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WHAT KEY ECONOMIC DRIVERS OR SHOCKS ARE LIKELIEST TO AFFECT FUTURE GROWTH OF AQUACULTURE WORLDWIDE?

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AQUA2018, Montpellier, 29. August 2018

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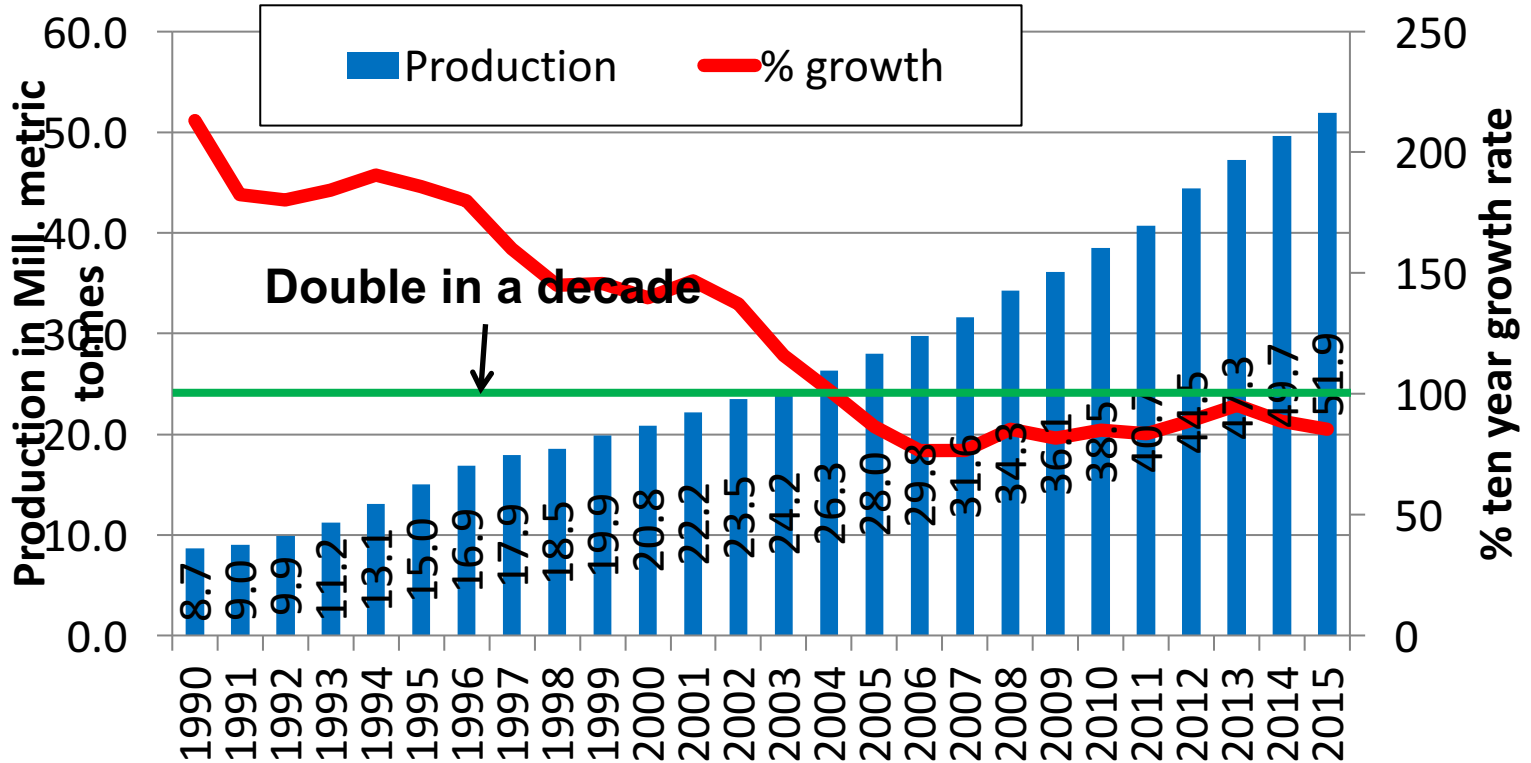
Aquaculture Production of Fish Species and 10-year growth rate

1990-2015



Source: FAO

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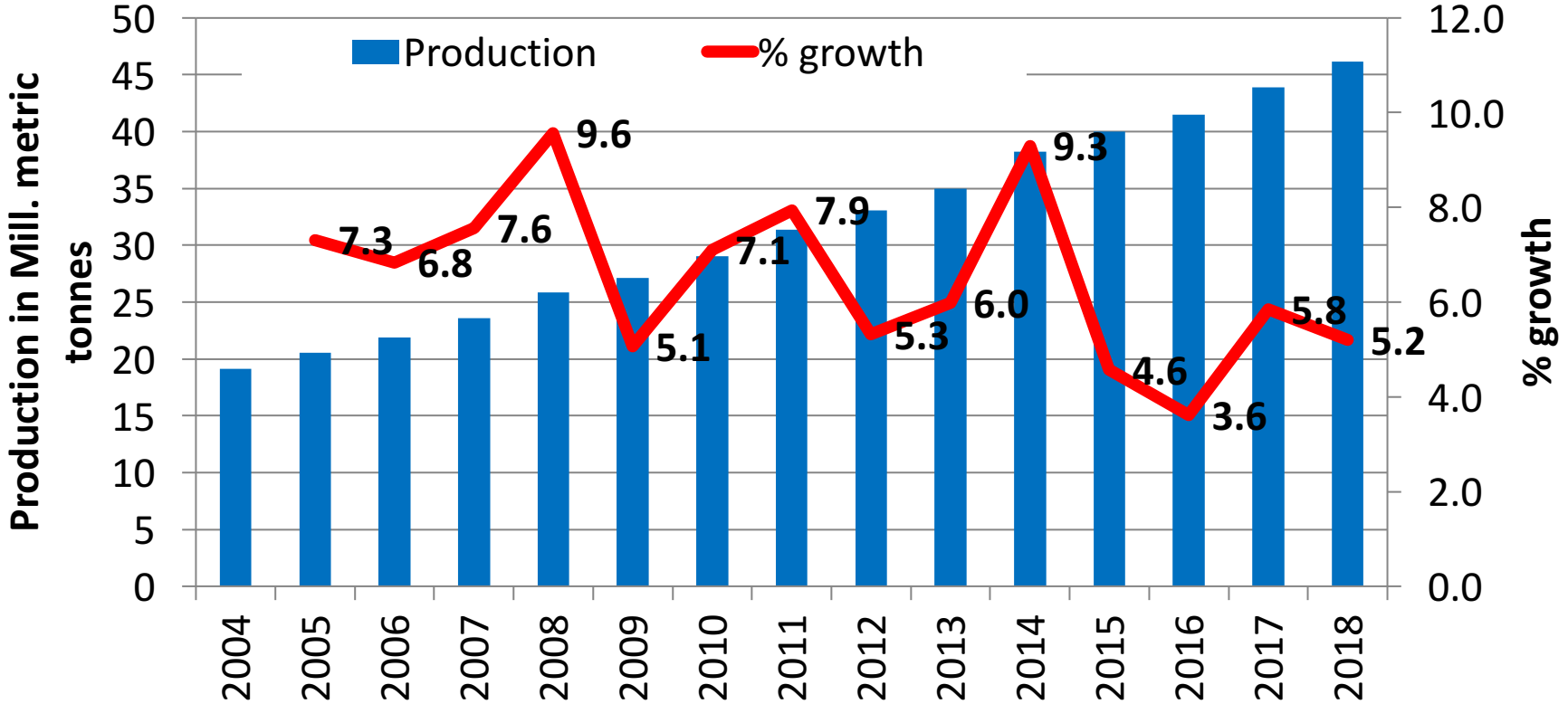
Production of Surveyed Species

Incl. Carp, 2004-2018



Source: GAA, Kontali

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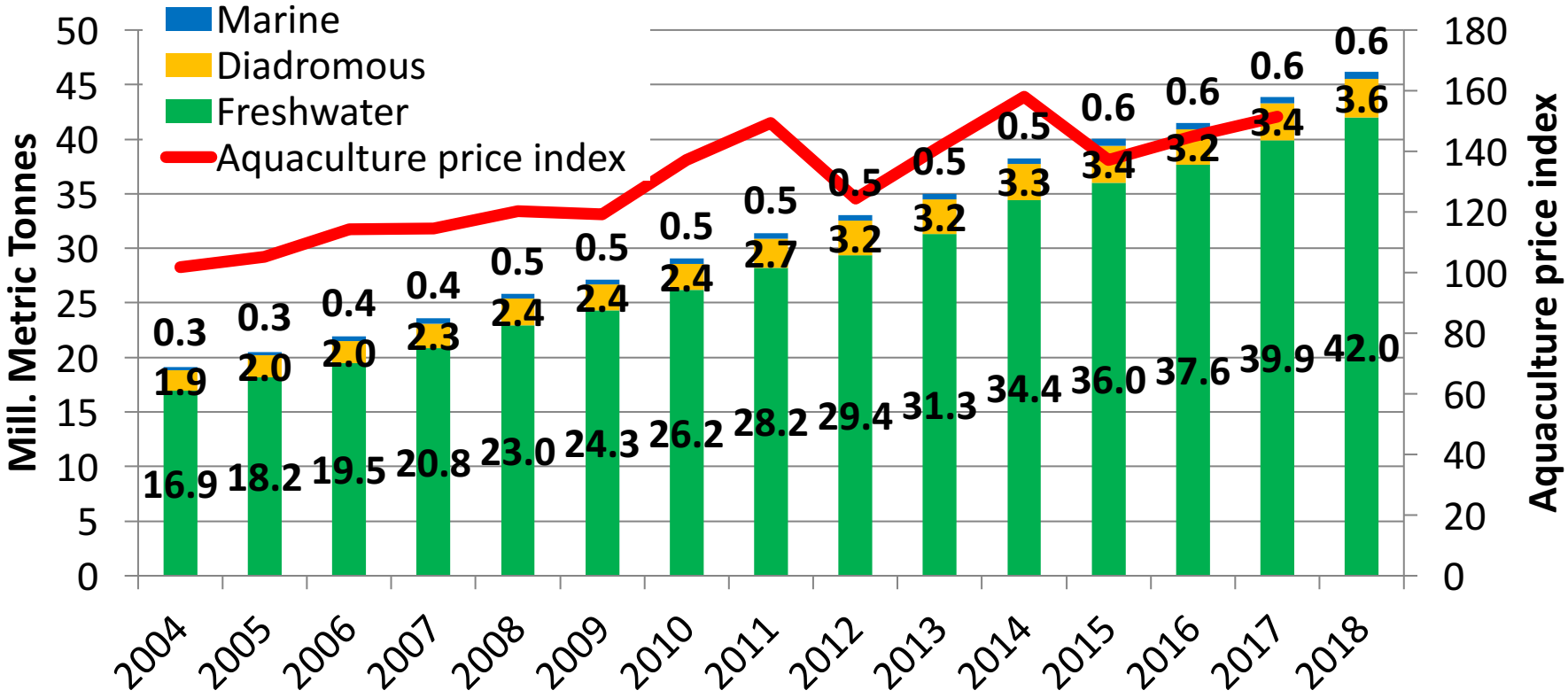
Most of production still in freshwater

Finfish species group 2004-2018



Source: Production: GAA, Kontali. Price index: FAO, Univ. of Stavanger, Norwegian Seafood Council

