

# Economic impact of innovation and digitalization in salmon farming

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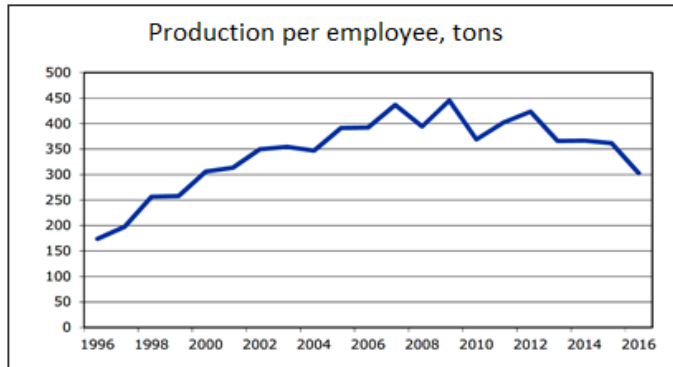
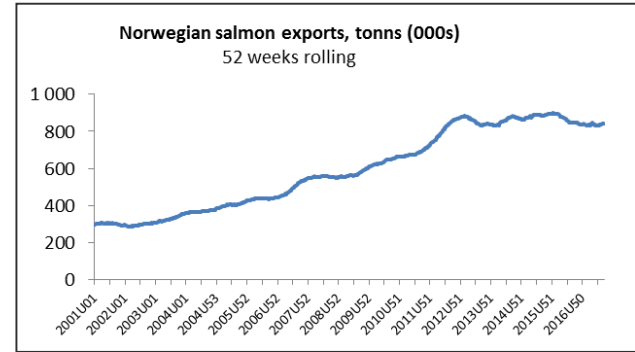
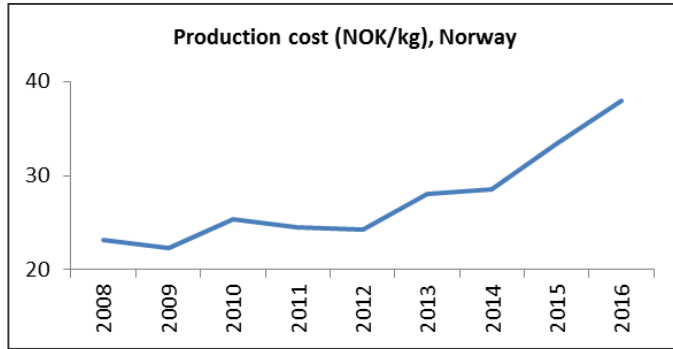
# DNB Bank is a global seafood player



# Agenda:

- Perspectives on digitalization
- Economic implications of digitalization




# Current production regime at the end of the road?



*Demand is «endless», no production growth would be a major lost opportunity*

DNB Foods & Seafood

# Innovation to the rescue!

- Sustainable production capacity not a fixed number given by Mother Nature
  - A function of technology, regulations, farming practices
  
- High level of ongoing innovation
  - High salmon price 
  - Low oil price 
  - Digitalization 



# New technology – science fiction becoming reality

*Digitalization, artificial intelligence, smart robots*

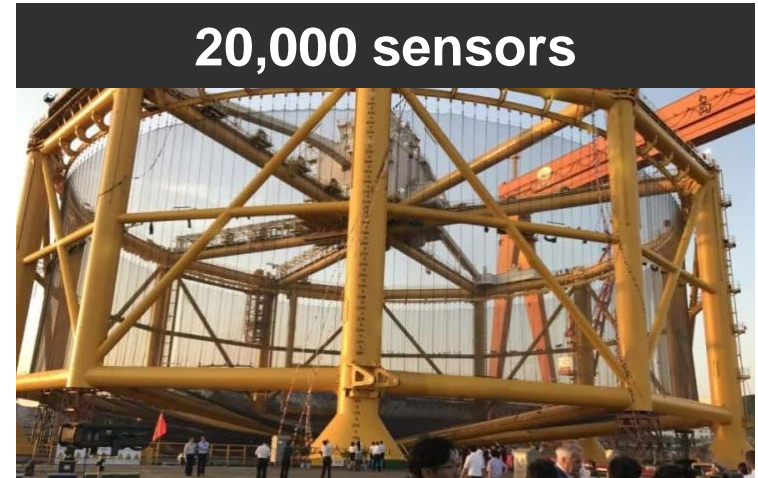
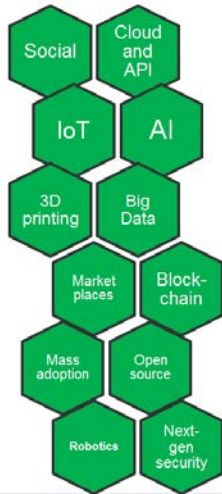


