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政策研究大学院大学  
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# Improving the Quality of Export Oriented Industries to Foster Diversification: Case of Chilean Salmon Farming

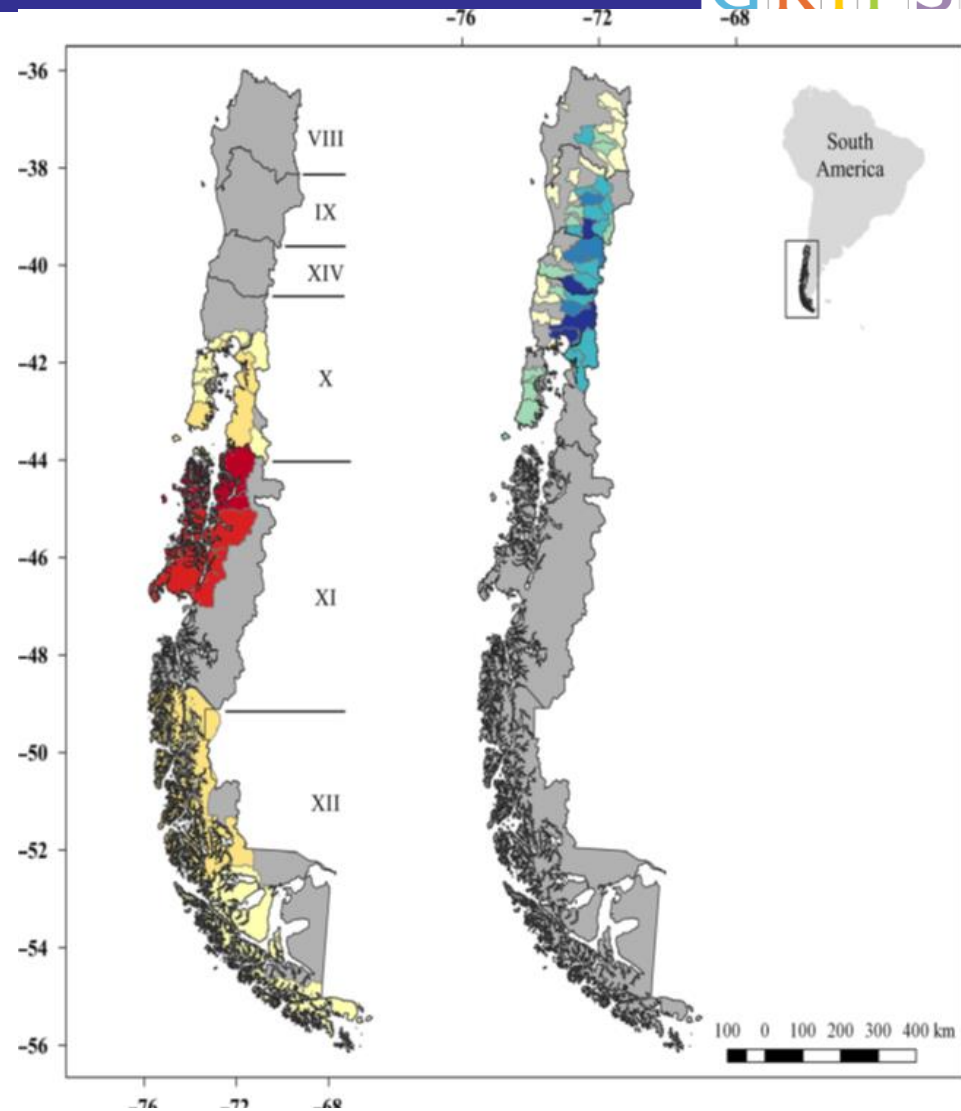
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# OUTLINE

1. Why this case may be relevant?
2. How industry got started and developed?
3. Remaining Challenges
4. Potentials of NRB?
5. What are the possible take away from this case?

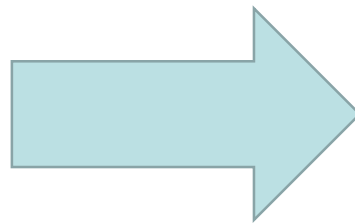


**Figure 1** Geographical location of freshwater and marine salmon aquaculture leases in 2016. Roman numerals correspond to the Chilean administrative regions. Information on land base concessions (hatcheries and smolt production) per county for regions XI and XII was not yet available for 2016. Information for these figures was provided (through the Transparency Law request process) by the Chilean Undersecretariat for Fisheries and Aquaculture (SUBPESCA) and the Chilean National Fisheries and Aquaculture Service (SERNAPESCA). Land-based (freshwater) concessions per county (N°): 1, 1-3, 3-5, 5-8, 8-13; Marine farm concessions per county (N°): 1-50, 50-100, 100-150, 150-200, 200-250, 250-300, 300-350, 350-369.