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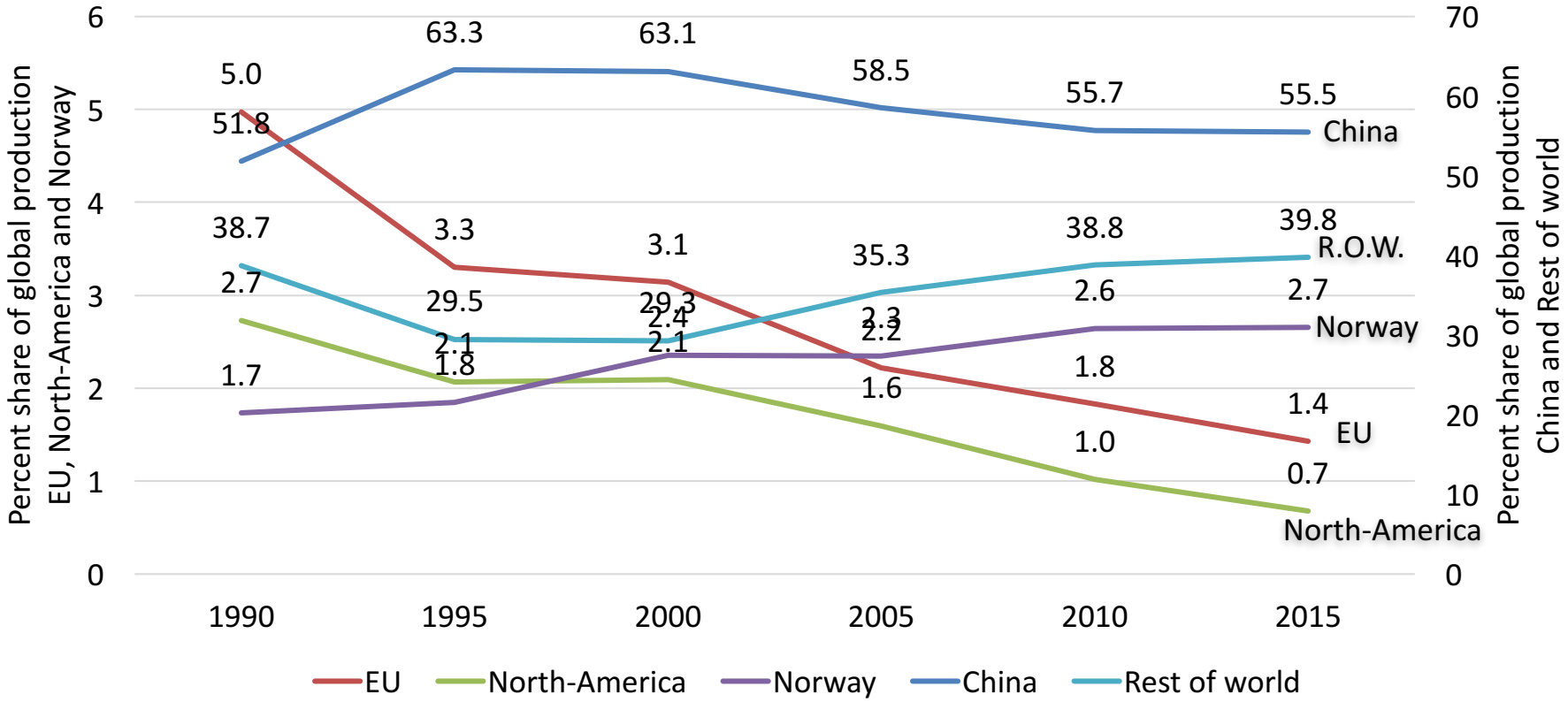
Share of global finfish production

Stagnant EU and North-America with declining shares



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Where are future growth drivers and shocks?

- Markets?
  - Consumer preferences and trends?
  - Government food safety policies and regulations?
  - Trade barriers?

- Supply side
  - Diseases and parasites?
  - Environmental external effects on other stakeholders?
  - Producer country policies and regulations?
  - Technological innovations?

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Market demand for aquaculture products will grow as long as

1. Costs and prices are competitive relative to terrestrial substitutes

2. Perceived as safe to eat

3. Perceived as not being harmful to the environment

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It’s the supply side that will determine the growth of aquaculture

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A race against externalities

Costs imposed on other fish farmers

Costs imposed on other stakeholders and the environment

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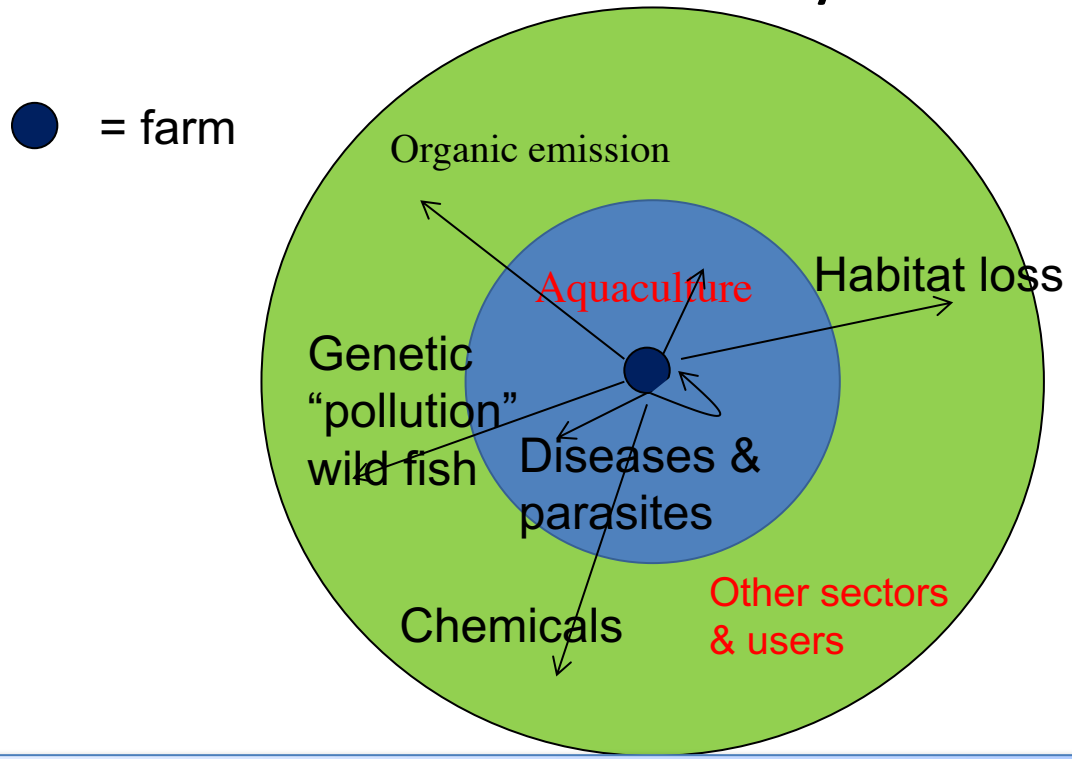
Externalities from aquaculture: An added cost to industry and society



Externalities influence productivity and production (1) directly through diseases etc., and (2) indirectly through public regulations etc. motivated by externalities

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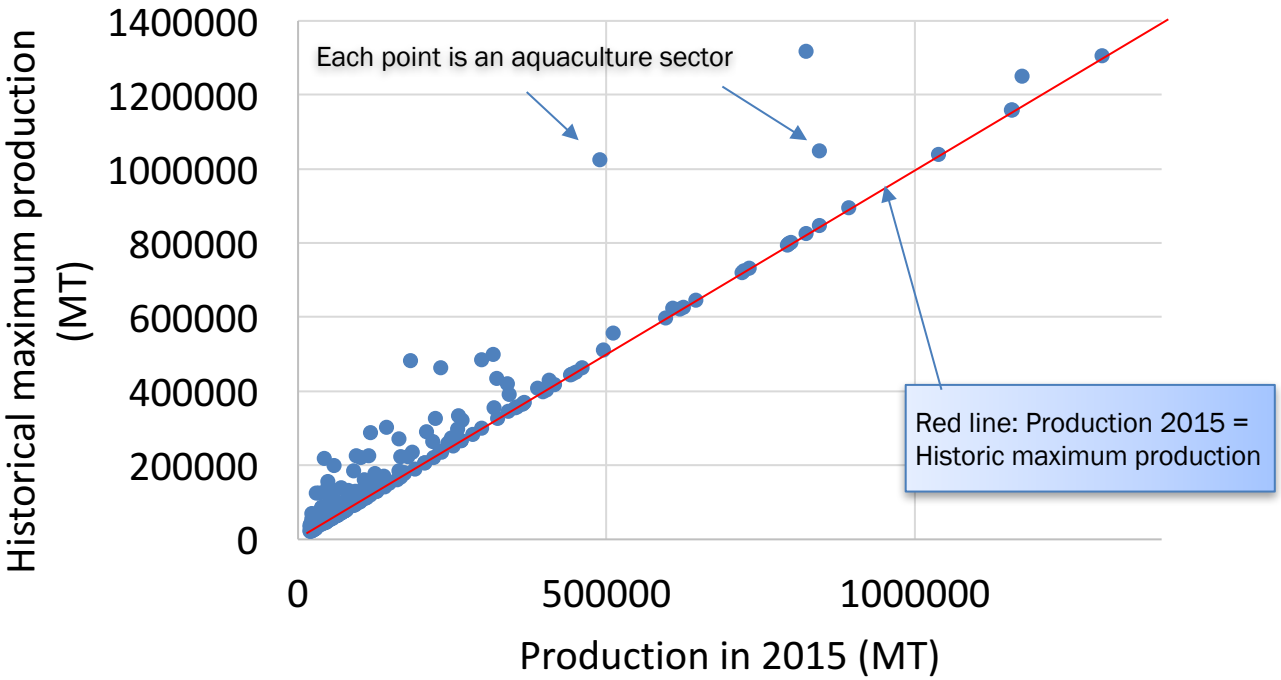
Many sectors have experienced significant decline in production compared to historical maximum



Data source: FAO

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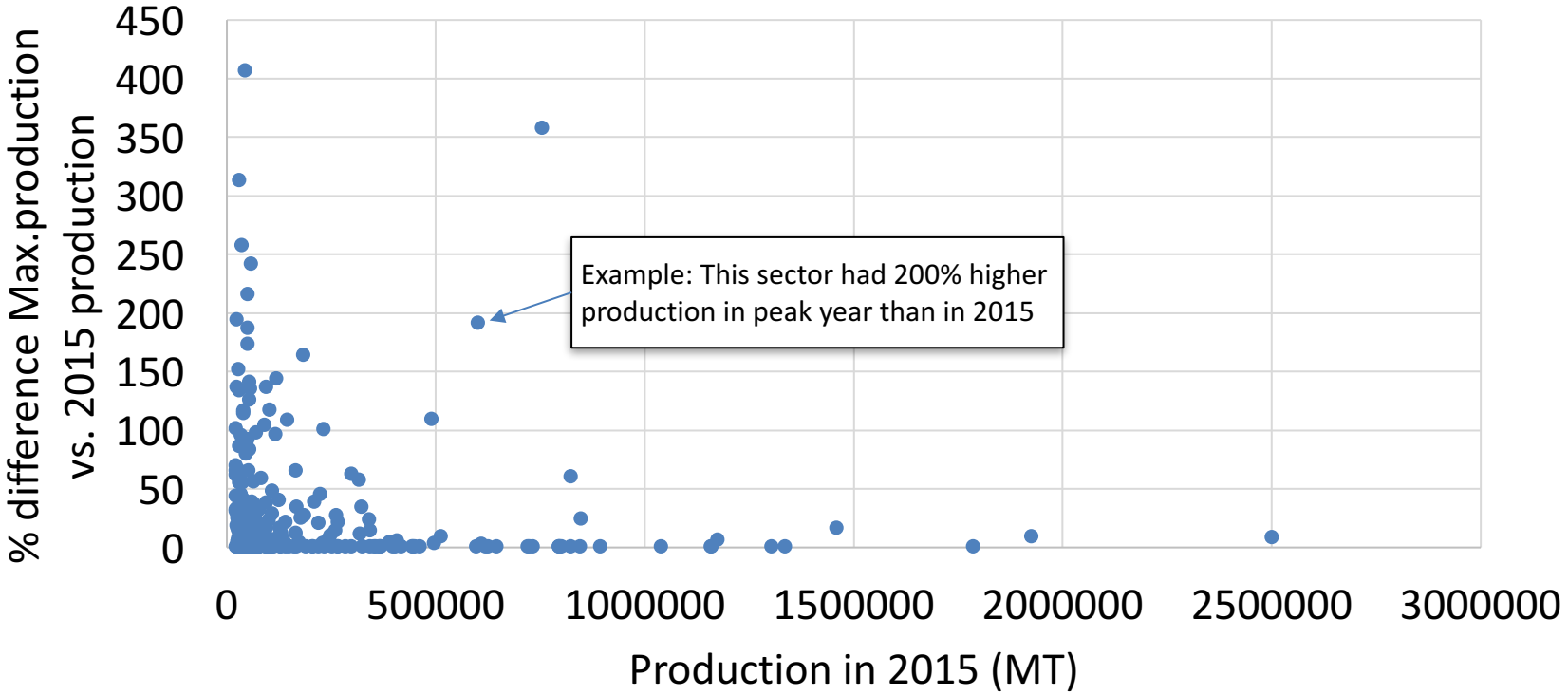

