to the segment’s overall revenue and profitability, generating 94% and 97% of the revenue and EBIT, respectively, in 2016.
- While the segment has been highly profitable for the last few years, previous periods fell short compared to the all-time high prices and profits of 2016 and 2017. The increased profitability and increasing demand for various supporting services have made the sector a major contributor to value and job creation along the Norwegian coast.
- Despite the record high profits of 2016, there is an underlying concern with the sector’s increasing challenges related to sea lice and other environmental issues. These challenges have plateaued the growth in production volumes for the past few years, paradoxically driving up prices and profits in the short term.

Key financials
![Revenue chart]

Segment composition (2016)*

<table>
<thead>
<tr>
<th>Number of companies</th>
<th>Revenue</th>
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<tr>
<td>Medium: NOK100m-NOK1,000m</td>
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<tr>
<td>Large: &gt;NOK1b</td>
<td>30%</td>
</tr>
</tbody>
</table>

*Note that many legal entities counted as single companies in this report are, in reality, part of the same group.
Segment analysis

Production (contd)

Record price levels drive all-time high profits, while operational concerns curb enthusiasm

Egg and spawn production

The companies in this subsegment are specialized in spawning and egg production, but many also cross over into smolt production and even sea farming on a smaller scale. Some of the companies in the subsegment operate on a stand-alone basis as specialists, while others are owned fully or partially by sea farmers or other industry players to secure influence and control over one of the most important aspects of the aquaculture sector.

- With increased profitability in the aquaculture sector as a whole, and increasing production challenges related to sea lice and diseases, major investments have been made in the subsegment in recent years.
- The egg and spawn production companies are at the forefront of development in the aquaculture sector, utilizing, among others, genetic technology to enhance resistance to diseases and sea lice, appearance, growth rate and other key attributes.
- The subsegment has experienced strong revenue growth over the last 10 years and the slight stagnation in 2015 was more than offset by tremendous revenue growth in 2016 of over 50%. Much of the revenue growth in 2016 must be attributed to a sharp increase in revenue from the sale of mature salmon grown on the egg producers' own licenses, as opposed to egg and spawn.
- The EBITDA margin of 20.8% for the subsegment has been relatively high over the last 10 years. In 2015, the margin fell as a result of major investments and upscaling of production, while revenues plateaued. Primarily driven by increased prices, the EBITDA margin surged to a peak of 26.7% in 2016.

Top five companies (2016 revenues)

1. AquaGen AS
2. Nordnorsk Stamfisk AS
3. Svanøy Havbruk AS
4. Salmobreed AS
5. Salten Stamfisk AS

Key financials

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (NOKb)</th>
<th>EBITDA margin</th>
<th>ROCE</th>
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<td>2016</td>
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</table>
Smolt production

Smolt producers operate among the broodstock and egg producers and the sea farmers—from when the eggs are fertilized to when mature smolt is ready to be put to sea. This process, which in the wild takes approximately 2-4 years, typically takes 6-12 months in specialized smolt facilities. In recent years, production of larger smolt (100-200 grams) and even intentions of producing smolt of up to 1kg have become more typical in order to shorten the time in sea due to the risk of sea lice and other illnesses.

All the top five companies by revenue in this subsegment are fully or partially owned by sea farming companies, and deliver primarily within their own group. In addition to this, smolt is also produced by companies considered in this report as sea farmers. This relates to vertically integrated companies, that aim to produce their own smolt, such as Marine Harvest Norway AS.

- The smolt-producing companies have experienced continuous revenue growth from NOK0.9b in 2007 to NOK2.8b in 2016 (CAGR 13%). At the same time, the EBITDA margin has remained relatively stable. In the period 2008-16, the EBITDA margin fluctuated only between 20% to 24% with an average of 21.5%.
- Without direct insight into bilateral purchases and contracts, it is difficult to verify but there is a reason to believe that the high degree of cross-ownership and intergroup trade, along with other long-term business relations, contributed to the stable revenue growth and EBITDA margin observed.
- With the sector continuing to battle sea lice problems, and possible expansions both to open sea or land-based facilities, new possibilities arise in smolt production. However, with the opportunity of capturing a larger share of the value creation in the sector comes large investment costs and high risk.
Production (contd)

Record price levels drive all-time high profits, while operational concerns curb enthusiasm

Sea farming

Sea farming is by far the largest subsegment in the aquaculture sector, with a combined reported EBIT of NOK22.8b in 2016, more than twice the previous peak in 2014. With its growth in 2016, sea farming is the largest contributor to the record high revenue and profit in the sector as a whole.