Source: Quinones et al, 2019

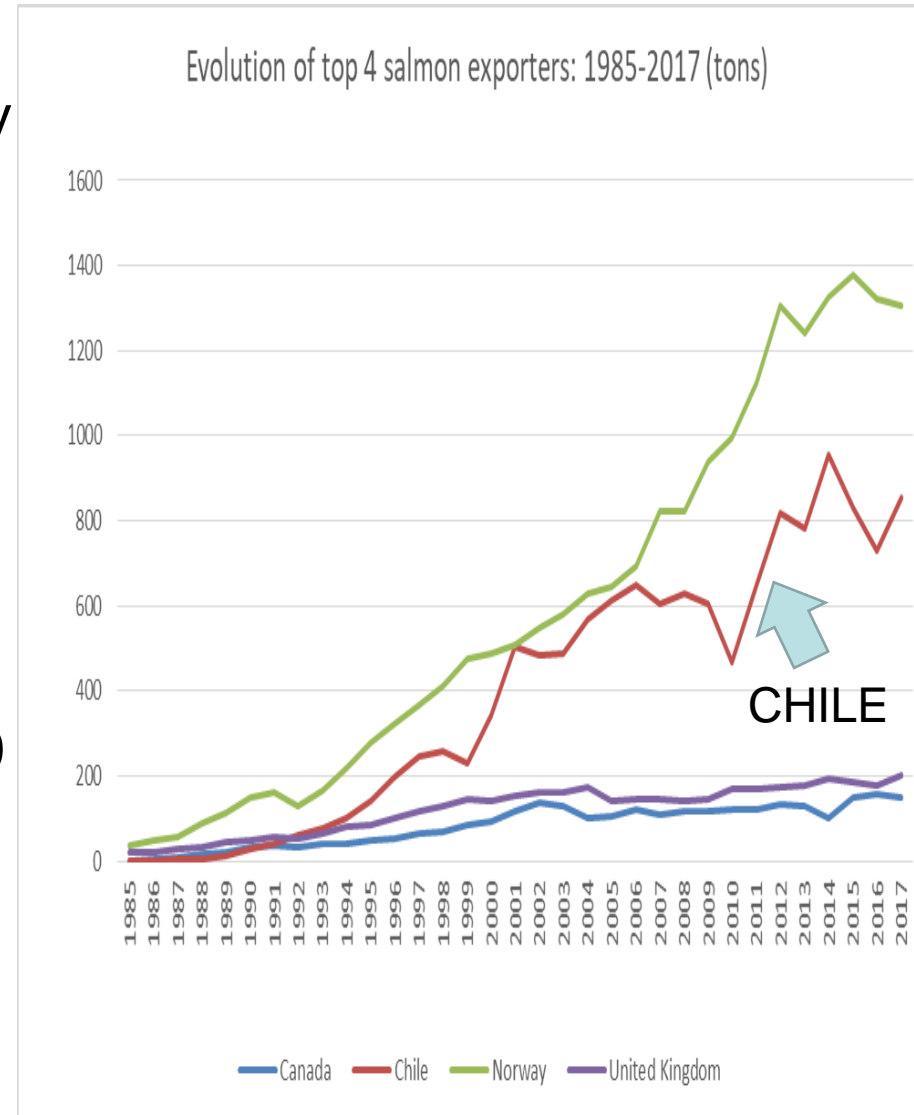
# Why the Chilean salmon farming case relevant for this workshop?

- A documented case of *creating an export industry from scratch*
- **Covers early phase of industrial development** not just the stage of “catching up”
- It is not the case of manufacturing but *natural resource based (NRB) activities* which has different ways of *value addition*



# Snapshot of Chilean Salmon Industry in 2018

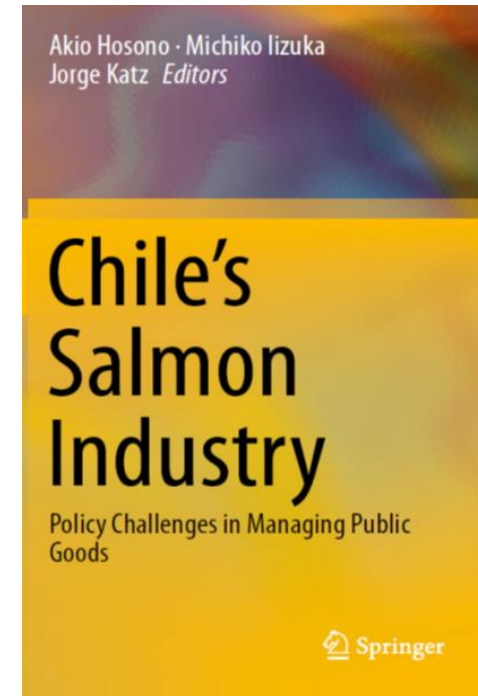
- No. 2 in export volume and value of farmed salmon in the world after Norway
- Exported to USA (21.5%), Japan(19%) and diversifying the destinations to emerging economies such as Russia, China and Brazil.
- Contributes about 7% of total export of Chile
- Generating direct employment of 30,000 direct and 14,500+ indirect (Soto, 2016)
- Salmon farming emulates the natural rearing of fish: complex mix of agriculture and manufacturing



# Question to the audience:

## When do you think this industry initiated in Chile?

1. **In the mid 1970s** when Chile shifted to market-oriented economic policy.
2. **In the 1980s** when Chile's export grew exponentially.
3. **In 1990**, when Chile became democratic country.
4. **Few years before 1992** when Chile became no. 2 in the world exporter of salmon.
5. **None of the above**



# Early phases of starts in the **late 1960s**

**WHY IN CHILE?**

**WHY AT THAT TIME?**

# Early phases of starts in the **late 1960s** Why in Chile and Why at that time?

## CHILE

## TIME

- **Favourable natural conditions for fish farming**
  - Good geographical conditions (Humboldt current, Fjord)
  - Pristine water: fresh and salt
  - Quiet environment
  - Right temperature
  - Luminosity
  - Fishfeed (fishmeal, anchoveta)
  - Relatively cheap labour
- **Region needed employment**
- **Government-Technological transfer salmon farming (with Washington University in 1968-1969)**
- **Concern over maritime jurisdiction in the 1960s.**
  - Russia forbidden to fish salmon near their sea. Same is expected in the USA.
  - Japanese Fishery Association look for possible new supply sources, send missions in 1969
- **Salmon farming –just started in Norway in the 1960s. Implemented in several countries including Japan (delayed release)**