Data source: FAO

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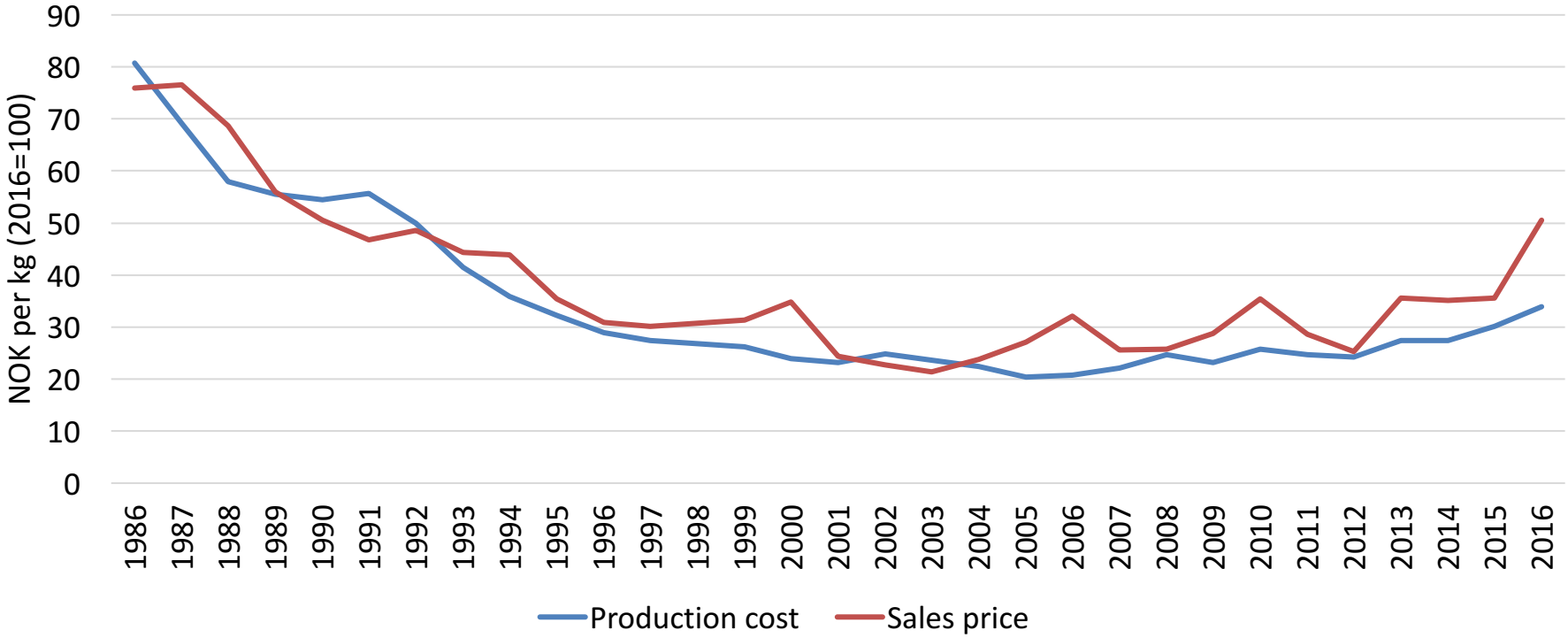
Salmon aquaculture costs shifting upwards

Norwegian production costs and ex farm sales price



Data source: Norwegian Directorate of Fisheries

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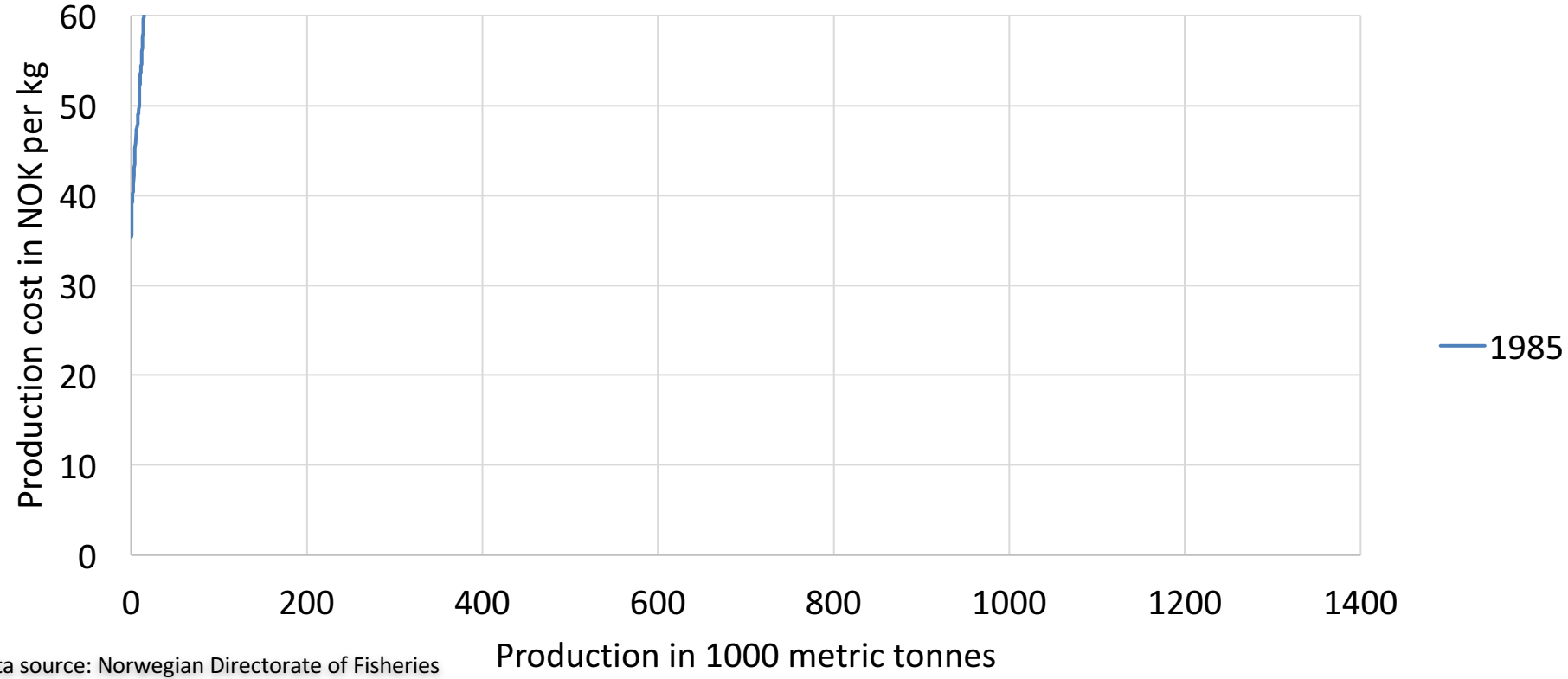
Supply curve for Norwegian farmed salmon



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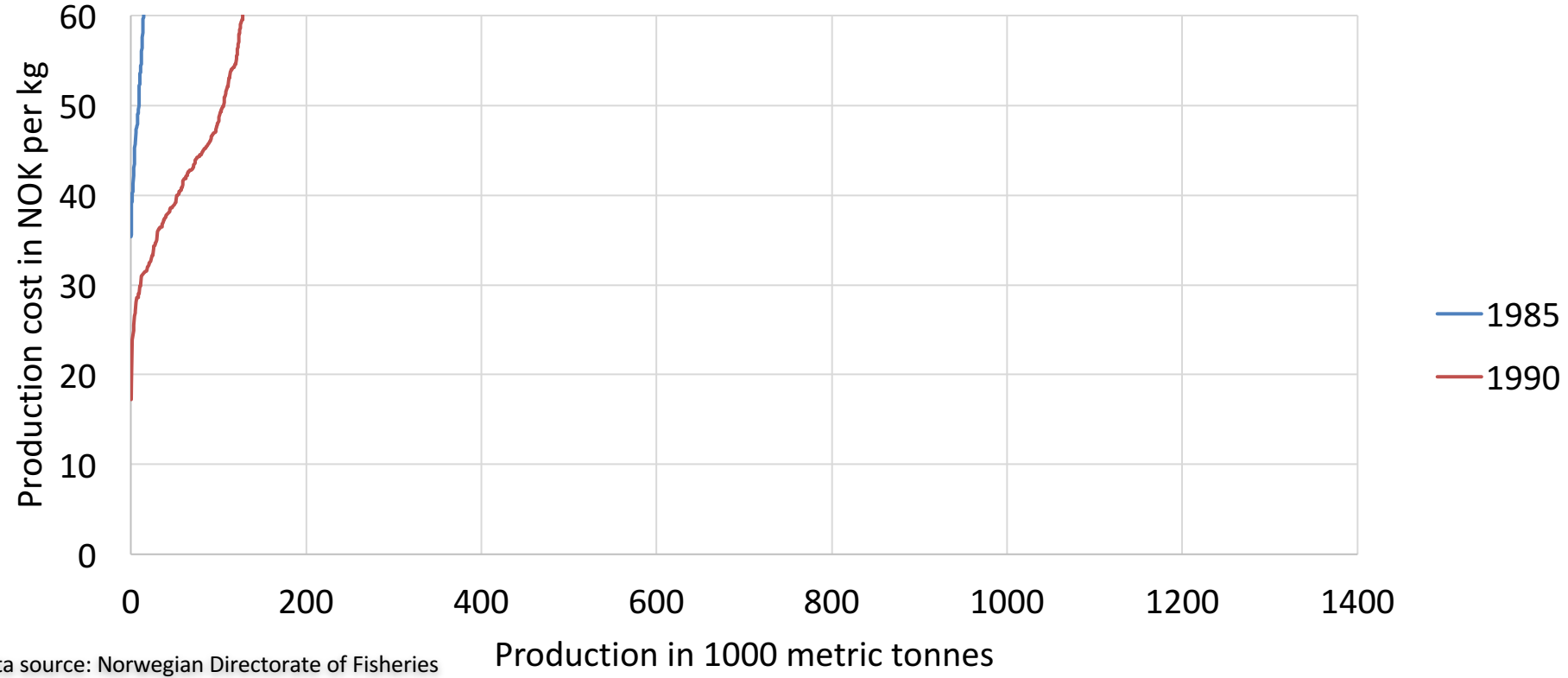

