Futures of shipping in the Arctic until 2050

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Our focus: Shipping in the Arctic

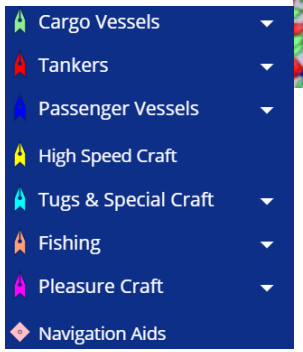
Destination shipping :

- From outside the Arctic to the Arctic or from the Arctic to outside the Arctic, i.e., ships going to the Arctic to load, unload, or perform an economic activity there

AND

Transit shipping:

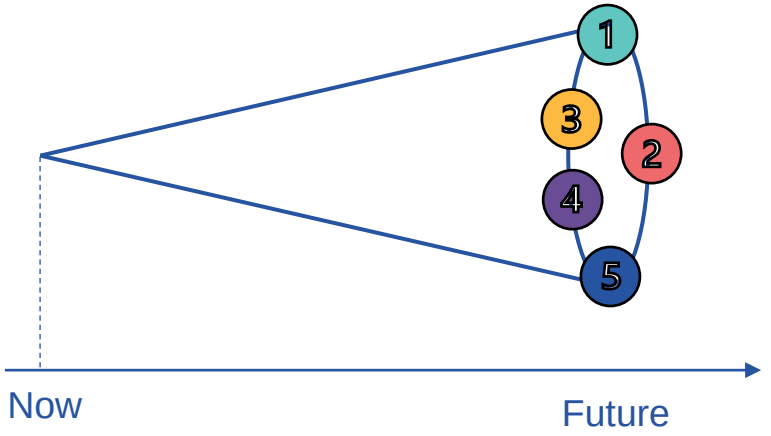
- From outside the Arctic to outside the Arctic via the Arctic



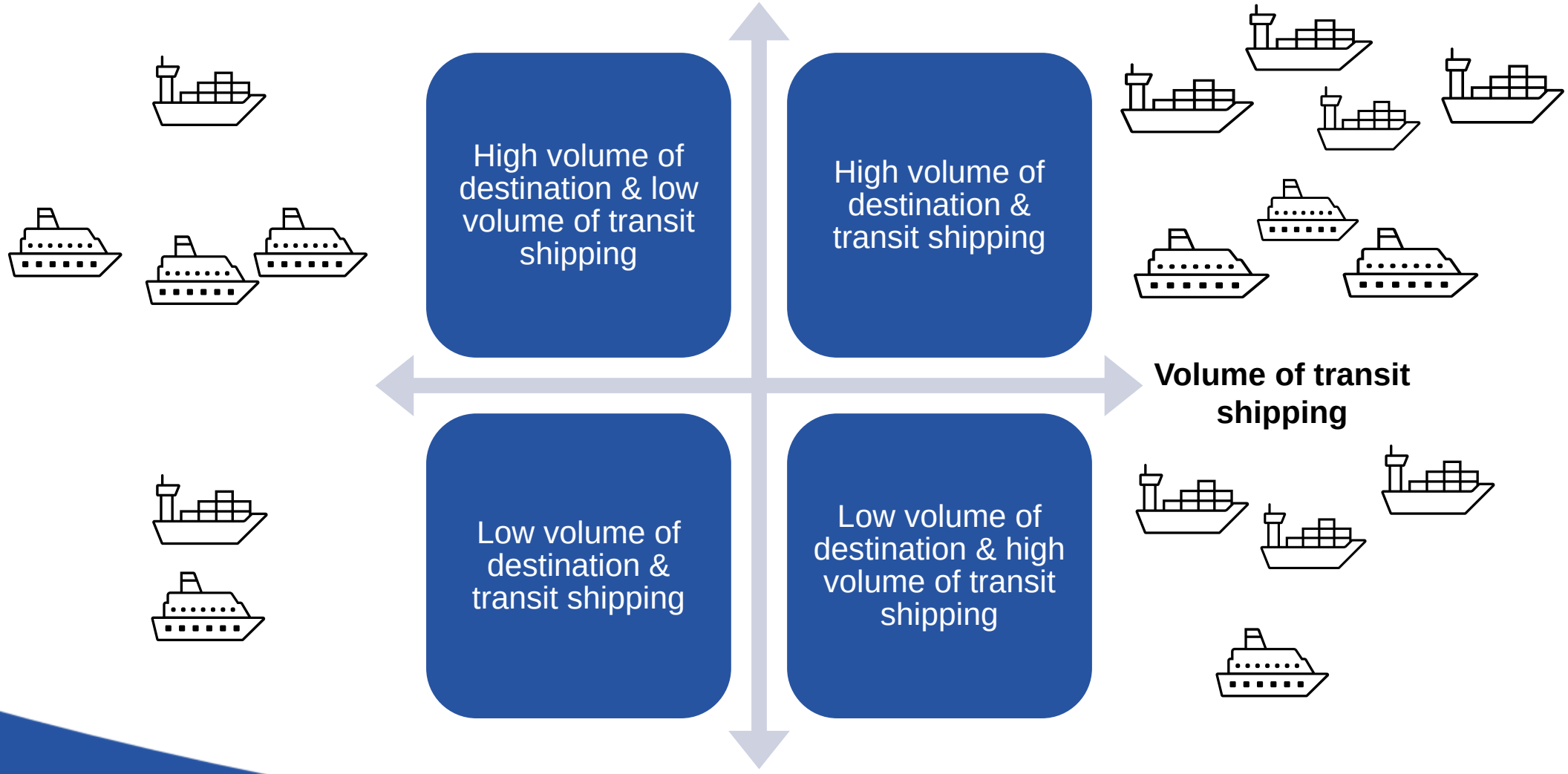
https://www.marinetraffic.com/ (August 9, 2021, 13:34 CEST)