# Early phases of starts in the late 1960s Why in Chile and Why at that time?

**SUPPLY SIDE CONDITIONS** ↔ **DEMAND SIDE CONDITIONS**

**Natural comparative  
advantage**

**Change in Market  
Conditions**

**Initiative taken by  
the government**

**Technological Window of  
opportunity**



# Experimentation and self-discovery: In the 1970s

## CHILE - JAPAN cooperation

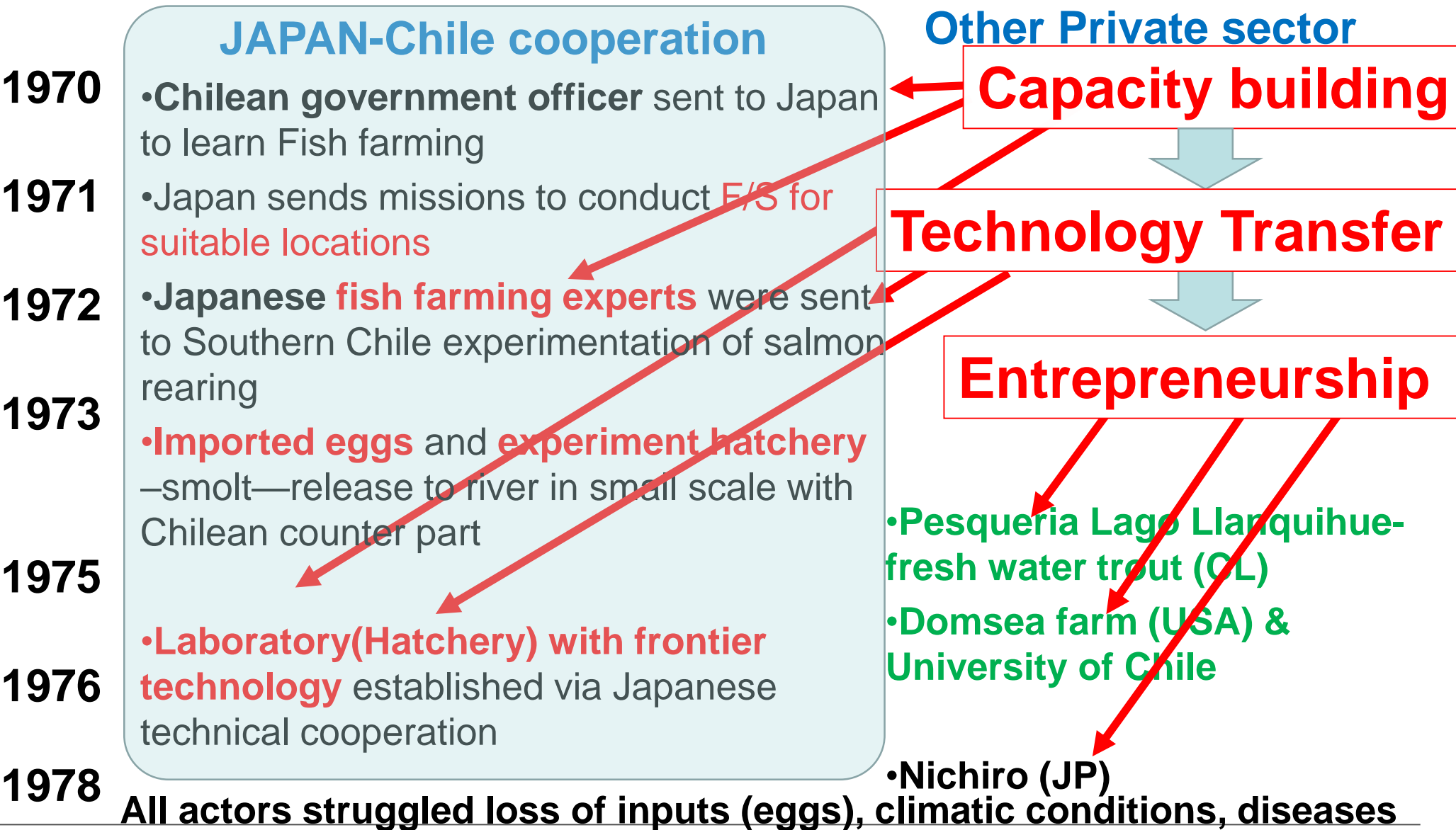
- 1970** •Chilean government officer sent to Japan to learn Fish farming
- 1971** •Japan sends missions to conduct F/S for suitable locations
- 1972** •Japanese fish farming experts were sent to Southern Chile experimentation of salmon rearing
- 1973** •Imported eggs and experiment hatchery—smolt—release to river in small scale with Chilean counter part
- 1975** •Experimental laboratory with frontier technology established via Japanese technical cooperation
- 1976** •Experimental laboratory with frontier technology established via Japanese technical cooperation
- 1978**

## Other Private sector

- Pesqueria Lago Llanquihue-fresh water trout (CL)
- Domsea farm (USA) & University of Chile
- Nichiro (JP)