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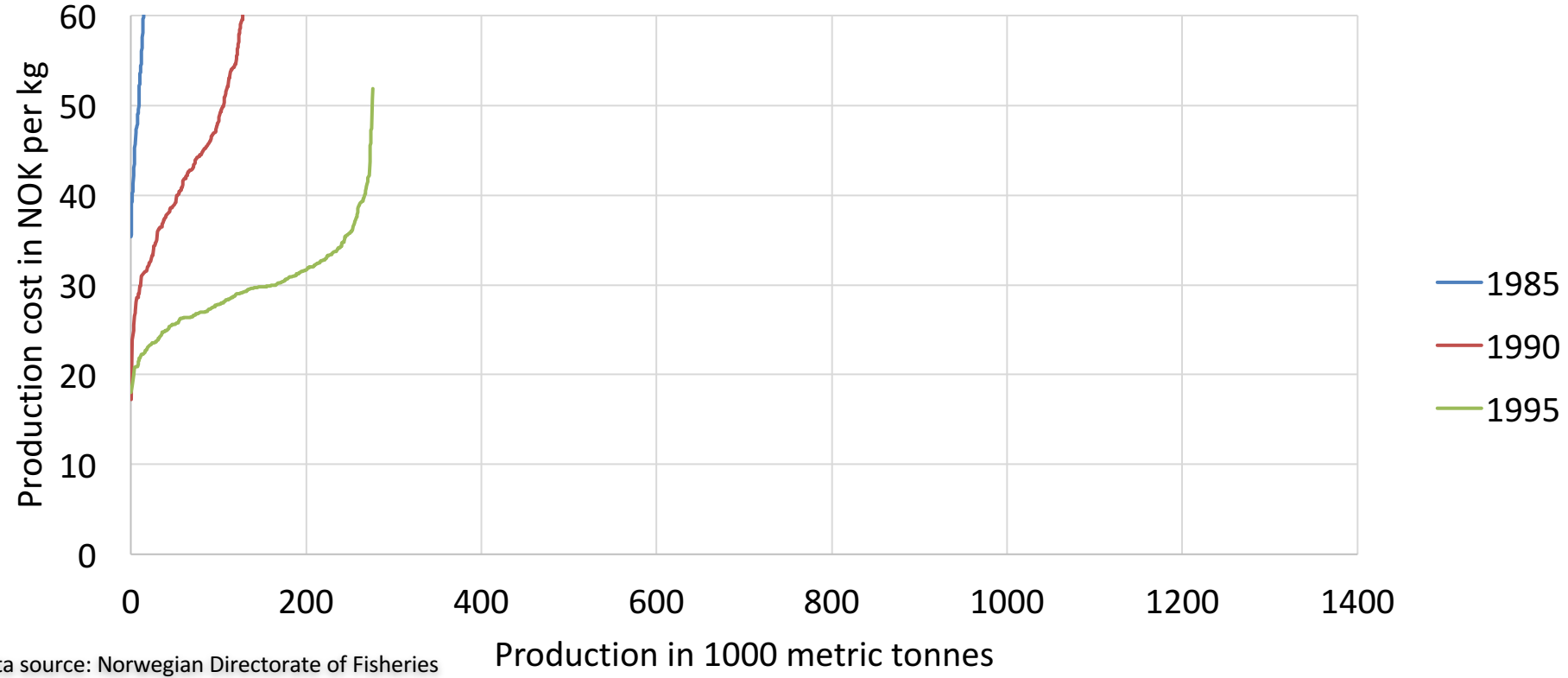

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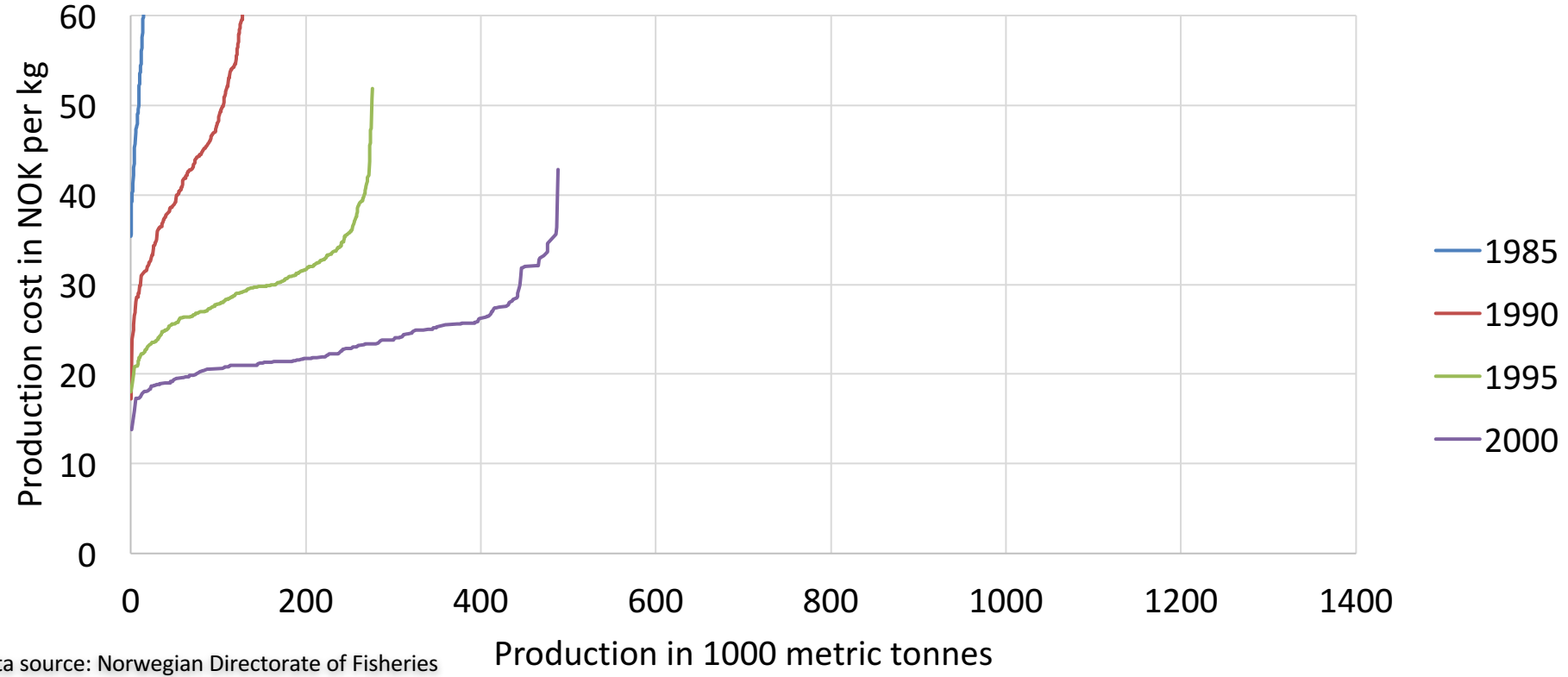

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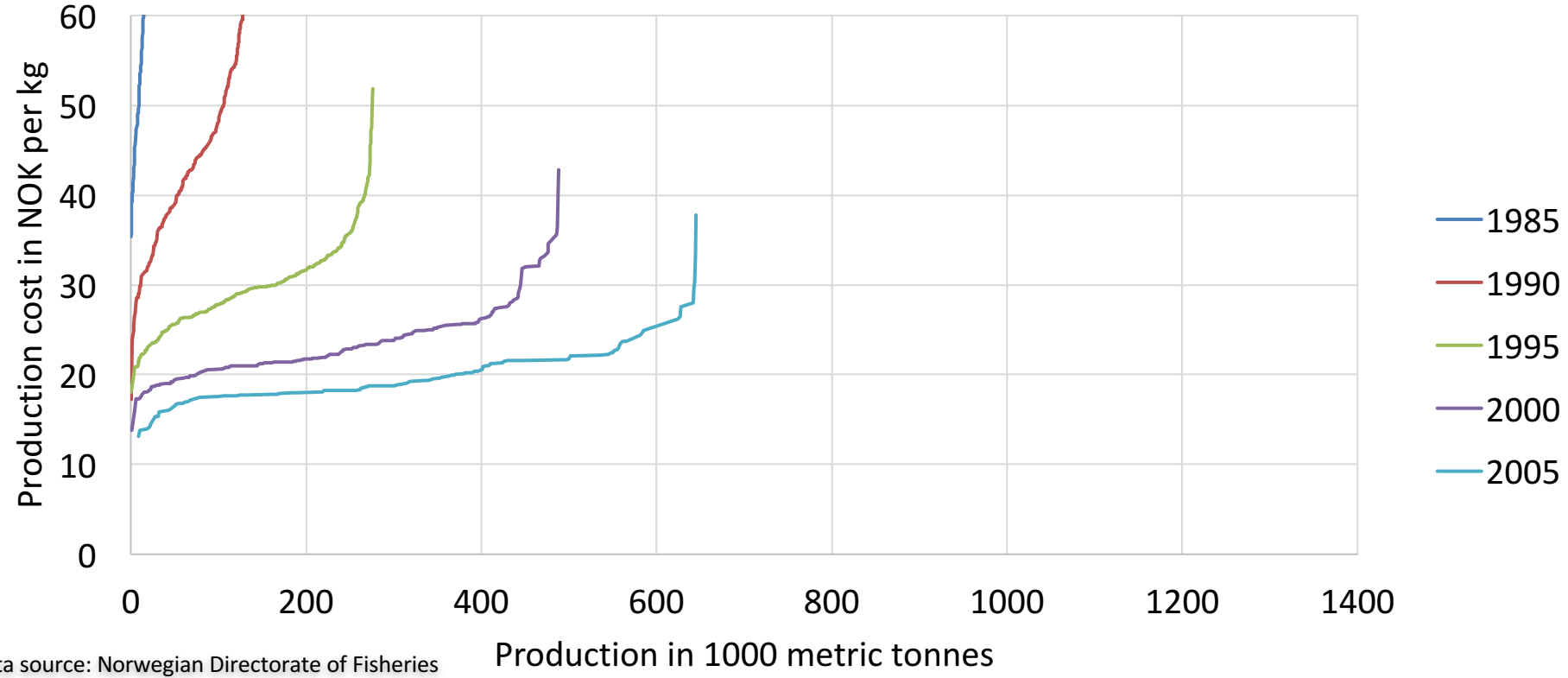