• With an EBITDA margin of 37.2% in 2016, 15 pp. above the previous nine years’ average, the subsegment is experiencing record high profitability.

• Driven by a combination of increased demand and a 5% reduction in Norwegian salmonids harvest volumes, the annual average price for farmed Atlantic Salmon surged by almost 40% from 2015 to 2016. The sector experienced increases in salmon prices also in 2014 and 2015; however, this was partly due to a weakening of NOK vs. EUR.

• Between diseases, extreme weather and other operational challenges, it is often hard to determine which is the most significant factor for the development in cost and production changes. For 2016, there was, however, little doubt that sea lice was the primary driver for the increase in cost and reduction in production volume, with key issues mentioned below:

  • Sea lice has contributed to the rise in explicit cost per kg through increased use of lice treatments, specialized feed, cleaner fish and investments in R&D. There is also a less-visible cost related to starvation, delayed growth and forced early harvest, curtailing production plans and harvest volumes.

  • Together with an increase in feed prices, the challenges related to sea lice have been the main cause for the increase in cost per kg over the last few years. The total cost per kg has increased by 60% over the last five years from NOK21.0 to NOK33.8.

  • The cost per kg for all main components have increased in absolute terms over the last five years as seen in the “Cost components per kg fish sold” chart. However, as more emphasis has been put on lice mitigation activities, we see a slight shift from COGS to operating expenses in terms of the share of total cost.

While the production challenges in 2016 contributed to a surge in prices and profits, the stagnating volumes and increasing costs are unfavorable developments in the long term.

• High prices can turn away consumers, reversing the trend of increased demand seen over the last few years. Unusually high prices spike investment both in alternative sea farming solutions and new geographic regions, possibly increasing the long-term supply significantly.

• In the short and medium term, however, the possibility for significant increases in production volume appear limited, and, in 2017, the sector has experienced continued high prices and profits, although salmon prices dropped toward the end of the year.
Between diseases, extreme weather and other operational challenges, it is often hard to determine which is the most significant factor for the development in cost and production changes.
About the segment
The distribution segment includes companies offering services related to trading, slaughtering and transportation on sea.

We have divided the segment into three subsegments:
1. Trading
2. Slaughtering
3. Transportation on sea

Segment highlights
• The distribution segment increased its combined revenues by 47.7% from 2015 to 2016; however, a significant part of this is explained by the establishment of a separate company by Marine Harvest for its trading business in Norway in 2016 – Marine Harvest Markets Norway AS. In 2016, the Marine Harvest trading business was integrated with the production business and, therefore, reported under “Production.” Without this change, the combined segment revenues increased by 21.2% still a formidable growth. The volume of slaughtered fish decreased by 5.3%; but with a 36.5% increase in the average salmon price, the increased revenues are hardly surprising.
• In addition to the volume decline, the trading companies’ struggle to push through the increased salmon prices to international consumer markets explain why the revenues did not increase even more.
• The trading subsegment represents a high share of the total segment, with the five largest trading companies generating 56.4% of the revenue in this segment in 2016, up from 44.4% in 2015.
• Despite the high revenue increase, EBITDA declined in 2016. The average EBITDA margin for 2007-15 was 2.2%, whereas it decreased to 1.3% in 2016 due to negative margin development in the trading and transportation subsegments. A negative EBITDA margin for the trading companies, due to a more than 40% decrease in gross margin, was the most significant contributor. The slaughtering subsegment increased the EBITDA margin from 9.7% in 2015 to 11.3% in 2016, but has limited impact on the overall segment.
• A combination of higher capital employed and a lower EBIT reduced ROCE from 11.6% in 2015 to 3.9% in 2016, by far the lowest level in the last 10 years. As with the EBITDA margin development, ROCE was down for trading and transportation, but up for slaughtering companies.
Trading companies
Norwegian-registered trading companies for farmed salmon and trout include both independent trading companies and trading companies owned by salmon producers that have organized this activity in separate companies. Some salmon producers perform trading as an integrated part of their production companies; however, these are not included in this analysis.