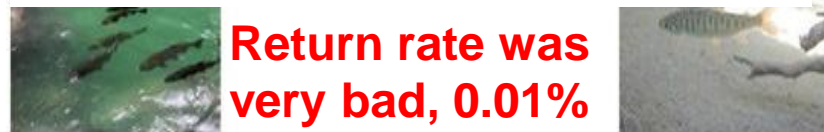
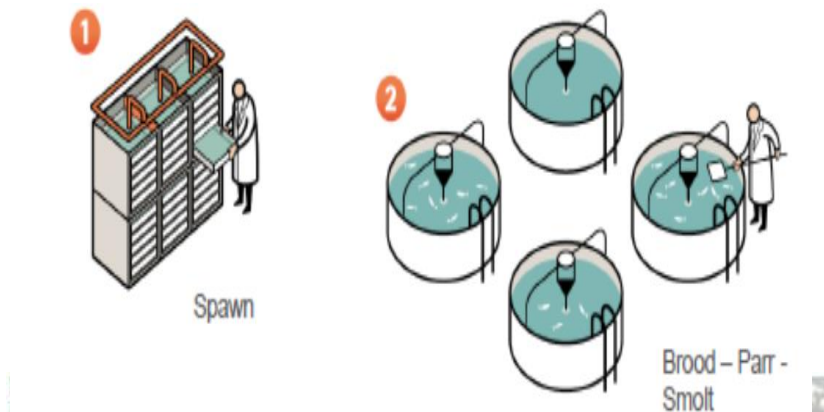
All actors struggled loss of inputs (eggs), climatic conditions, diseases

# Experimentation and self-discovery: In the 1970s

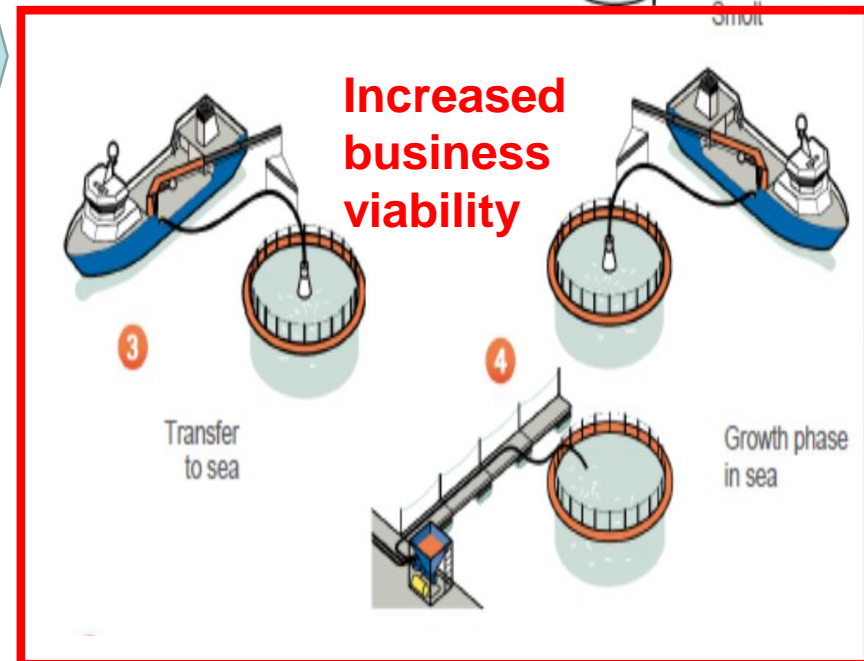
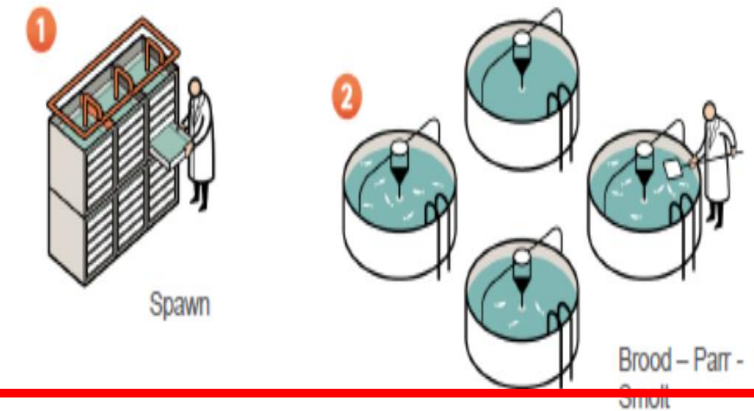