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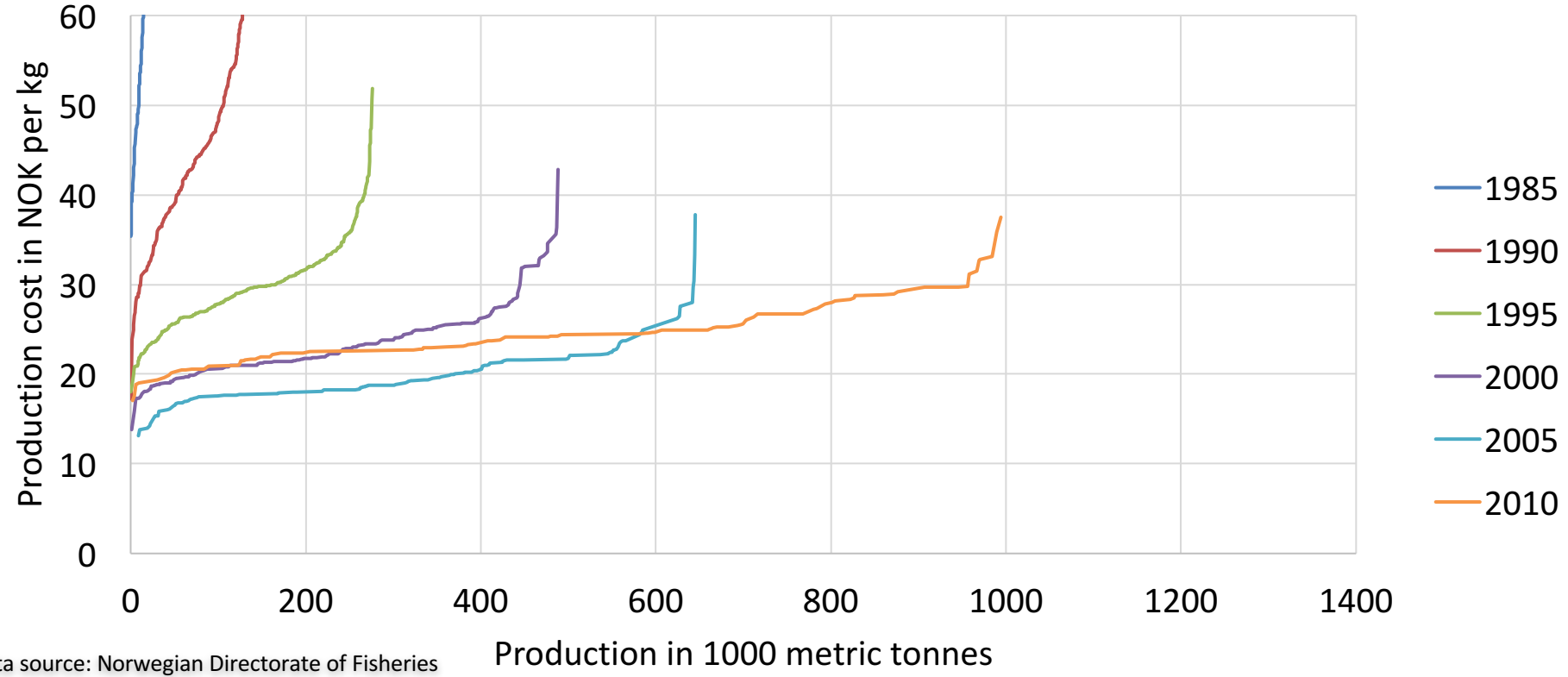

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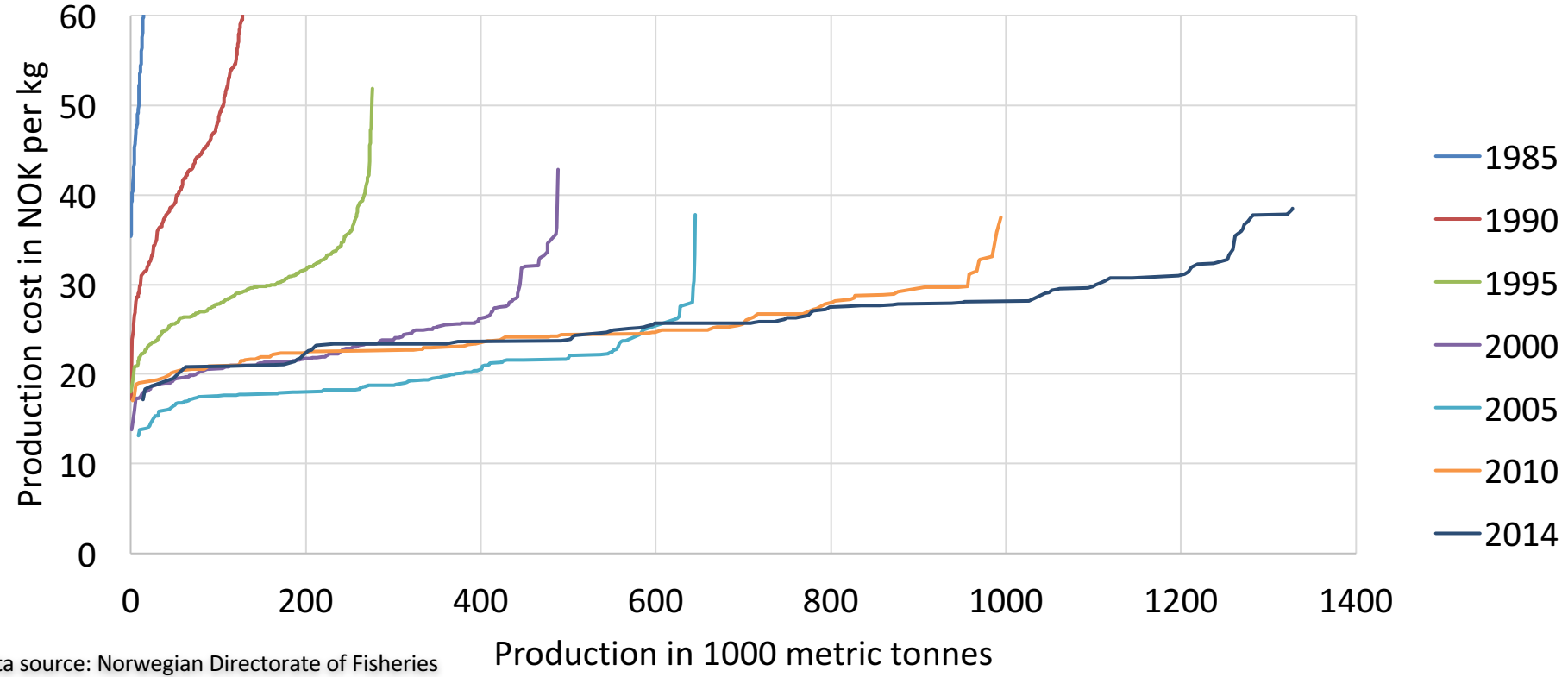

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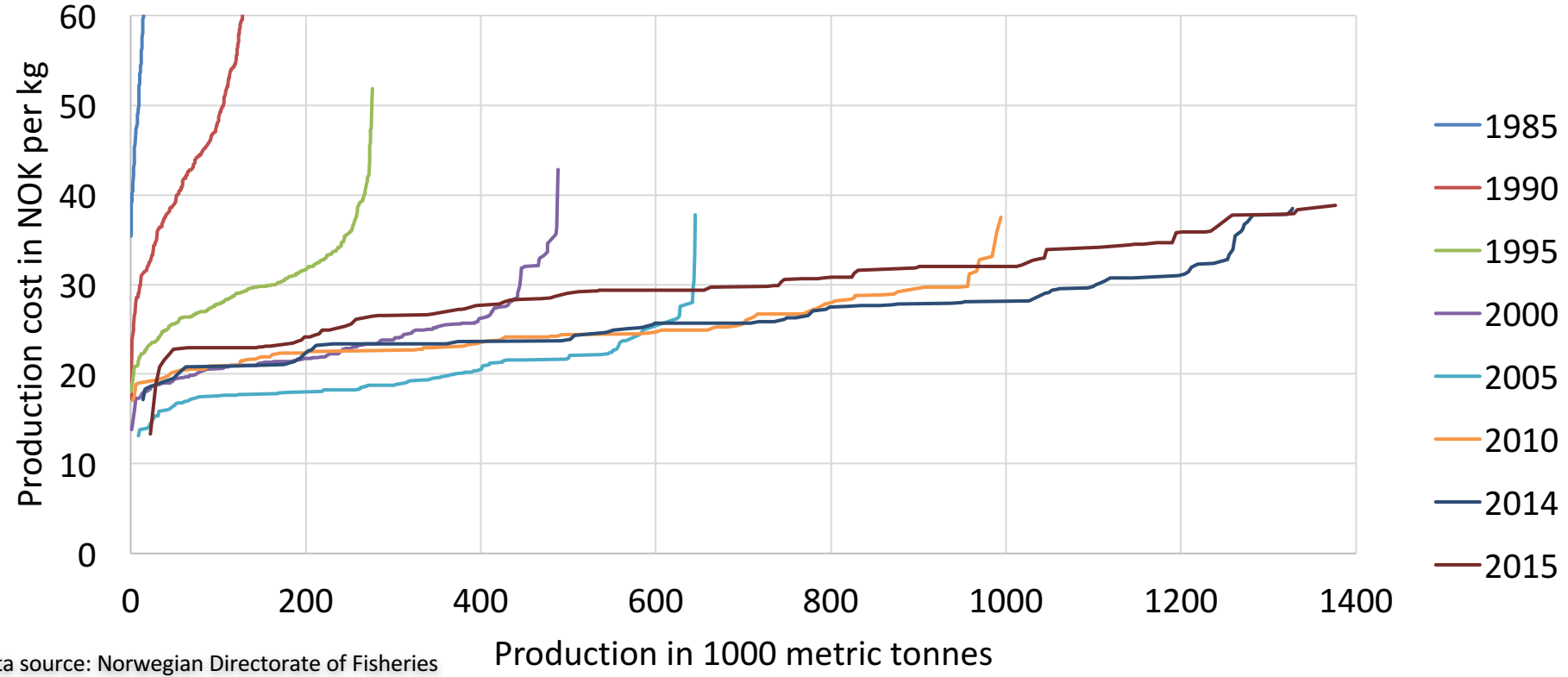

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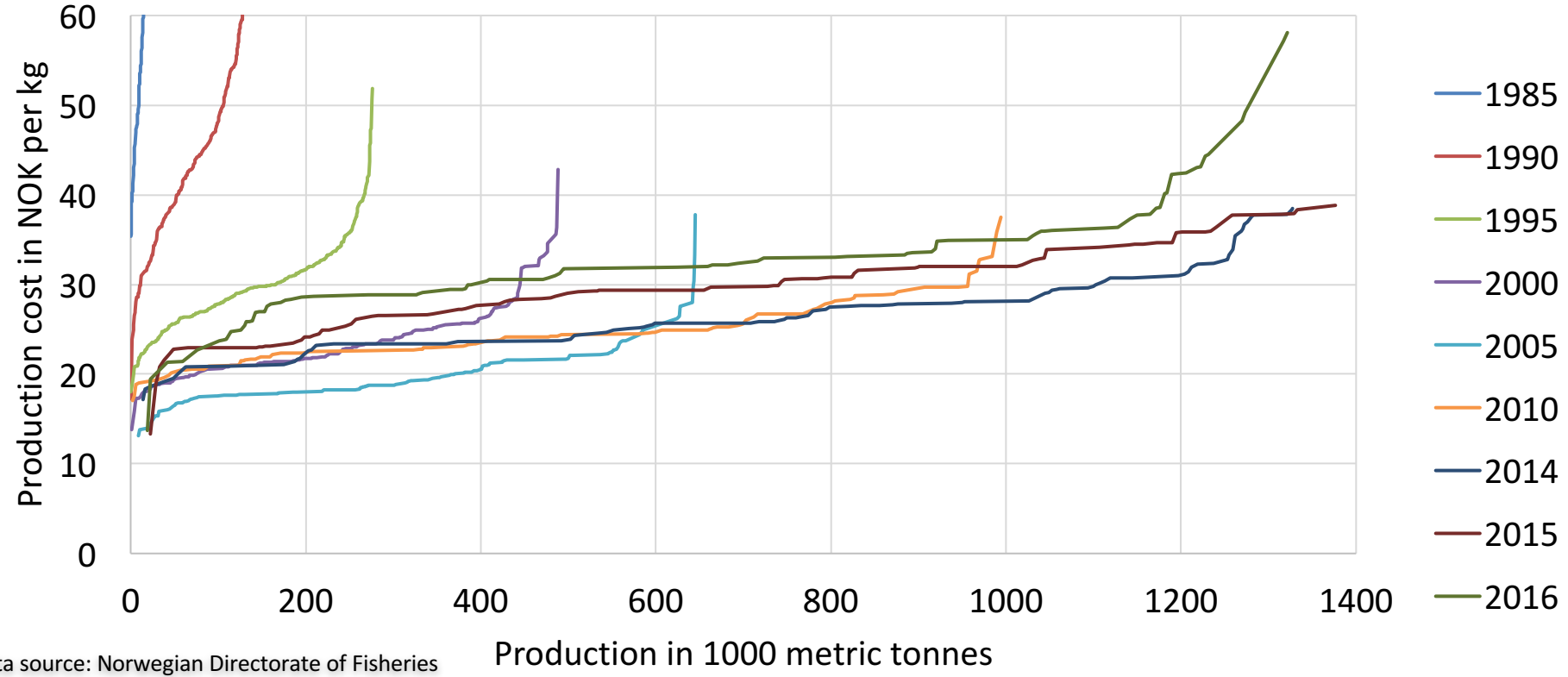

