Modelling supply chain logistics networks: the case of Norwegian salmon

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VALUMICS

Food Systems Dynamics

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Outline

- Introduction
- EU Logistics system and planning
- Developing Case Study logistics system from system dynamics
- Global salmon logistics system
- Norwegian salmon case
- Where are we and how we can help each other?

Introduction

- Food value chain with environmental dimension;
- Examine different modes of transportation in the food chains;
- Provides the minimum transportation cost;
- Develops several experimental transportation scenarios based on:
  - Food types (e.g. perishable, processed, temperature controlled);
  - Food packaging (e.g. small, bulky, fragile)
  - Origins of food and food production (e.g. co-location).
- Identifies inefficiencies, opportunities of CO_2 emissions reduction, disproportionate transportation cost commonly occurs, how inefficiencies in food transportation can be significantly reduced.

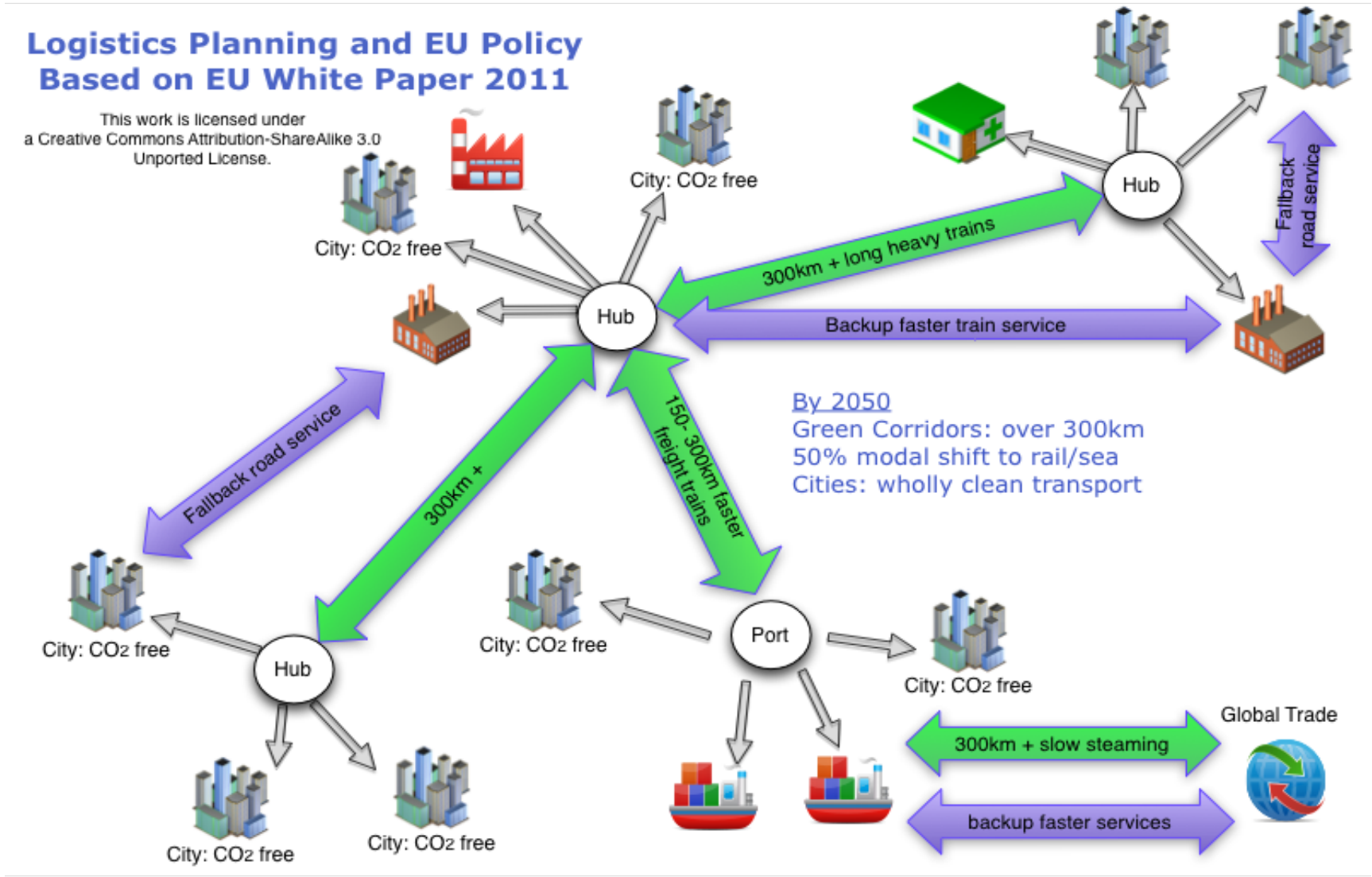
The importance of DATA in research of the logistics system