# 1979-1980 Technological Change in Salmon Farming Mariculture

## “Rise and release”

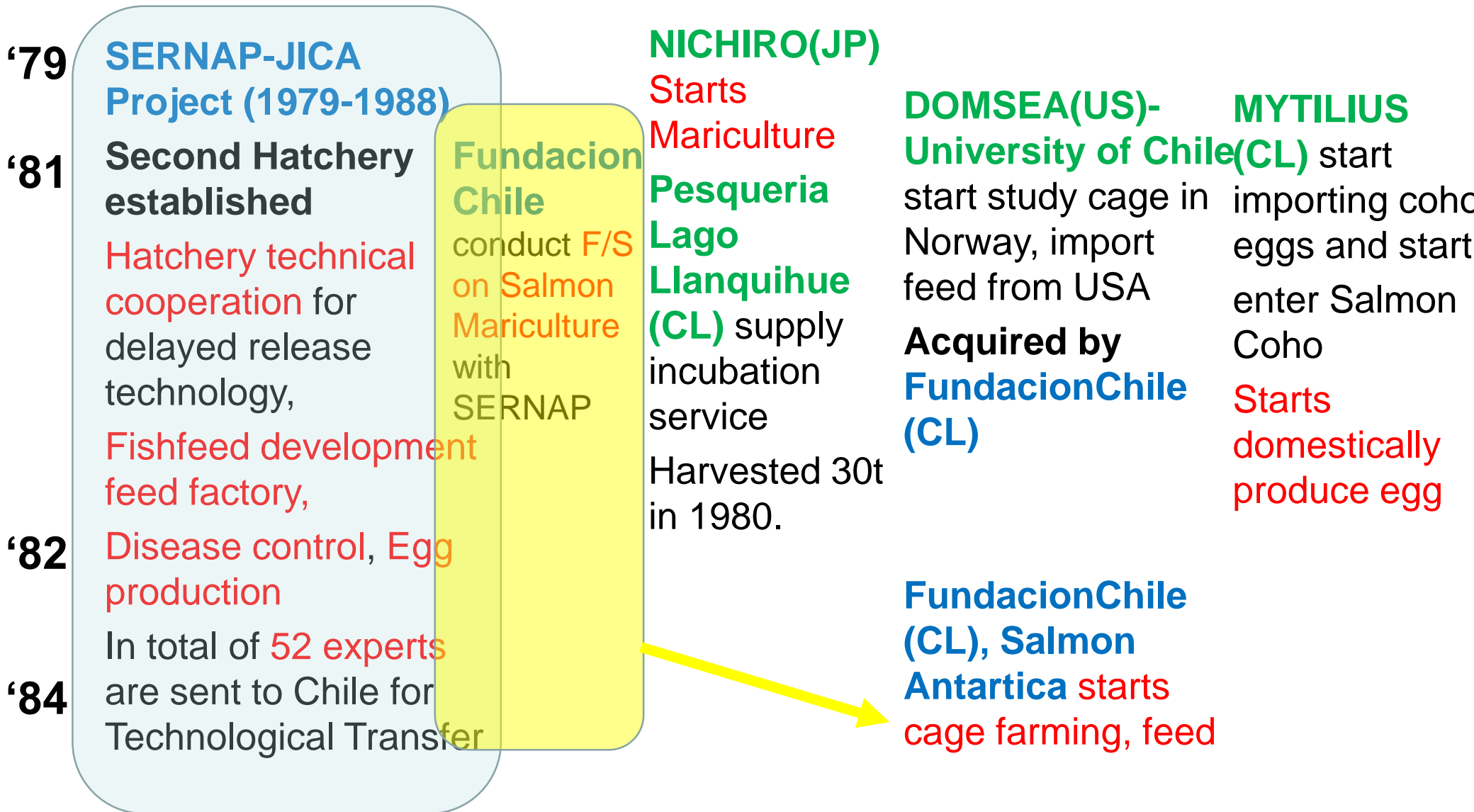


**Waiting period until return: 4 yrs**

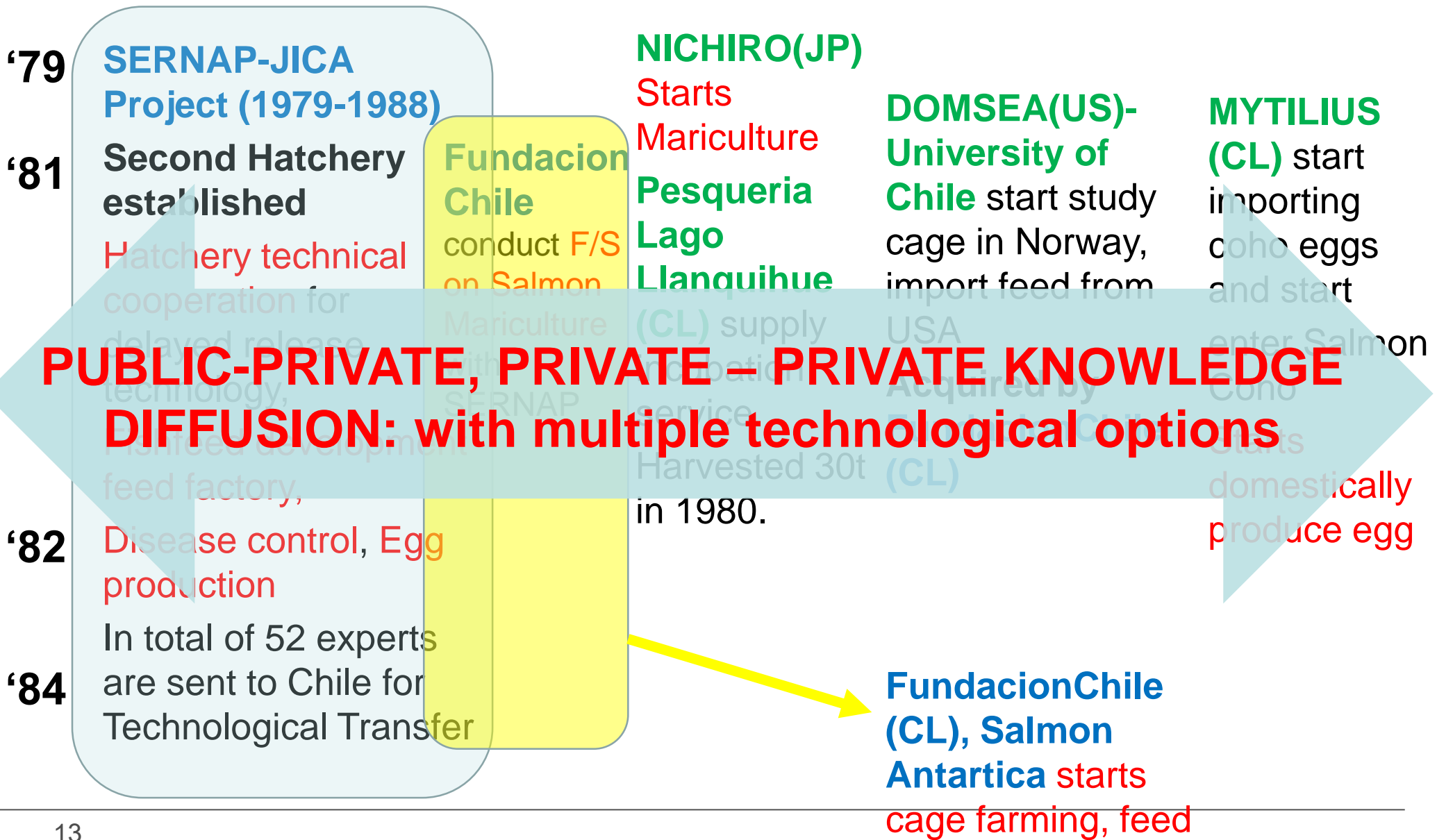


Source: MarineHarvest and <https://www.nps.gov/olym/learn/nature/the-salmon-life-cycle.htm>