Data source: Norwegian Directorate of Fisheries

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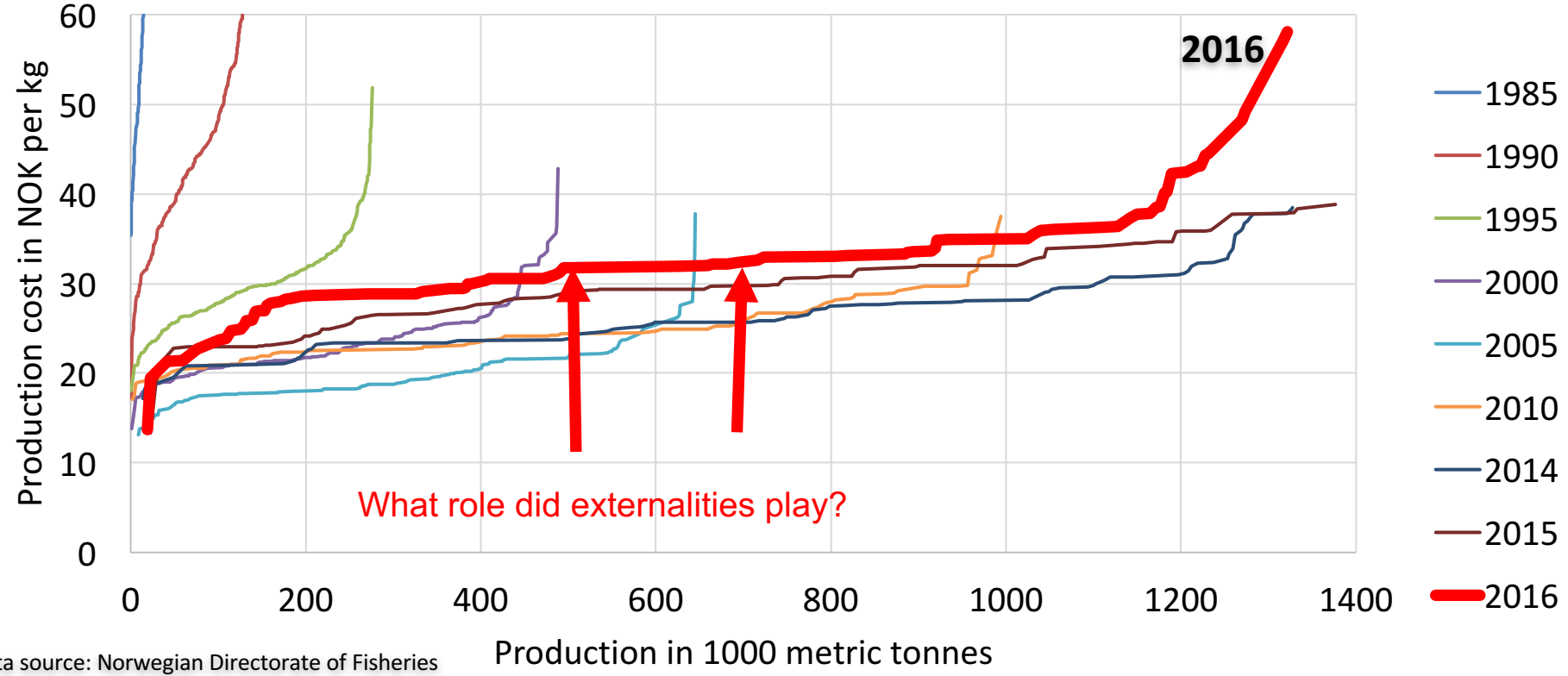
Externalities can shift costs upwards

Supply curve for Norwegian farmed salmon



Data source: Norwegian Directorate of Fisheries

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Supply side challenges

1) Continuous innovation based on R&D which can reduce external effects
   - within aquaculture (diseases etc.) and
   - to other sectors

2) Developing appropriate and effective policies and regulations
   - Developing/emerging economies – real externalities due to insufficient regulations
   - Developed (OECD) economies – perceived or very high standards for environmental effects

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A productive relationship between aquaculture and government

- Finding the productive balance in
  - division of labour and
  - risk sharing

  in the following areas
  - Research & development
  - Innovation investments
  - Regulation of production activities and environmental effects

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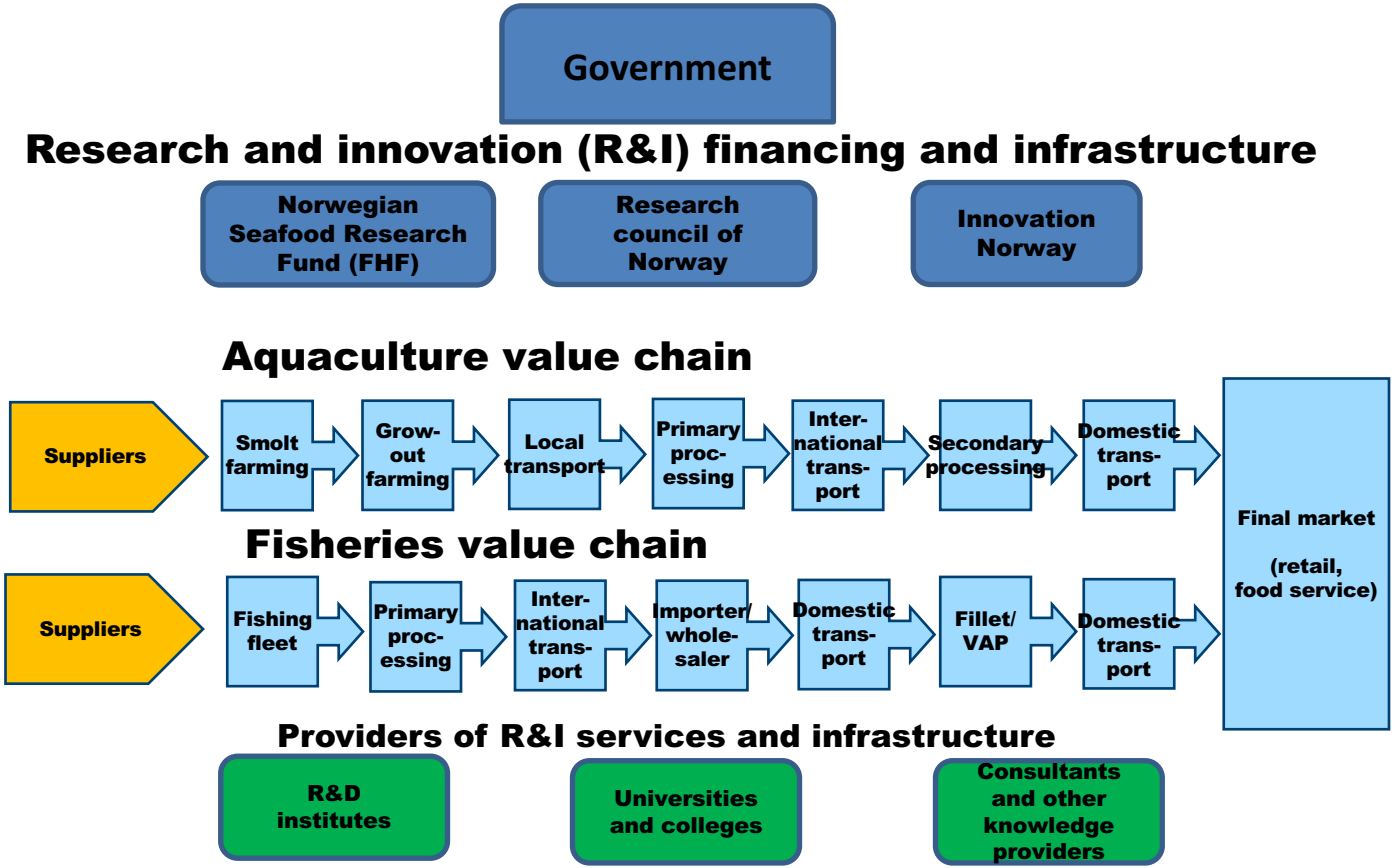
Seafood value chains and supporting institutions in Norway



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Innovation challenges for aquaculture and society

- Increasing R&D based knowledge production and innovation output from R&D
- Facilitating innovation among suppliers to aquaculture
- Facilitating large-scale, high risk innovation projects
- Public regulation innovations

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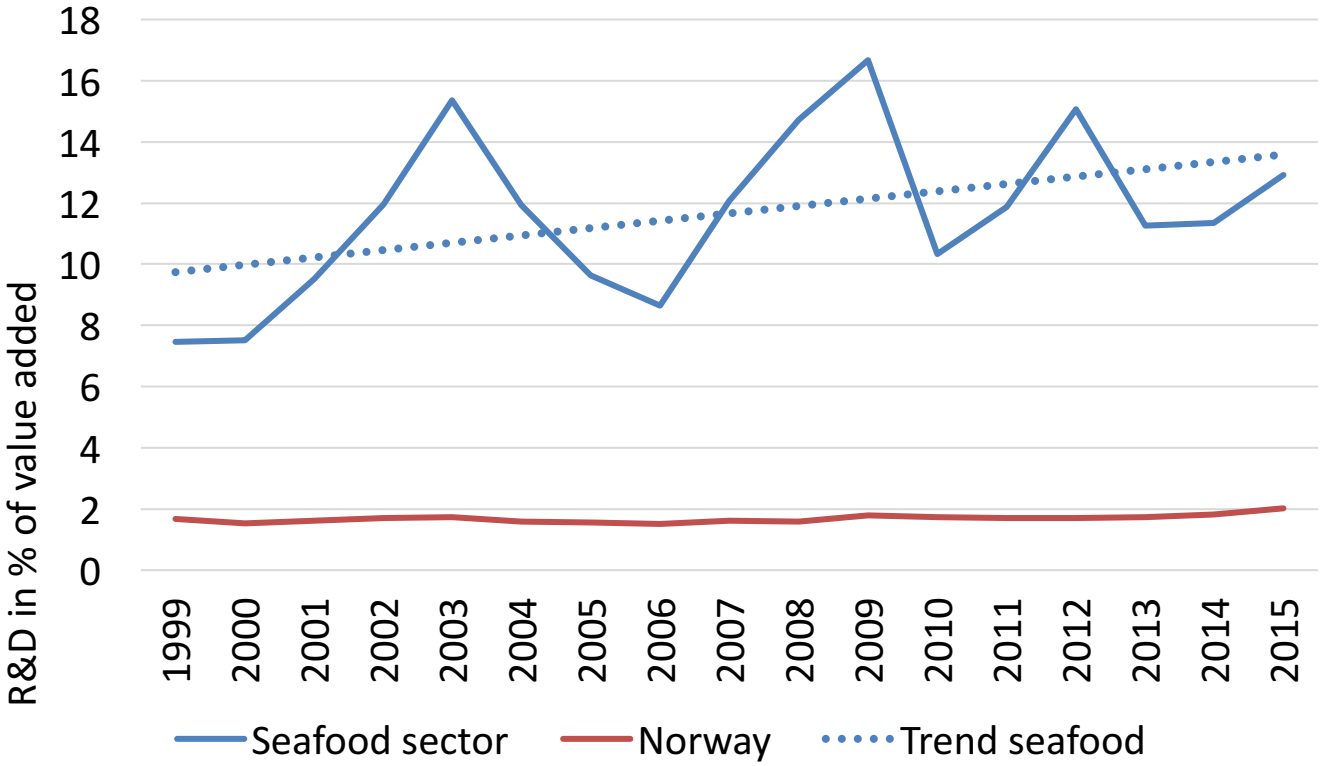
Norway - R&D spending is much higher in seafood than in the rest of the economy