• The companies within this subsegment increased revenues by 21.6% from 2015 to 2016 when not accounting for the new company Marine Harvest Markets Norway AS, that in previous years has been integrated and reported as part of the production company in the Marine Harvest Group. When including this company in 2016, revenues increased by 49.5% from 2015 and reached an all-time high revenue of NOK79.8b. The increase is explained by the high salmon prices throughout 2016, as the sold volume of slaughtered fish (round weight) decreased by 5.3%.

• The trading segment is a low-margin business. The EBITDA margin has been in the range of 1.3% and 1.8% over the last 10 years. In 2017, the EBITDA margin was negative for the first time, averaging at -0.1%. A decline in gross margin from 6.5% in 2015 to 3.8% in 2016 explains most of the drop in EBITDA margin, whereas increased personnel expenses also contributed.

• While the high salmon price has driven the revenue increase, it also created a very challenging sales and market situation for the trading companies, which has a negative impact on the EBITDA development. Although COGS has increased significantly, the trading companies to a certain extent suffer under long-term customer contracts with fixed prices and struggle to get acceptance for higher prices in the end markets, putting a strain on the gross margin.

• The combined effect of a negative EBIT and increased capital employed caused ROCE to drop dramatically from 11.4% in 2015 to -1.8% in 2016.

• International markets, and in particular EU countries, are the trading companies’ main markets. In 2016, the export value of Norwegian salmon increased from NOK47.6b in 2015 to NOK61.3b, an increase of 29%. The value increase comes despite a volume decrease of 5.3%, again underlining the significant impact of an average salmon price of NOK59.4 in 2016, up from NOK43.5 in 2015 (36.5%).

• As in 2015, Poland and France were the two single most important export markets for Norwegian salmon measured in value. The export value of salmon increased for all markets shown in the “Export markets for salmon” chart in 2016 compared to 2015, with the US (+200%) and Poland (+39%) representing the largest changes. In terms of volume, the exported volume decreased the most for Sweden (-13%) and Spain (-12%).
Segment analysis

Distribution (contd)

All-time high revenue once again, but declining margins and lower ROCE

Slaughtering

Similar to trading, slaughtering is offered by both independent suppliers and salmon producers as an integrated part of their value chain. This analysis includes only slaughtering businesses that are organized in separate legal entities, and it will, therefore, underestimate the total size of the subsegment.

- After a reduction in revenue 2015, the subsegment generated increased revenues of 10.8% in 2016, representing an all-time high of NOK848m.
- The revenue increase comes despite a 5.3% lower volume of slaughtered fish in 2016 compared to 2015. This can imply both that the segment has been able to increase prices, or that slaughter volumes have increased for separate slaughtering entities, on the expense of slaughtering plants in integrated salmon producers.
- The key driver for the slaughtering plants is the delivered volumes of fish from farmers. Outbreaks of diseases and sea lice will impact both volumes and timing of the supplies, which may be very cyclical.
- The number of approved slaughtering plants was reduced from 60 to 57 in 2016, resulting in a 1.1% increase in the volume slaughtered per slaughtering plant.
- The EBITDA margin reverted to 2014 levels with 11.3% in 2016, up from 9.7% in 2015. While the development in personnel expenses was stable, other operating expenses fell somewhat relative to revenues. The main driver for the higher EBITDA margin was, however, a higher gross margin, indicating higher prices.
- ROCE went up quite significantly from 8.1% in 2015 to 12.1% in 2016, primarily due to higher EBIT.
- A future trend that may influence the slaughtering subsegment is the entrance of slaughtering vessels, where the fish is slaughtered onboard and transported on sea directly to production sites closer to the customer market. Hav Line Vessel AS has, for example, ordered a slaughtering vessel that will collect the salmon at site, slaughter it onboard and transport it directly to Denmark. The vessel will have a capacity to slaughter 7,000 tons of salmon per year (average per slaughtering plant in 2016 was 23,184 tons) and will in operation starting 30 2018. Such vessels will significantly reduce the need to transport slaughtered salmon by trucks over longer distances.