# Private sector enter Mariculture: From 1979 to 1984



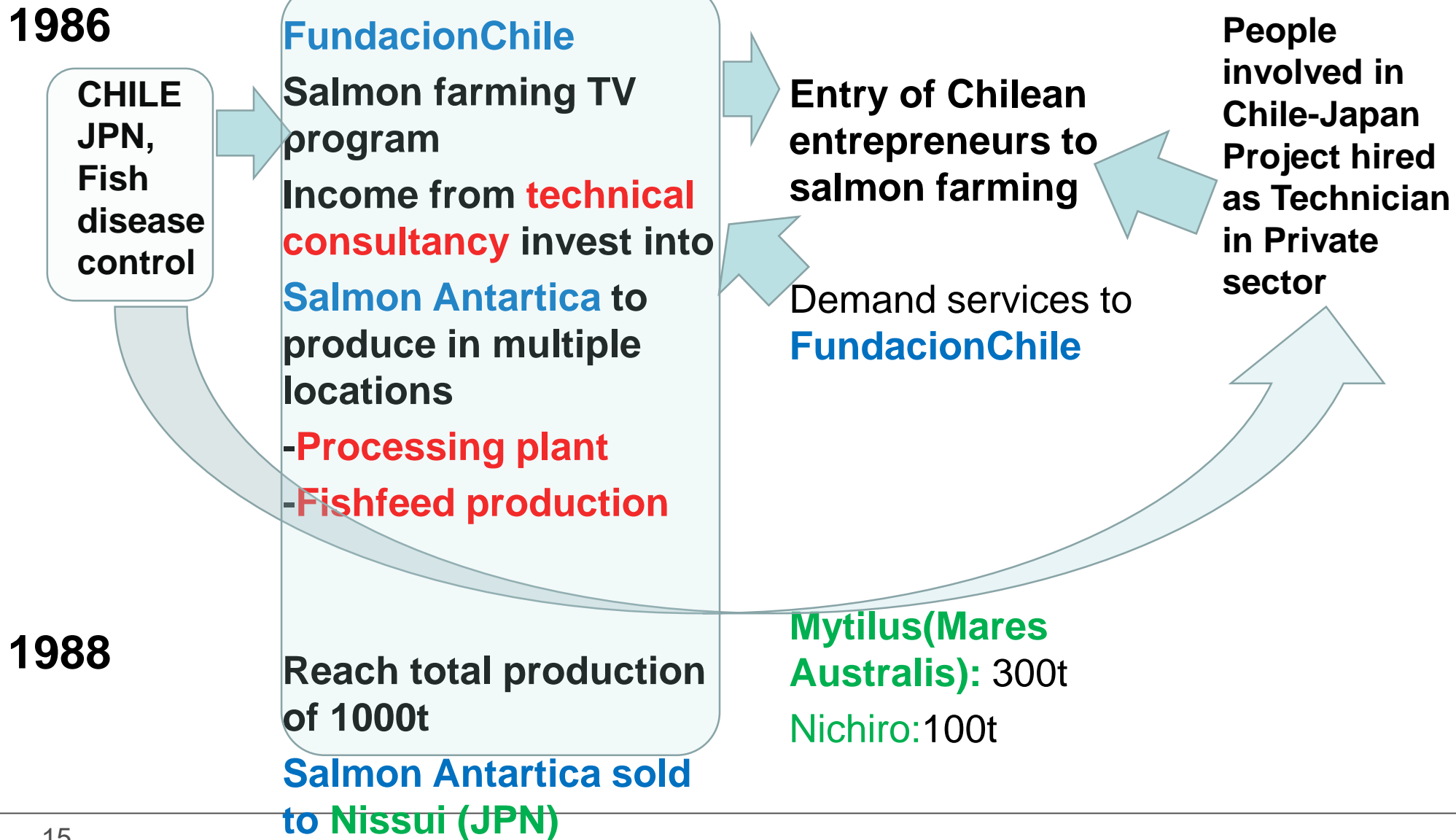
# Private sector enter Mariculture: From 1979 to 1984