Data source: Statistics Norway; NIFU

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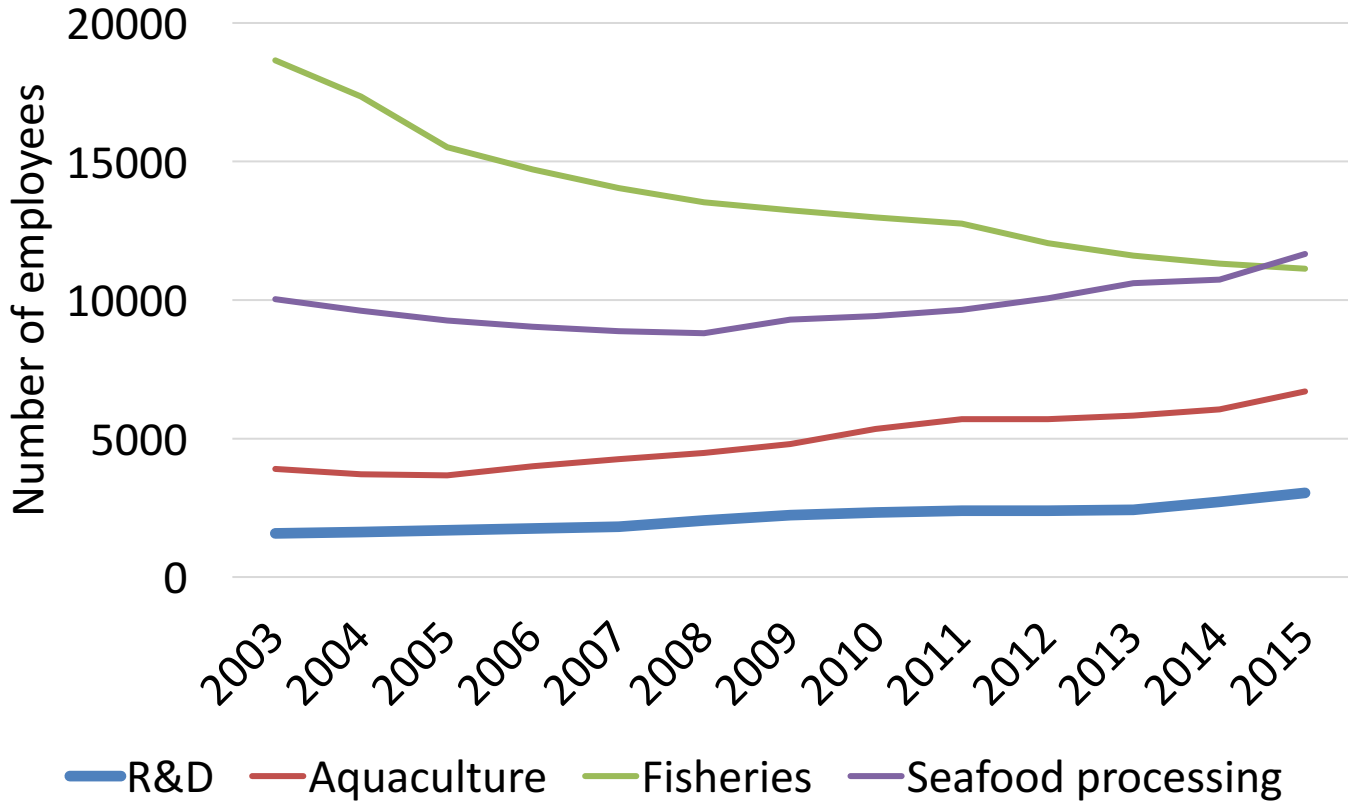
A more knowledge intensive sector

Employment in Norwegian marine R&D and seafood sectors



Ratio R&D to other sectors	
Aquaculture	2.2
Fisheries	3.7
Seafood processing	3.8
Total Seafood	9.7

Data source: Statistics Norway, Directorate of Fisheries, NIFU

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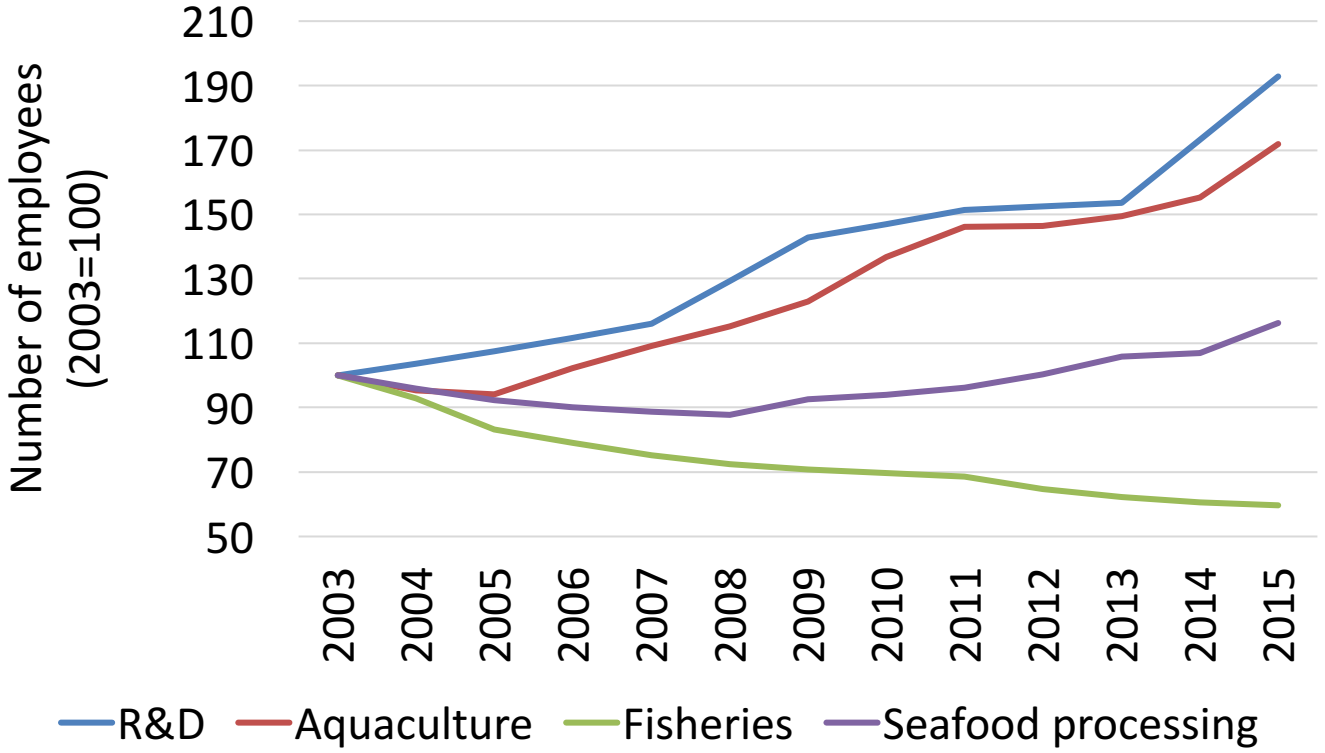

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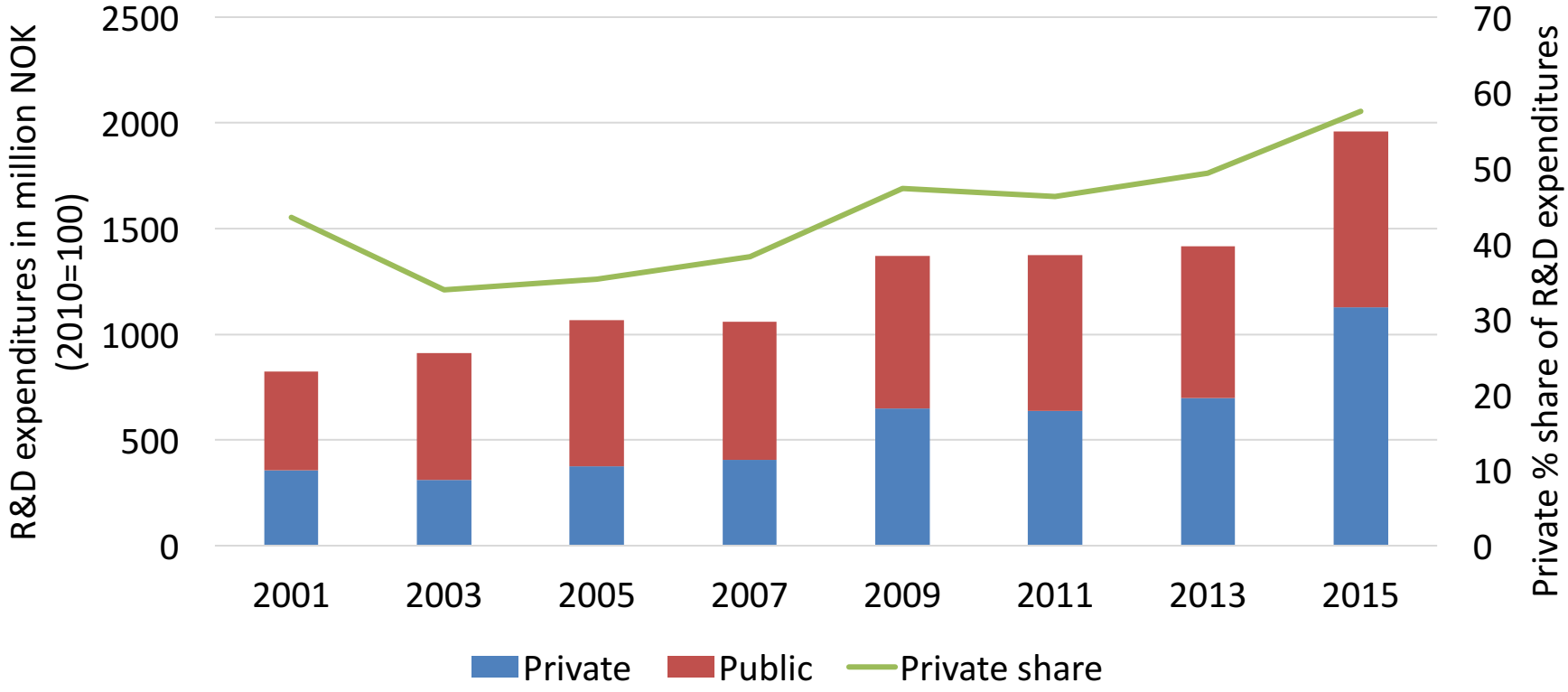
Norwegian Aquaculture R&D doubled 2005-15