Top five companies (2016 revenues)

1. Pure Norwegian Seafood AS
2. Viking Fjord AS
3. Slakteriet AS
4. Martin E Birknes Eff AS
5. Salten N950 AS

Key financials

![Graph showing key financials]

Development in slaughtered volume and number of plants

![Graph showing development in slaughtered volume and number of plants]

Source: The Norwegian Food Safety Authority
Transportation on sea
The subsegment consists of wellboat companies that transport smolt to sea farms and live salmon and trout from farming cages to harvesting or processing plants. Most of these companies also offer sea lice and amoebic gill disease (AGD) treatment onboard wellboats as well as services such as sorting and counting of fish.
- The wellboat industry managed to outperform 2015 financials and delivered all-time high revenues and EBITDA in 2016. Revenues totaled NOK2.3b, up by 14.5% compared to that of 2015. Although the EBITDA margin went slightly down from 44.1% to 43.7%, the companies generated a formidable EBITDA of NOK1b.
- The revenue growth is due to continued high activity, especially related to treatments for sea lice and AGD, which drives rates and utilization levels. The industry keeps being dominated by a few large players, although from 2015 to 2016, the top five companies’ share of industry revenue dropped from 80.6% to 77.7%.
- The slight reduction in EBITDA margin is due to higher personnel and other operating expenses relative to revenue. Higher activity has increased the reported number of employees the last year.
- ROCE was 11.0% in 2016, down from 12.2% in 2016 due to a 22.1% increase in capital employed as the companies continued their investments in larger and more technologically advanced new builds in 2016.
- The new build program continues in 2017, with at least 10 planned new builds this year, representing a significant capacity increase. The net impact on supply will depend on the number of scrapings and vessels on international contracts.
- It is notable that several of the planned new builds are ordered by companies owned in full or part by salmon producers. Through its 50/50 owned joint venture with Solstad Farstad, Dess Aquaculture Shipping, Marine Harvest has, for example, ordered four wellboats and one processing vessel for delivery in 3Q 2018 and later. This trend will undoubtedly increase margin pressure in the industry going forward.
- Another potential game changer in this industry in the longer term is the possible increase in processing vessels (where the fish is slaughtered onboard). There has historically been only one processing vessel in the Norwegian market for the past 10 years; however, several more are now planned for and advocates for this trend pinpoint advantages such as lower investments and costs, increased fish welfare and lower mortality as well as lower contamination risk of sea lice and diseases.

Top five companies (2016 revenues)
1. Rostein AS
2. Norsk Fisketransport AS
3. Sølvtrans Rederi AS*
4. Bæmlo Brønnbåtservice AS*
5. Oppdretternes Miljøservice AS

Key financials

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (NOKb)</th>
<th>EBITDA margin</th>
<th>ROCE</th>
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<td>2007</td>
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<tr>
<td>2016</td>
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Number of wellboats*

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<td>90</td>
</tr>
<tr>
<td>2016</td>
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</table>

* Based on the number of members in Fraktfartøyenes Rederiforening.

Key drivers that we expect will impact the wellboat industry going forward include the entrance of salmon producers as investors and owners of wellboats, the effects of new industry regulations concerning water quality and potentially freshwater treatments and the experience with processing vessels as a potential substitute for wellboats. Finally, continued high revenues and margins will depend on the lack of immediate solutions to the sea lice and AGD challenges.

*Bæmlo Brønnbåtservice AS is a subsidiary of Sølvtrans Rederi AS. Combined, the Sølvtrans Group was the largest player in 2016 in terms of revenue.
Processing

Margin effects of increased salmon prices are absorbed by other parts of the value chain

About the segment
The processing segment includes companies offering services primarily related to secondary processing and companies producing different types of packaging.

Key financials

Segment composition (2016)
Processing
We distinguish between primary and secondary processing. Primary processing concerns slaughtering and gutting, while secondary processing is fileting, filet trimming, portioning, smoking and the like. Primary processing will mainly be covered by the presentation of subsegment slaughtering. Secondary processing leads to products normally referred to as value-added products (VAP).