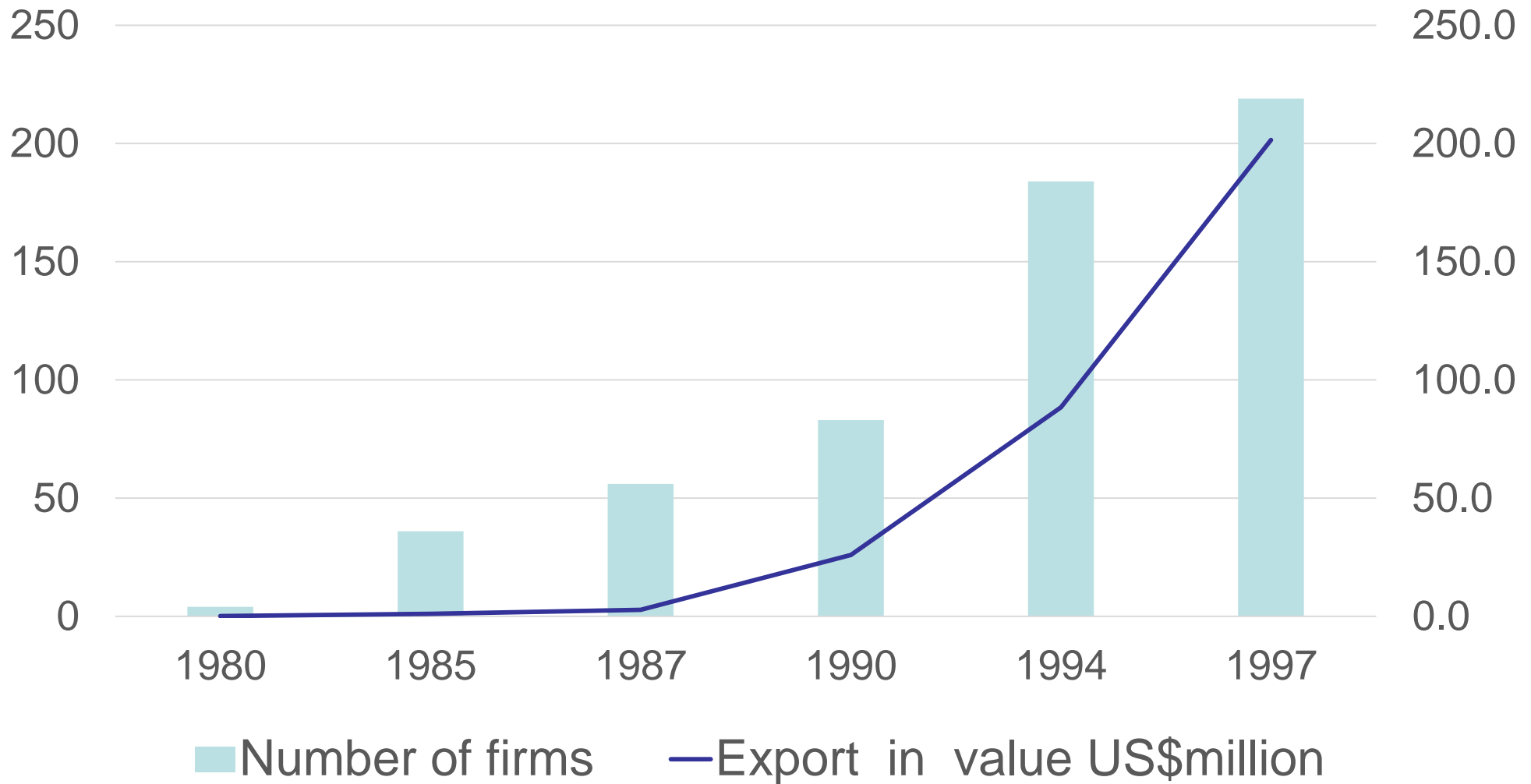
## Private sector enter Mariculture : 1979-1984

- Technological Change: Mariculture
- Different private sector firms taking similar actions but trying different methods (Japan, Norway, USA)
- Chile-Japan cooperation provided expertise: intermediation of knowledge
  - Extremely long technical cooperation (1969-1988)
  - FundacionChile start take over knowledge intermediation role
- Personnel Trained under Chile-Japan cooperation were hired by private sector as technicians
- Tight network of technicians in public and private sector generated better coordination and good diffusion of knowledge

# Scaling up production volume: the late 1980s



# Growth in export and number of exporting firms





# Learning to export 1: the late 1980s to early 1990s

## Challenge for Exporting

- **Marketing & Learning**
  - Pricing mechanism
  - Entry requirements
  - Different cuts by market
- **Inputs and services**
  - Healthy domestic eggs
  - Good quality Fishfeed
- **Regulation**
  - Law is needed for international agreements