- Trends of healthier food choice and willingness to pay from higher socio-economic group.
- Traditional logistics approach: minimise distance or reduce costs for supplying customer demand
- Costs models beyond economic efficiency: in environment and social
- Very little that we know about the real implications in the real business environment

- We do not know how much the impact of salmon fillet production on CO2 emission in monetary unit. And if this unit can be used as catalyst to increase value to the salmon product due to demand.
- We don’t know where and how much in the supply chains, the value added activities have been absorbed as well as distributed, thus benefitting certain socio-demographic sustainably.

Logistics planning

Transportation system – freight system – food system

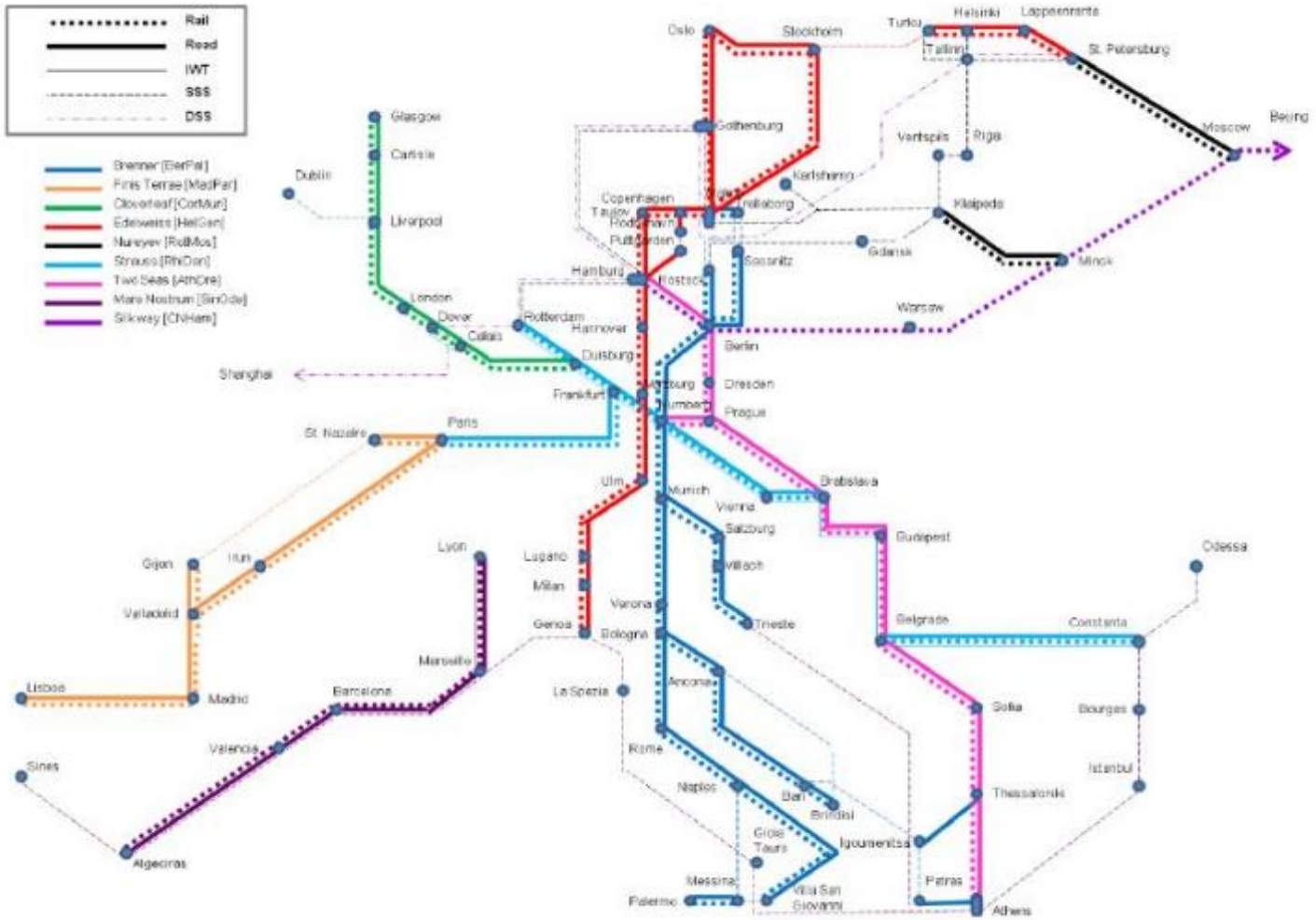


EU logistics systems and planning

Characteristics of green corridors

- Freight traffic concentration between major hubs and over relatively long distances;
- Use advanced technologies, e.g. Smart ICT, alternative clean fuels (in addition to energy efficiency);
- Promote cooperation between transport modes to improve quality and environmental performance;
- Maintain punctuality, reliability, speed and accessibility;
- Collaborative business models.
- KPI indicators: cost, delivery time, emissions, reliability, frequency, ICT applications, cargo security and safety, and congestion and bottlenecks.

EUFP7 project metro map (2011)