• This analysis includes only separate legal entities, while processing is offered by both individual entities and salmon producers as a part of their value chain. The analysis will, therefore, underestimate the total size of the subsegment.

• Compared to the other subsegments, this is one of the most fragmented, with only 47% of the total revenue represented by the five largest entities.

• The subsegment is being affected by “new” ways of processing fish. While we have seen vessels slaughtering and processing fish earlier, this now seems to be an increasing trend. This gives rise to an expectation of a more efficient processing subsegment, both in terms of costs and environmental footprint as transportation routes could change and shorten.

• The revenue growth from 2015 to 2016 of NOK2.0b (+14.7%) was mainly driven by increased prices, while the EBITDA margin continues to decline. The subsegment’s EBITDA was NOK57.9m (-10.2%) lower in 2016 compared with 2015. This implies that the processing subsegment has not fully transferred the effect of increased salmon prices to the end customer.

• Other operating and personnel expenses have been relatively stable from 2015 to 2016 with a marginal decrease of -0.4%. COGS has, on the other hand, increased by +20% since 2015, explaining the reduction in EBITDA margin.

Top five companies (2016 revenues)
1. Sekkingstad AS
2. Nils Wiliksen AS
3. Hofseth AS
4. Norsk Sjømat AS
5. North Sea Seafood AS

Key financials

Segment composition (2016)
Segment analysis

Processing (contd)

Margin effects of increased salmon prices are absorbed by other parts of the value chain

Packaging

The packaging subsegment consists of small- to medium-sized companies producing and providing all sorts of packaging and wrappings for fish and feed. While the companies generally produce for the aquaculture industry, a vast share delivers products to other industries as well. Thus, the subsegment is partly overstated in absolute terms.

- The subsegment’s revenues of NOK1.5b in 2016 represents a NOK170m (+13.2%) increase compared with 2015. At the same time, the EBITDA margin has decreased by 0.9pp. to 10.4%, making the EBITDA increase only by NOK5.8m ending on NOK151.2m.
- Growth and profitability of this subsegment is primarily driven by increases in shipped volumes rather than increases in salmon prices. From the development in key financials, over the previous years, we find that the packaging companies have not taken part in the trend of increased profit margins in the sector.

Top five companies (2016 revenues)
1. Vartdal Plastindustri AS
2. BewiProdukter AS
3. A/S Nesseplast
4. Accon AS
5. Strømbergs Plast AS

Key financials

Segment composition (2016)
Activity going forward

Methodology
Revenue has been estimated for 2017 and 2018 based on a quantitative forecasting model. Several approaches have been incorporated into the model, varying among the different subsegments. Approaches used are:
- Analysis of historical correlation between key variables (such as salmon price and volume) and revenue
- Guidance from public companies
- Analyst reports for certain subsegments
- Discussions with industry experts

Going forward
Due to high prices in the first half of 2017, the price decreases in the second half are not expected to drive the average annual price much lower than that of 2016.

As with most industries, price is seen in context with volume; and even though demand may have increased, we see that the sudden oversupply in parts of 4Q 2017 (as compared to 4Q 2016) led to a sharp decline in price. Overall, production volume in 2017 is expected to be a couple of percentage points higher than that of 2016 – but below the level of 2015. As an example, Sjømat Norge stipulated a 1%-3% volume increase in 2017.

Going into 2018, the major fish farming companies have guided with significant volume growth – with an aggregated 12% volume increase expected by the listed companies alone. We find it unlikely that such volume increase will be seen throughout the segment, especially with the continued biological challenges and high mortality rates. However, we do believe there will be higher volume growth in 2018 than seen in the last couple of years.

With the positive expected volume development in 2018, prices are expected to be below 2016-2017 levels. As of November 2017, this seems to be the consensus among analysts and forward contracts on Fish Pool.

The effects of increased volume production and decreasing prices are show in the chart “Norwegian aquaculture forecast 2017-2018. While revenue growth is expected for 2017, a reduction is forecasted for 2018. The combination of price and volume in 2017 yields a positive contribution to margins. On the other hand, we expect biological challenges to be a continued threat to margins and expect that the industry will need to continue their investments to combat this. As revenues are mainly driven by price and volume, we expect that the negative effect of the price reduction in 2018 will be greater than the positive volume effect — resulting in a revenue decline from 2017 to 2018.