Photo: Salmar

# Why the avalanche of Gutenberg moments?

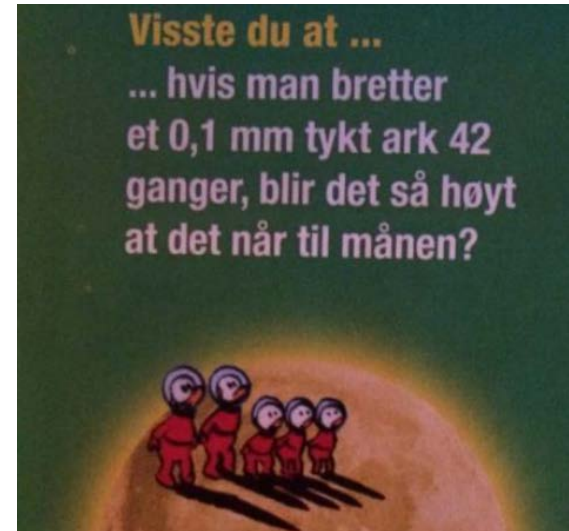
## Two reasons:

- 1) Moore's law
- 2) Moore's law has been in force a long time



### 3 key elements:

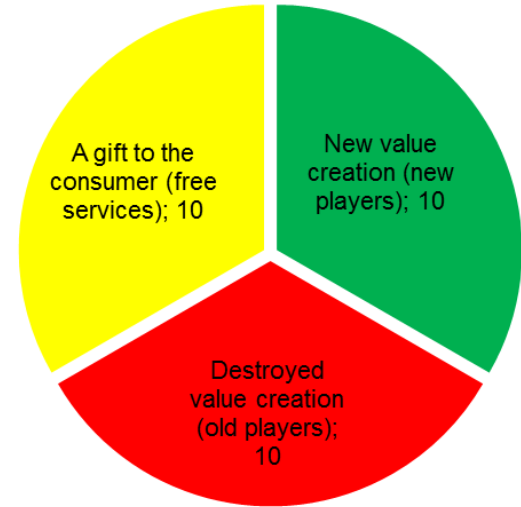
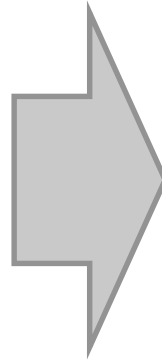
- Internet of things
- Sky computing
- Artificial intelligence



# Disruptive technology: winners & losers

Global gross economic impact next 10 years \$30 trillion\* gross, \$10 trillion net

- New value creation \$10 trillion
- Destroyed value \$10 trillion
- Free value \$10 trillion



*The economy overall will be a winner as the consumer gets free stuff. In business there will be winners & losers*

*\*Equals 2x current US GDP, 1/3 of global GDP in 10 years.*

*Source: TRK/McKinsey*

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Banking is necessary, banks are not..

*But salmon farmers are necessary!*



Bill Gates

## *Key salmon farming characteristics*

- A biological production, not digital
- The product satisfies the end-need
  - As opposed to a drill..(the consumer wants holes, not a drill)
  - Not suitable for the sharing economy..