Modelling logistics system

Global system – regional – national – local system

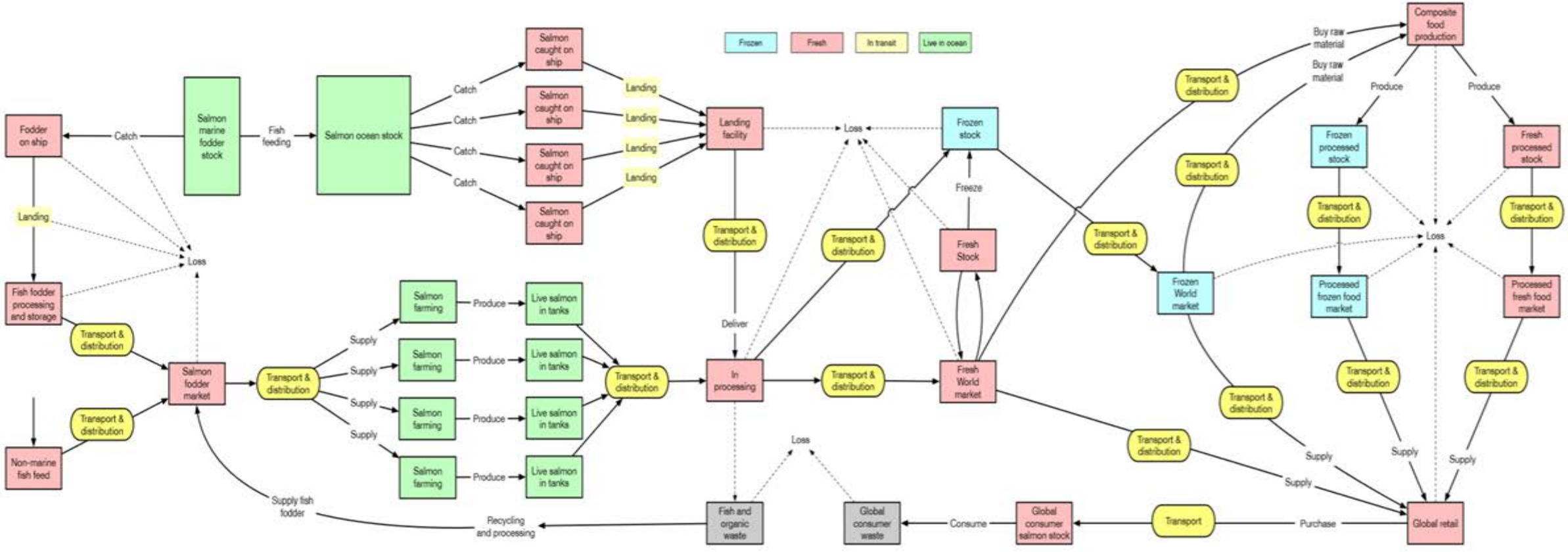


Figure 3 Global salmon flow chart

Global salmon value chain case system dynamics

Multi-echelon multiple period global SC Model

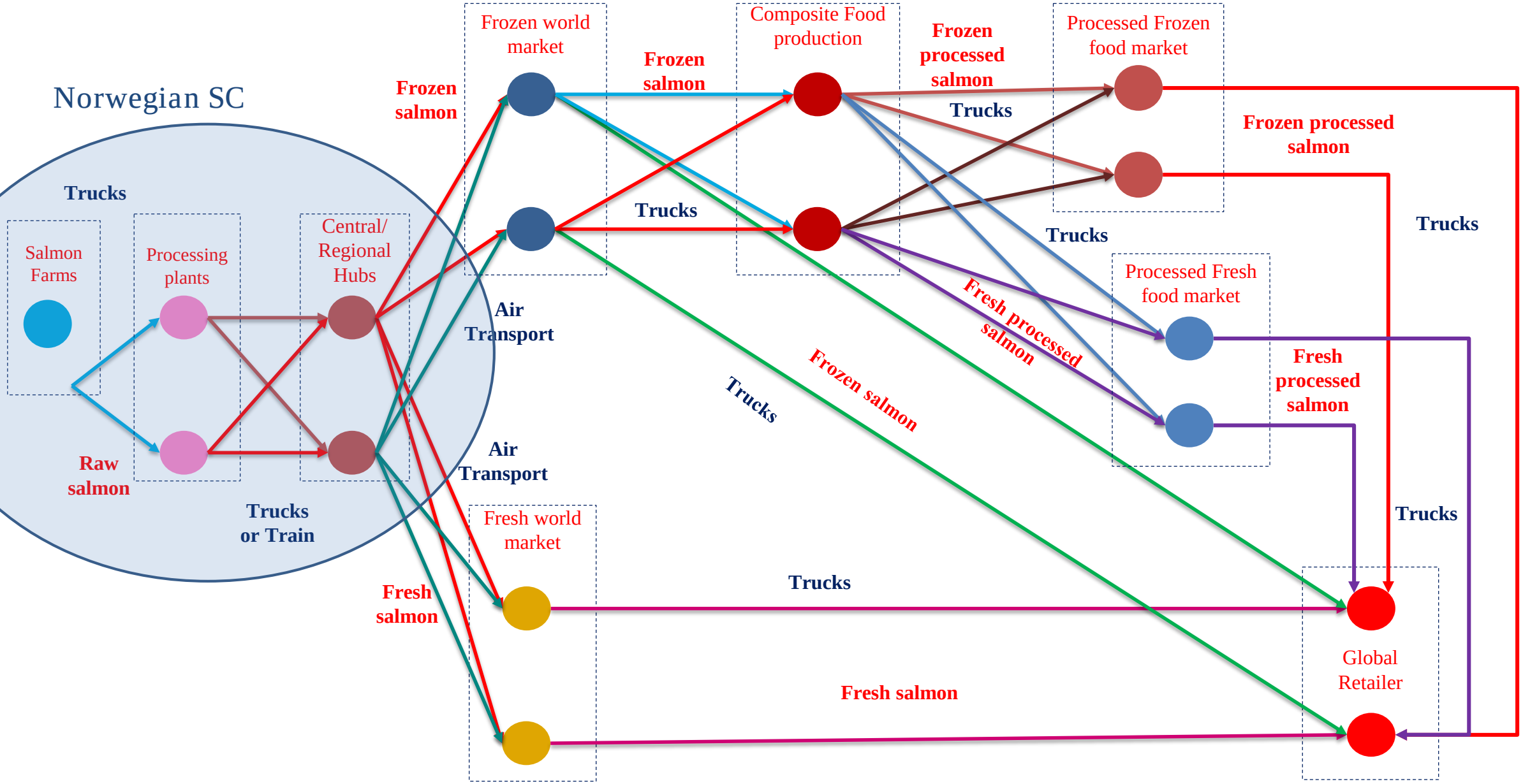
Minimize

Total Cost = Transportation Cost + Fuel Cost + Inventory Holding Cost + Processing Cost + Wastage/Residual Cost

Subject to

1. Supply Constraints
2. Constraints related to Processing
3. Storage Capacity Constraints
4. Inventory Balancing Constraints
5. Demand Constraints
6. Carbon Emission Constraint
7. Transportation Capacity Constraints