A point to keep in mind is the lag between changes in spot price and retail price. The high prices in 2016 and in the first half of 2017 increased the price for the end consumers through 2017. This may have a negative impact on demand going forward. On the other hand, the demand from the Chinese and Russian markets are both in early stages of recovery and is expected to increase.

Norwegian aquaculture forecast 2017-2018

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Future outlook

Growth through sustainable innovation —the technogreen revolution

The aquaculture industry is aiming to become the most valuable export industry in Norway.

The first hurdle remains to be finding sustainable solutions to the sea lice problem and environmental issues related to inshore fish farming. In that respect, the ongoing research and development license program may provide the industry with robust and sustainable solutions. The government is, however, facing challenges in managing the awarding of green licenses and in the selection of players who will be the most positive contributors in the sustainable farming race. Research and innovation is closely linked risk, and failure is inevitable for some of the ideas presented. However, major industry players have invested with significant amounts of risk capital into new innovative closed offshore farming installations, onshore facilities and biotechnical treating and preventive measures.

We may expect the outcome of these innovative investments to significantly change the structure of today’s production facilities and capacity. However, we do not expect to see major scalable breakthroughs for production volumes within the next five-year period.

In the meantime, demand trends are rising and supply estimates are challenged. Hence a major issue for the industry will revolve around the sustainable international market price equilibrium. We already see that the processing and distribution segments face challenges because of the current price level benchmarked toward substitute product. The market entry of new consumers in emerging economies and urban growth areas do, however, balance the reduced volumes in mature, price-sensitive mass markets.

For the value chain as a whole, the biological challenges, combined with all-time high margins as a result of the high salmon price, have represented a sound platform for developing forefront solutions within software, hardware, biotechnical, processing and logistical products and services. Including the potential of these players and their potential to deliver to farmers of other species of aqua and agriculture, the target of becoming the most valuable export industry in Norway, seems more attainable.
Megatrends will change the industry
Looking ahead, we expect that underlying key megatrends1 will continue to have powerful effects on the global aquaculture and seafood industry.

Digital and behavioral revolution
The digital revolution and deployment of behavioral technology solutions, can become powerful tools. For example by customizing nudges in smart phones and smart watches, helping people to a healthy diet. However, introducing big-data processing and digital tools may solve issues related to traceability from raw material and ingredients to finished product. It may also represent a breakthrough in analyzing predictive models for growth, feed or pathogenic dependencies.

Resourceful planet and sustainable food production
The world population is growing, which will have a direct impact on the need for protein-rich, nutritious food.

Demographic trends will push the world’s population to 10 billion in 2050, which will challenge the natural resource constraints. The question is whether innovation can make the planet resource-rich instead of resource-scarce.

In the aquaculture industry, this implicates sustainable solutions such as land-based, offshore and zero-wastewater fish farming. Competitors are other providers of protein nutrition, such as producers of meat and poultry, together with other marine-based protein sources. Feed is an important factor in providing nutritious and healthy products. Other challenges will be how to handle spill water, antibiotics and a growing demand for sustainable solutions for the recirculation of water and waste. Perhaps will we see a gradual shift from wellboats to combined well-, slaughter and processing vessels? Such cost-effective innovations may be required from a cost optimization perspective.

Increased urbanization
In 2008, the world reached a milestone. For the first time in history, the majority of the world’s population lived in cities. At current rates of urbanization, the world will be two-thirds urban and one-third rural by 2050, with most of the growth occurring in Asia and Africa.2 A consequence of urbanization may be an increase in households where both spouses work, leading to higher household incomes and less available time for preparing meals. This will have a large implication on the market growth in regards to feeding a growing population, customizing products to segments and delivering products at the right time.

Conscious consumers and health reimagined
The behavioral revolution has already impacted the demand for healthy food. Chronic diseases are one of today’s biggest challenges for humanity. Many of these diseases stem from human behavior and habits, such as poor diets, lack of exercise and excessive consumption.