# ..any black swan risk in salmon farming?

*You can never know for sure..*



- A € 250,000 hamburger
- Cultured beef made from 20,000 muscle fibers from cow stem cells at Maastricht University
- Paid for by Google co-founder Sergey Brin
- Cargill bought into Memphis Meat last month



Dr Post shows the hamburger to the world's press. Photograph: David Parry/EPA

I'm more of a front-stabbing person compared to DC backstabbers



Anthony Scaramucci

*Salmon farmers should be better positioned than most industries in spotting any black swans ahead of time*

# Digitalization in salmon farming, trend #1

- **Increased instrumentation & data collection**
  - Temperature, oxygen, salinity, algae, etc
  - A candy box of tools – ROVs, robots, ultrasound, IoT, etc
- Driven by more mature technology and a more mature salmon farming industry
  - But large variance among farmers from very limited to very advanced use

# Digitalization in salmon farming, trend #2

- **Increased biological focus**
  - Biology is complex with many parameters. Big data and artificial intelligence can contribute significantly.
    - The interaction between the fish, environment and feed
    - Breeding, smolt, lice resistance
    - If a customer wants x tons of y quality at time z; which combination of fish stock, vaccine, region, feed, etc is optimal?
- Driven by a need to understand the fish better
  - A lot of the technological development has been engineering focused rather than focused on the fish as such

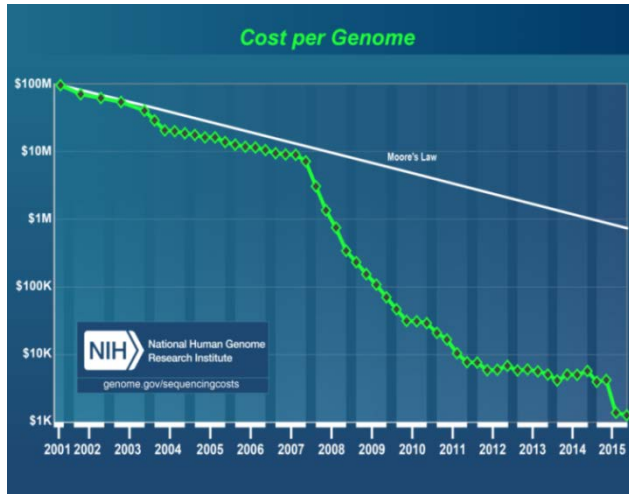
# Big data, artificial intelligence, and digitalization

*Big names are getting involved in digital salmon farming*



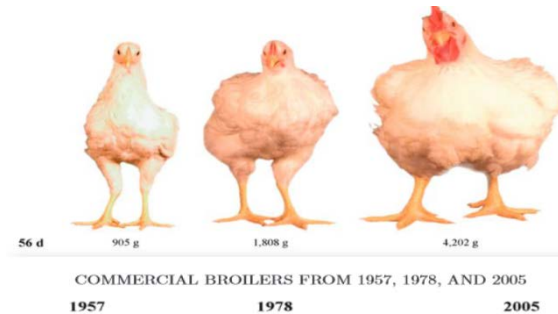


# Digital revolution impacts genetics too



Source: NHI

## Chicken 1960 vs 2015



Source: AquaGen

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# Three key questions

*Impact on profits due to technological transformation*



1. What happens to cost ?



2. What happens to sustainability & “license to operate”?

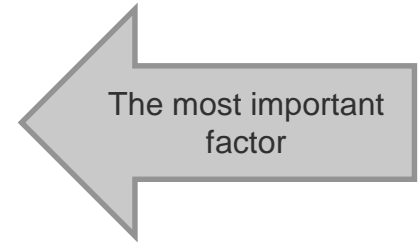


3. What happens to entry barriers?

# 1) Cost should drop due to digitalization



- “Doing things right”
  - Improved efficiency
- “Doing the right things”
  - Better understanding of the fish’s biology and genetics
  - Better understanding of farming’s interaction with the environment





## 2) Sustainability should improve

- A better biological and genetic understanding of the fish along with better understanding of the interaction with the external environment should allow for more sustainable farming and better regulations
  - Reduced disease
  - Reduced environmental footprint
- Sustainable production capacity is a function of technology, farming practices and regulations – not just the natural environment

*Sustainability = license to operate (and license to grow)*



### 3) Entry barriers should decline

- Lice & sustainability problems created an effective entry barrier
- A lifting of the sustainable biological production capacity will lower them again
  - Large expensive onshore and offshore installations may increase exit barriers
- Max value is a trade-off between volume growth and margins
  - But short term and long term price elasticities are very different..