## Solutions

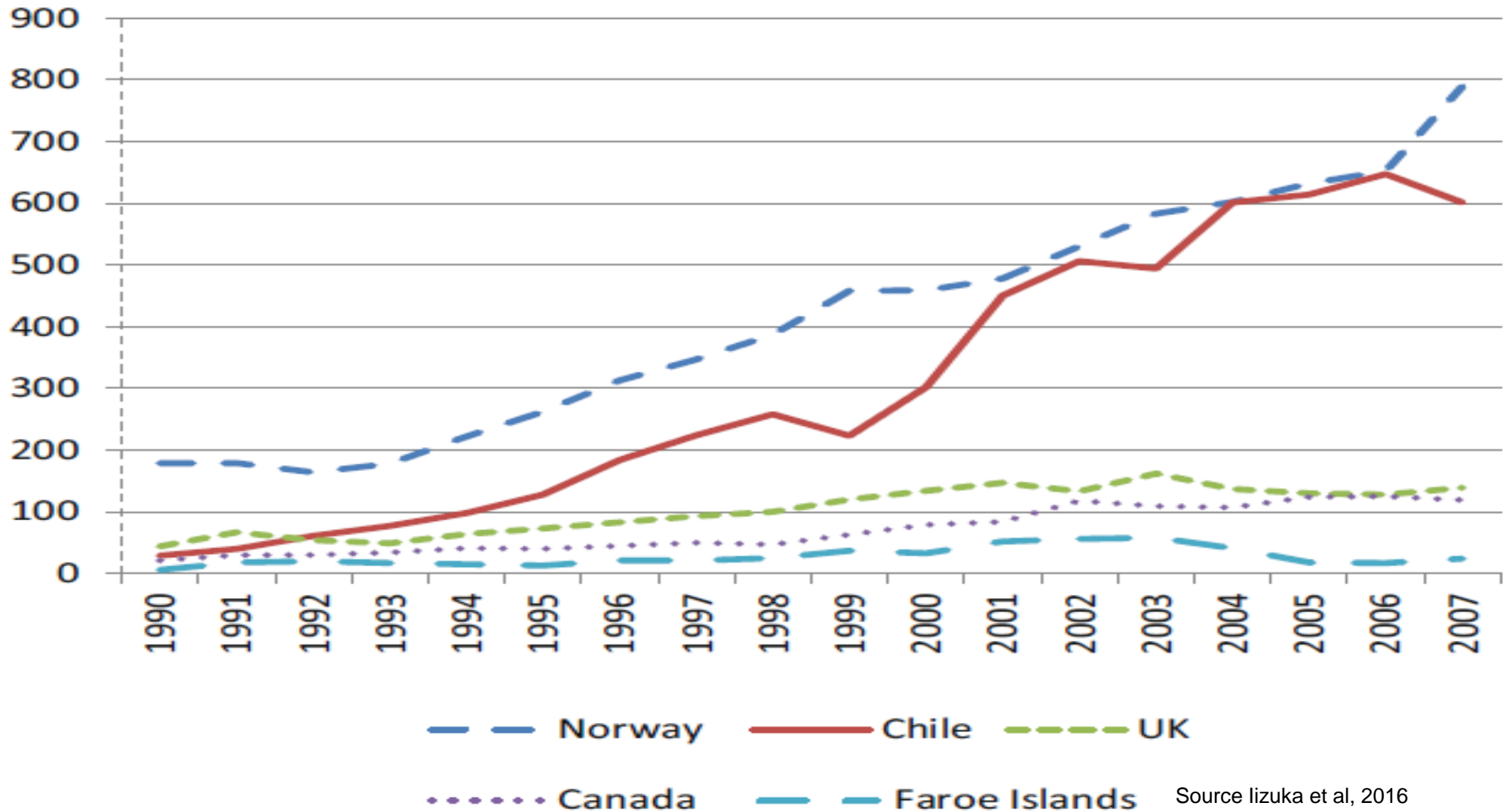
- **Collaboration with buyers (importers)**
  - Buyers sending technicians to transfer know-how(Japan)
- **Government cooperation in Export & Import promotion**
  - JETRO (JP), ProChile (CL)
- **Salmon association formed in 1986**
  - Quality control of product
  - Joint marketing
    - Association sending missions to Japan
- **Chile-Japan Technical cooperation**
  - IFOP-JICA
  - JICA expert
- **Regulation**
  - Sanitation standards unified to the strictest
  - Controlled by the government

# What made rapid export growth possible?: surviving competition as a cluster

- **Increased % of processed salmon (value addition)**
  - From 51% to 63% of total production between 1998-2008
- **Creation of diverse input and service suppliers via externalization from salmon farms (cost efficiency)**
  - These suppliers later becomes competitive exporting sector of niche supply in LA
- **Increased domestic production of egg (reducing uncertainty)**
  - 8 times between 1998 to 2008.
  - Decrease import and improved control of disease entry, genetic improvements.
- **Improved feed efficiency (cost reduction)**
  - 4 kg of feed to 1.25kg to produce 1 kg of salmon between 1980 to 2000.
- **Public investment in research on salmon farming (technology)**
  - US\$61million between 1987-2008. Top areas were pathology, sanitary management, Genetics and reproduction and Nutrition and feed

# Rapid increase in Export and its upgrading: 1990-2007

Thousand tons



Source: Iizuka et al, 2016

# Rapid increase in Export and its upgrading: 1990-2007

- **Rapid increase in export is supported by**
  - Development of diverse suppliers: increasing efficiency with scale
  - Improvement in sophistication of processing of product
- **Increasing competition is met by**
  - Increasing productivity based in incremental innovation
    - Feed
    - Externalization of services
    - Domestication of input and services
- **Where technologies are sourced?**
  - Key capability established in 1970s: absorptive capability
  - Increase in foreign direct investment: Transfer of knowledge on feed, eggs, etc.
  - Some public investment were made research

# Remaining challenges

- Environmental sustainability & regulation: where to find the right balance
  - Crisis happened in 2007 etc
- Social inclusion---how to distribute improvement of welfare from this industry?
  - Labour disputes
- Diversification from copper dependency?
  - Is natural resources an answer to diversification or still a curse?
  - Chile's export export dependency is still at around 50%
- Human resources in Science to meet the challenges

# Creation of value: Natural Resource based activities

## Increasing productivity via **backward linkages**

- Productive feed
- Improved genetics for eggs
- Using improved technology to increase productivity
  - Autofeeders etc

## **Decreasing production cost and negative externalities**

- Vaccine (preventive of disease)
- Better disease resistance (genetics)
- Water and energy efficient systems
- Bio security controls and management
- Systems/ technology to ensure safety of employees

## **Emerging technologies, systems to exploit possibilities**

- Sensors, Remote access
- Satellite systems
- Robotics, AI
- Solar systems, Distributive grid systems for water etc.

# Creation of value: Natural Resource based activities

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**Supplier plays an important role in productivity**

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**These tech/supplier can be applied for other sectors**





# Takeaways: What can be learned from this case?

- Creating an industry takes a long time
- Comparative advantage + Window of opportunity (technology, market)
- Use internal and external resources to build capability (demand and supply)
- Capability building help entrepreneurs and suppliers to emerge
- Good institutional condition helps entrepreneur to emerge but do not fix everything. Supports are needed (Technical cooperation, FundacionChile)
- Export and competition and creating of cluster
- Collaboration needed: Association, collaboration within firms, Cluster and between public and private sector
- Development of industry is context specific
- Explore potentials of natural resource based activities and emerging technology and services
- Moment of technological change is where opportunity arise

# Thank you

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