Health care spending is on an unsustainable trajectory, thanks to demographic shifts (aging population) and globalization (sedentary lifestyles that accompany economic development and urbanization). Providing a healthy food alternative will be imperative and both fish and processed products (e.g., protein, Omega 3-based) are important.

By responding quickly and proactively, new business opportunities and value creation will emerge. If the companies in the Norwegian aquaculture industry manage to stay on top of these trends, they will reap the rewards of a new global reality.

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Activity going forward
Methodology

Data collection
Accounting information is publicly available from the Brønnøysund Register Centre. The companies’ business addresses, as registered by the same register, have been used to reflect the entities’ geographic location. The number of companies included in the analysis will vary somewhat depending on the availability of financial information.

In order to analyze economic activity by geographic location and across the value chain, we have used the stand-alone financial statements of individual legal entities. As a result, large corporations have been analyzed through their constituent individual companies and not as a consolidated group. Intercompany transactions have not been eliminated when financial figures are aggregated. In addition, the revenues of subsidiaries owned by a Norwegian holding company but registered abroad are not captured. 2016 figures have been modeled based on previous years, where annual reports were not available by the time this report was prepared. For entities operating with divergent financial years, figures have been modeled to fit a calendar financial year.

Inclusion criteria
A company is defined as a Norwegian aquaculture company if both of the following criteria are met:
• At least 50% of its turnover is generated in the aquaculture sector.
• It is a Norwegian-registered company.

Value chain segments
Each company in the aquaculture portfolio has been reviewed individually and an assessment has been made with regard to the company’s position in the value chain.

The value chain has the following categories:
• Technical solutions
• Biotechnology
• Production
• Distribution
• Processing

Each of these categories are further broken down into subsegments to capture the huge diversity within the industry.

Companies have been categorized according to the value chain segment in which they generate the majority of their revenues.

Company size definition
• Large companies: revenues above NOK1b
• Medium-size companies: revenues between NOK100m and NOK1b
• Small companies: revenues below NOK100m

Location
The locations used in the analysis have been chosen to reflect and illustrate where the value creation takes place — along the coast from north to south in Norway:
• Finnmark county
• Troms county
• Nordland county
• Nord-Trøndelag county
• Sør-Trøndelag county
• Møre og Romsdal county
• Sogn og Fjordane county
• Nordland county
• Rogaland county
• Other locations (Aust-Agder, Vest-Agder, Telemark, Buskerud, Oppland, Hedmark, Oslo, Akershus, Østfold and Vestfold counties)

Calculations
EBIT = Earnings before interest and tax

EBITDA = EBIT + Depreciation and amortization

Capital employed = Total assets - (Financial long-term and short-term investments + Cash) - (Trade creditors + Tax payable + Public duties payable)

ROCE (Return on Capital Employed) = EBIT / Capital employed

CAGR = Compound Annual Growth Rate
EY contacts

Assurance, Ernst & Young AS
Eirik Moe
Partner
+47 951 24 045
eirik.moe@no.ey.com

Assurance, Ernst & Young AS
Kjetil Håvardstun
Partner
+47 932 13 574
kjetil.havardstun@no.ey.com

Assurance, Ernst & Young AS
Kai Astor Frøseth
Partner
+47 959 72 885
kai.astor.froseth@no.ey.com

Assurance, Ernst & Young AS
Amund Petter Amundsen
Partner
+47 920 34 503
amund.p.amundsen@no.ey.com

Assurance, Ernst & Young AS
Øyvind Nore
Partner
+47 918 15 268
oyvind.nore@no.ey.com

Transaction Advisory Services, Ernst & Young AS
Merete Skage
Partner
+47 982 06 499
merete.skage@no.ey.com

Transaction Advisory Services, Ernst & Young AS
Jan-Erik Åsland
Director in Lead Advisory
+47 975 47 391
jan.erik.asland@no.ey.com

Advisory, Ernst & Young AS
Maria Borch Helsengreen
Partner
+47 957 42 213
maria.b.helsengreen@no.ey.com

Tax/Legal, Ernst & Young AS
Gaute Ebeltoft
Partner
+47 982 06 476
gaute.ebeltoft@no.ey.com
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