Over 60% funded by private companies



Data source: NIFU

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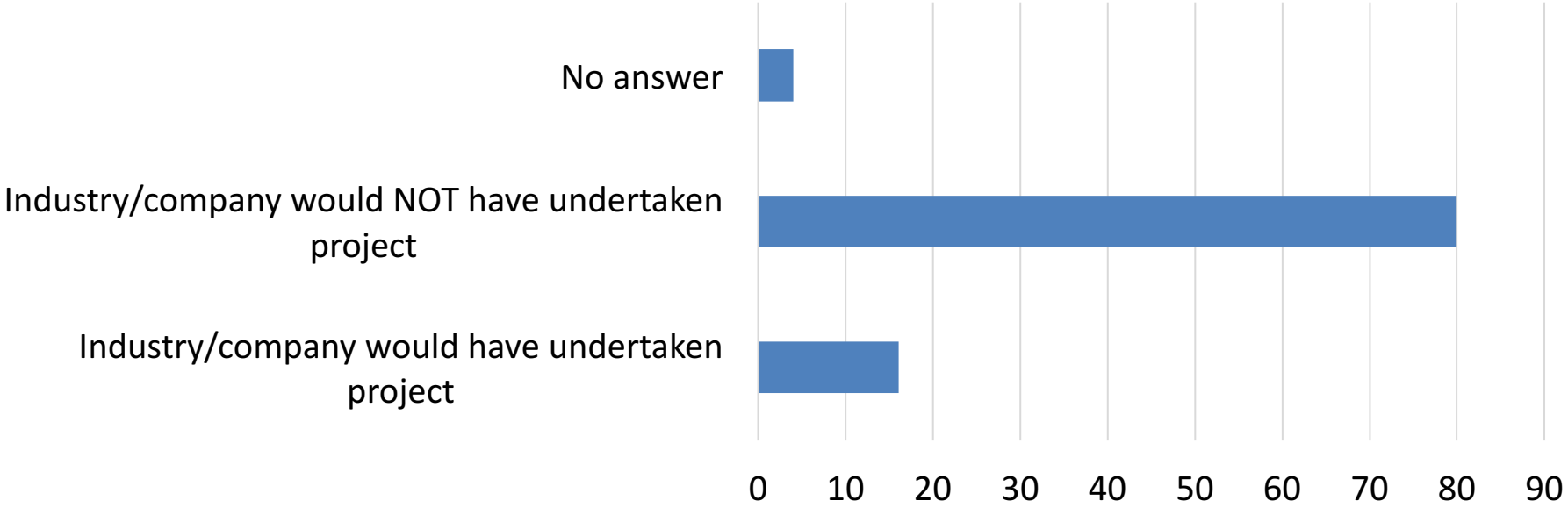
Evidence that many R&D projects require collective funding

What would have happened with the R&D project if it had not been collectively funded? % distribution



Source: Survey on projects funded by the Norwegian Seafood Research Fund (FHF)

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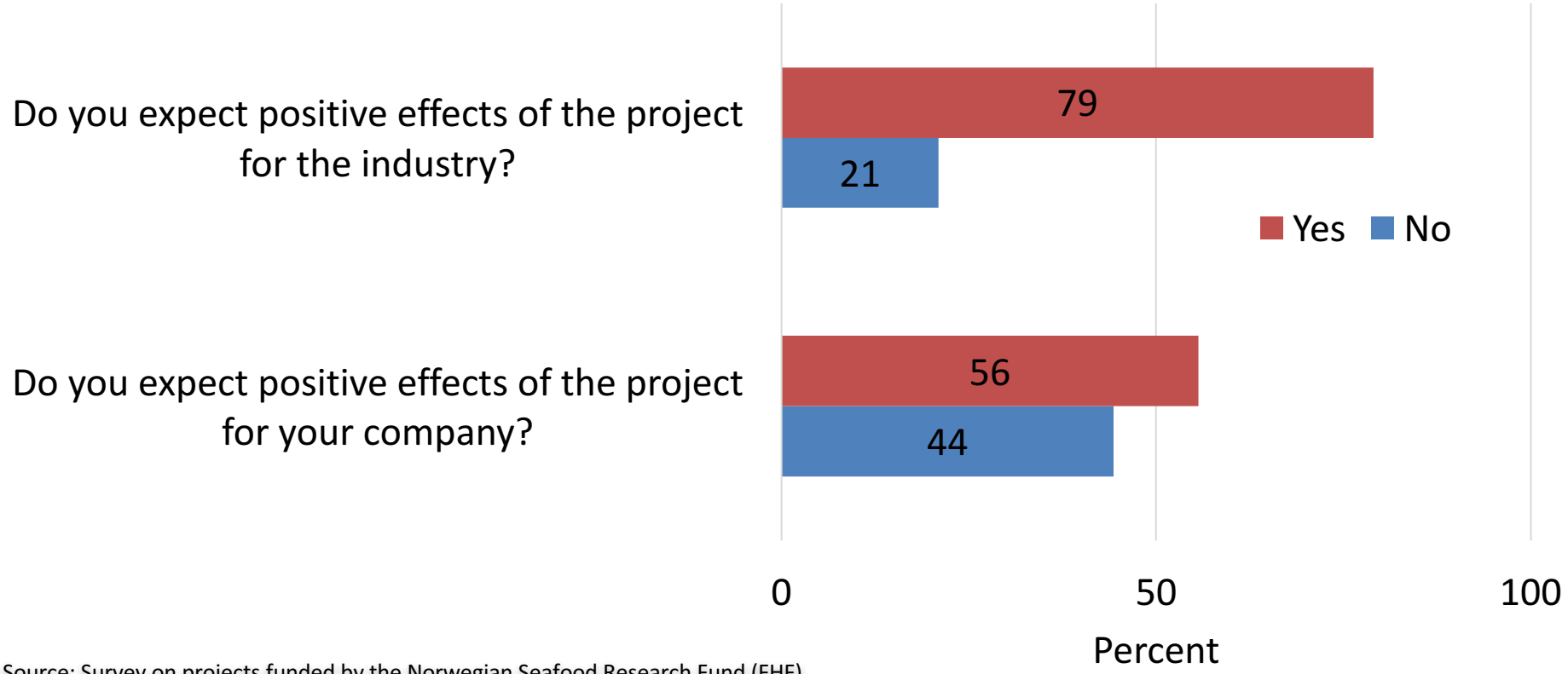
Collectively funded R&D projects with benefits for the entire sector



Source: Survey on projects funded by the Norwegian Seafood Research Fund (FHF)

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Private-public R&D collaboration and risk sharing necessary

- Much R&D will still require public funding and project execution

- Causes:
  - Long tail of firms with limited internal resources
  - Collective knowledge needs in aquaculture
  - Market failure in private R&D funding due to appropriation failures, high risks and large scale
  - Several types of R&D competence and capital most rational to have in public universities and research institutions

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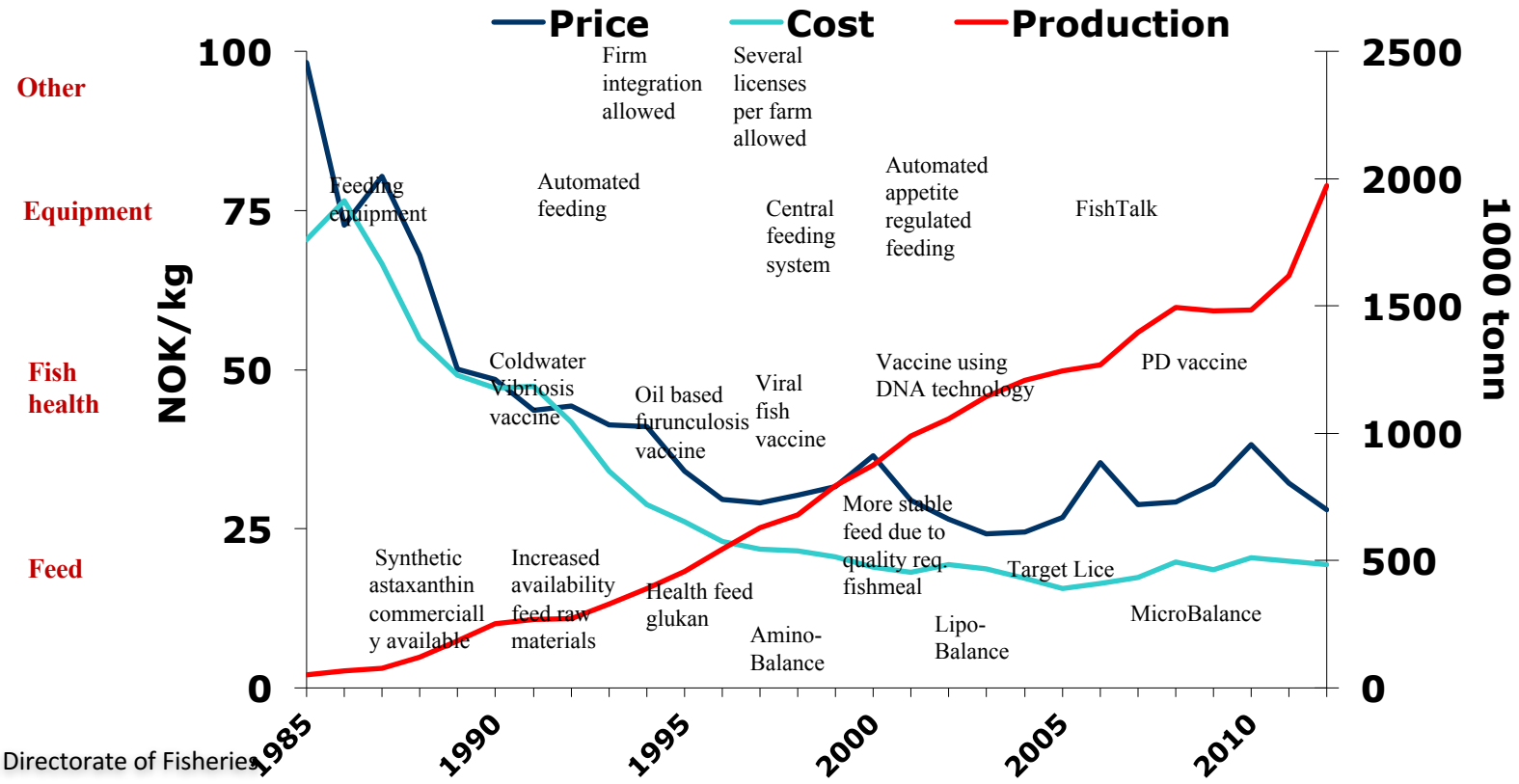
Suppliers did much of the job - Innovations in salmon farming

Price, production cost and global production



Data source: Kontali, Directorate of Fisheries

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Aquaculture suppliers are the most innovative

Share of firms with innovation

	Product innovation	Process innovation	Radical product innovation
Aquaculture farms	12%	27%	4%
Aquaculture suppliers	38%	49%	21%
Fisheries	13%	13%	4%
Seafood processing	25%	25%	11%
Exporters & wholesalers	23%	23%	11%
Manufacturing	33%	25%	19%

Data source: Statistics Norway

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Challenges for many suppliers

- Volatile and thin markets for their products
- Thin profit margins – the fruit of their innovations are harvested by the farm stage
- Innovations will increasingly depend on R&D investments
- Scale of R&D and innovation investments will increase

- Innovation policy which provide external funding, human capital and provide sufficient IP protection

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A sustainably growing industry is one that finds the productive division of responsibilities, labour and risks between itself and government

…and is able to educate government and nudge it in the right directions when that is appropriate