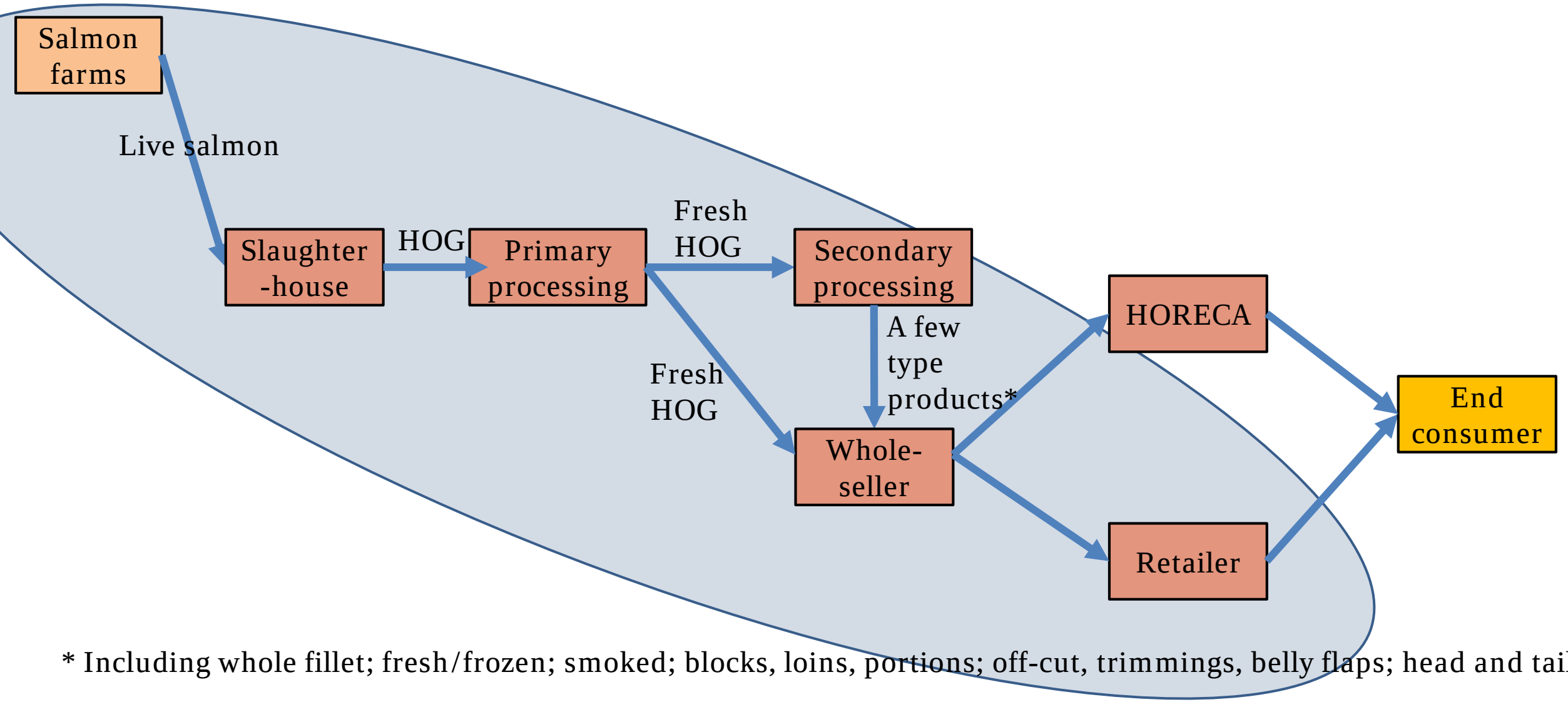
Global salmon supply chain network conceptual framework