A more attractive market structure

		ENTRY BARRIERS	
		high	low
EXIT BARRIERS	high	hydro power	airlines
	low	salmon farming now	salmon farming before

No entry barrier = normal farming margin NOK/kg 3

# Sanity check – is digitalization just a hype?

*No!*




















*We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction.*



Bill Gates

# Thank you for your attention

## - Selected transactions within DNB Seafood

<p>2017</p>  <p><b>Nova Austral</b> PURE SALMON FROM ANTARCTIC WATERS</p> <p>Bond issue</p> <p><b>USD 300 million</b> <i>Joint bookrunner</i></p>	<p>2017</p>  <p><b>ATLANTIC™ SAPPHIRE</b></p> <p>Private placement for land-based salmon farmer</p> <p><b>USD 70 million</b> <i>Joint Bookrunner</i></p>	<p>2017</p>  <p><b>NORSILDMEL</b></p> <p>Working Capital Facilities</p> <p><b>NOK 850 million</b> <i>Sole Lender</i></p>	<p>2016</p>  <p><b>SÖLVTRANS</b></p> <p>Refinancing</p> <p><b>NOK 2,786 million</b> <i>Agent</i></p>	<p>2016</p>  <p><b>NORTHERN HARVEST SEA FARM</b></p> <p>Senior Credit Facility</p> <p><b>CAD 105 million</b> <i>Sole Lender</i></p>	<p>2016</p>  <p><b>Clearwater</b></p> <p>Senior Loan</p> <p><b>CAD 83 million</b> <i>Participants</i></p>	<p>2016</p>  <p><b>LERØY</b></p> <p>Financing the purchasing of shares in Havfisk</p> <p><b>NOK 1,000 million</b> <i>Sole Lender, Market mandate</i></p>
<p>2016</p>  <p><b>COOKE AQUACULTURE</b></p> <p>Refinancing</p> <p><b>USD 87.5 million</b> <i>Mandated Lead Arranger &amp; Sole Lender</i></p>	<p>2016</p>  <p><b>SCHOUW+CO</b></p> <p>Refinancing</p> <p><b>DKK 1,800 million</b> <i>MLA</i></p>	<p>2016</p>  <p><b>arctic shipping</b></p> <p>Refinancing</p> <p><b>NOK 222 million</b> <i>Sole Lender</i></p>	<p>2016</p>  <p><b>ROSTEIN AS</b></p> <p>Refinancing</p> <p><b>NOK 1,008 million</b> <i>Bookrunner and MLA</i></p>	<p>2016</p>  <p><b>HB GRANDI</b></p> <p>Senior Loan Facilities</p> <p><b>EUR 55 million</b> <i>Bookrunner and MLA</i></p>	<p>2016</p>  <p><b>AQUACHILE</b></p> <p>Refinancing of RCF and Term Loan</p> <p><b>USD 252 million</b> <i>Joint lead Manager</i></p>	<p>2016</p>  <p><b>HAVFISK</b></p> <p>Senior Loan Facilities</p> <p><b>NOK 1,500 million</b> <i>Bookrunner, MLA &amp; Agent</i></p>
<p>2016</p>  <p><b>AkerBioMarine™</b></p> <p>Refinancing</p> <p><b>NOK 900 million</b> <i>Sole Lender</i></p>	<p>2015</p>  <p><b>ORKLA</b></p> <p>Amend &amp; Extend</p> <p><b>NOK 1,000 million</b> <i>MLA</i></p>	<p>2015</p>  <p><b>rammi</b></p> <p>Senior Loan Facilities</p> <p><b>EUR 35.2 million</b> <i>Bookrunner and MLA</i></p>	<p>2015</p>  <p><b>ESKJA</b></p> <p>Senior Loan Facilities</p> <p><b>USD 65 million</b> <i>Bookrunner and MLA</i></p>	<p>2015</p>  <p><b>AQUACHILE</b></p> <p>Bridge Facility</p> <p><b>USD 260 million</b> <i>Joint Lead Manager</i></p>	<p>2015</p>  <p><b>Grieg Seafood</b></p> <p>Senior Loan Facilities</p> <p><b>NOK 2,000 million</b> <i>Joint Lead Manager</i></p>	<p>2015</p>  <p><b>HB GRANDI</b></p> <p>Senior Loan Facilities</p> <p><b>EUR 77 million</b> <i>Bookrunner and MLA</i></p>