Norwegian Salmon supply chain

Design – Baseline data – Analysis – Advance data

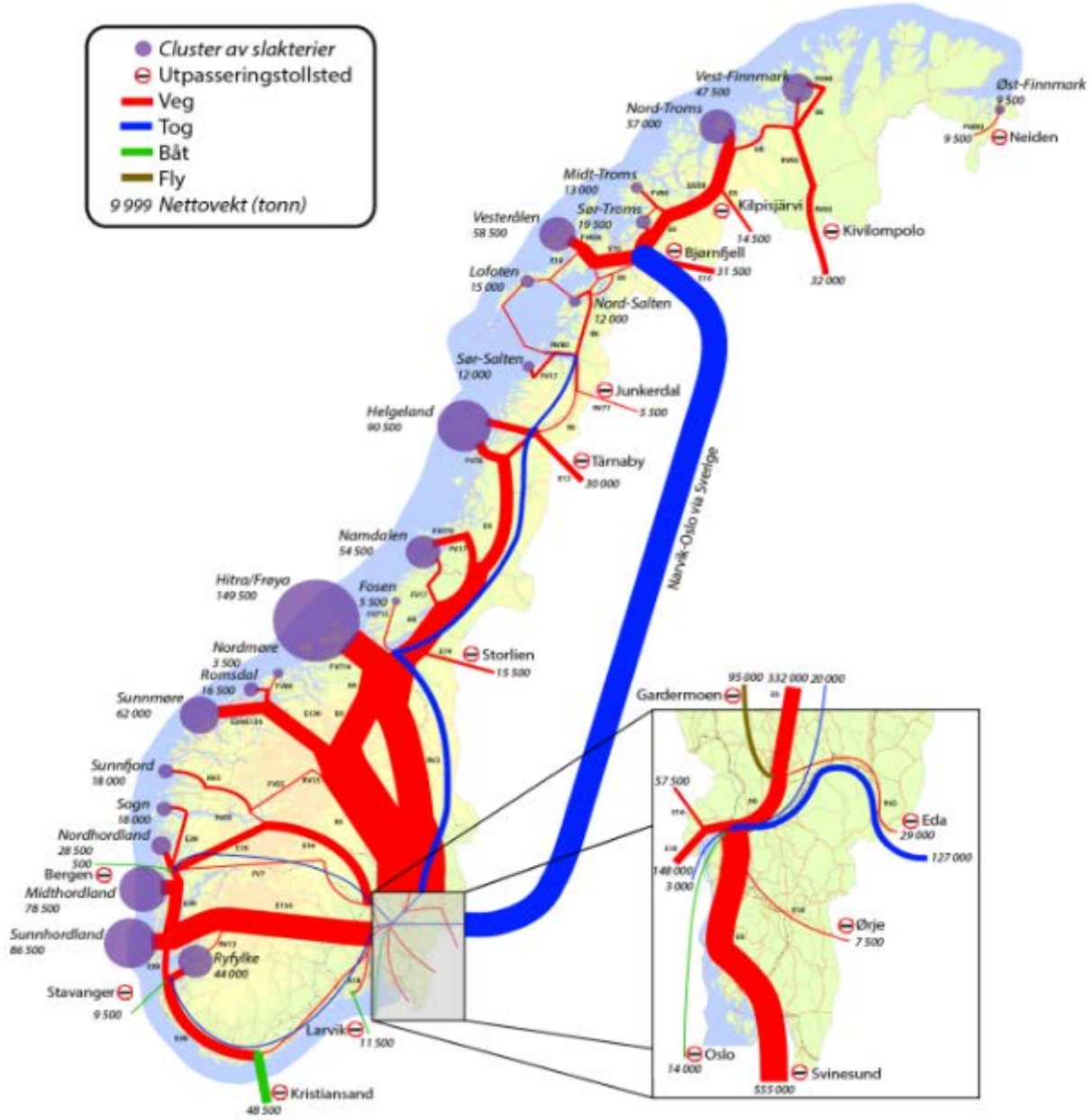
Norwegian salmon supply chain network conceptual framework



* Including whole fillet; fresh/frozen; smoked; blocks, loins, portions; off-cut, trimmings, belly flaps; head and tailbo

Salmon and trout transportation logistics flow in 2013

- 4 fish feed producers with 9 plants
- 991 farms – produces > 170k fish items
- 60 slaughterhouses
- 52 active plants
- Export hubs:
  - 81% by truck (via Svinesund)
  - 11% by fly (via Gardermoen)
  - 8% by boat (via Kristiansand)



Why are we here and how we can help each other?

- Experience & expertise - Access to the know-how to improve logistics system
- Opportunities - To have choices in embedding environmental and social credential
- New business model - Be one of the first to promote products targeting selected market with informed environmental and social credential
- Green champion - in the business environment at the highest level with highest agenda, for instance: fighting against climate change
- Knowledge - Allow documentation of valuable scientific evidence which will be useful to inform policy decision makers and future generation

What next?

Farms – slaughterhouse – 1st processing – 2nd processing – wholesaler – retailer

Data that would help us to model the logistics system of Norwegian Salmon SC network:

- A single supply chain network with information such as number of salmon farms, slaughterhouses, processing plants, wholesaler and retailers
- Daily supply of raw salmon to each slaughterhouse
- Shipment capacity with mode choices
- Connectivity between each entity
- Transportation cost per unit of raw salmon
- Fuel consumption in litres per unit distance per unit product.

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