Foresight for the Euro-Asian Arctic: Socio-economic scenarios

- **Deeply uncertain** system
- Describe various **plausible socio-economic futures of the Euro-Asian Arctic until 2050** in the form of short **narratives**
- Account for both **Arctic** (endogenous) and **global** (exogenous) factors – political, economic, social, technological, environmental, legal (PESTEL)
- Developed based on extensive literature research and input from various experts from academia and industry using the **morphological analysis** method
- Original focus on emerging trade routes between Europe and Asia, i.e., shipping in the **Euro-Asian Arctic**



Four plausible visions of Arctic shipping

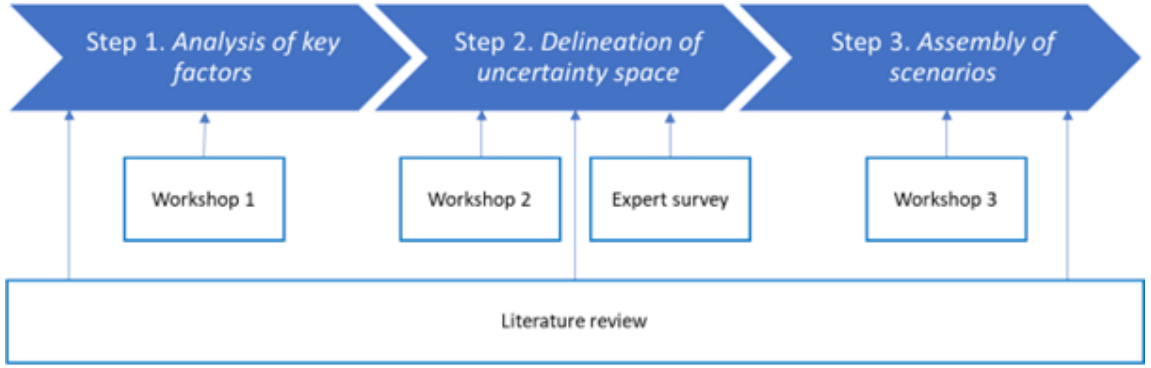


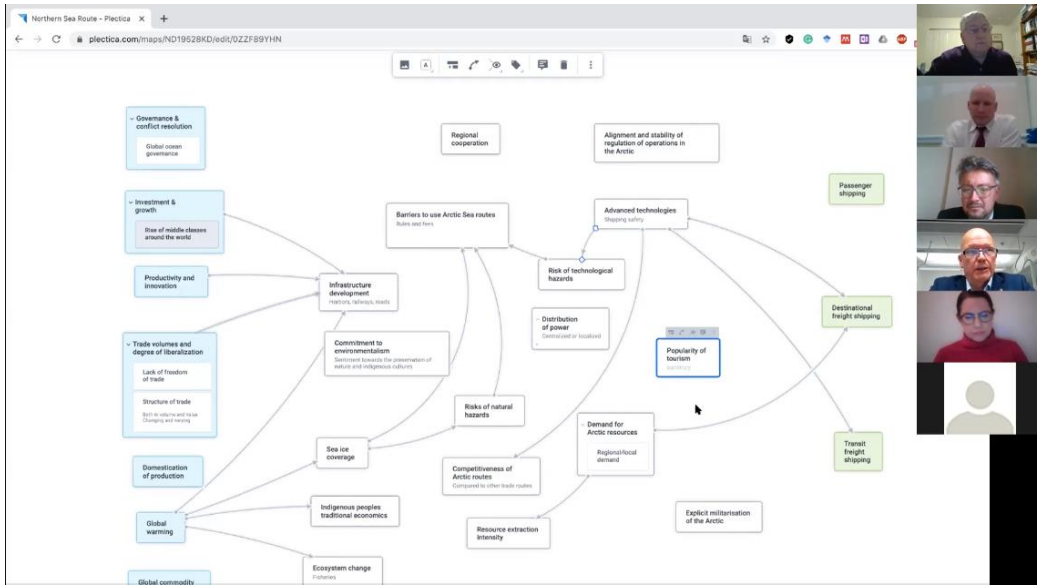
Foresight exercise

Low volume of destinational & high volume of transit shipping

- Feasible?
- Transpolar route?

Navigation conditions (sea ice, weather, etc.)
Regulatory and financial barriers to use Arctic Sea routes
Global governance, cooperation & ease of international trade
Infrastructure development in the Arctic
Governance of the Arctic
Advanced technologies for shipping and safety
Demand for Arctic transit of cargo
Economic growth & consumption
Disruptive technologies
Extraction of renewable and non-renewable Arctic resources
Non-fossil fuel-based energy
Commitment to preserve untouched nature and indigenous cultures





Morphological analysis

Major steps:

1. Identification of the relevant factors
2. Identification of these factors' realizations (alternative states)
3. Construction of the morphological matrix
4. Cross-consistency analysis

Example

SATURDAY'S WEATHER				
Temperature	Wind	Rain	Humidity	Pressure
Hot	No wind	no rain	dry	low
Pleasant	Mild wind	constant mild rai	low	high
Cold	Strong wind	rain showers	medium	fast changing
Freezing	Storm wind	heavy rain	high	
		hail	100%	

Hot sunny day

Warm dry day

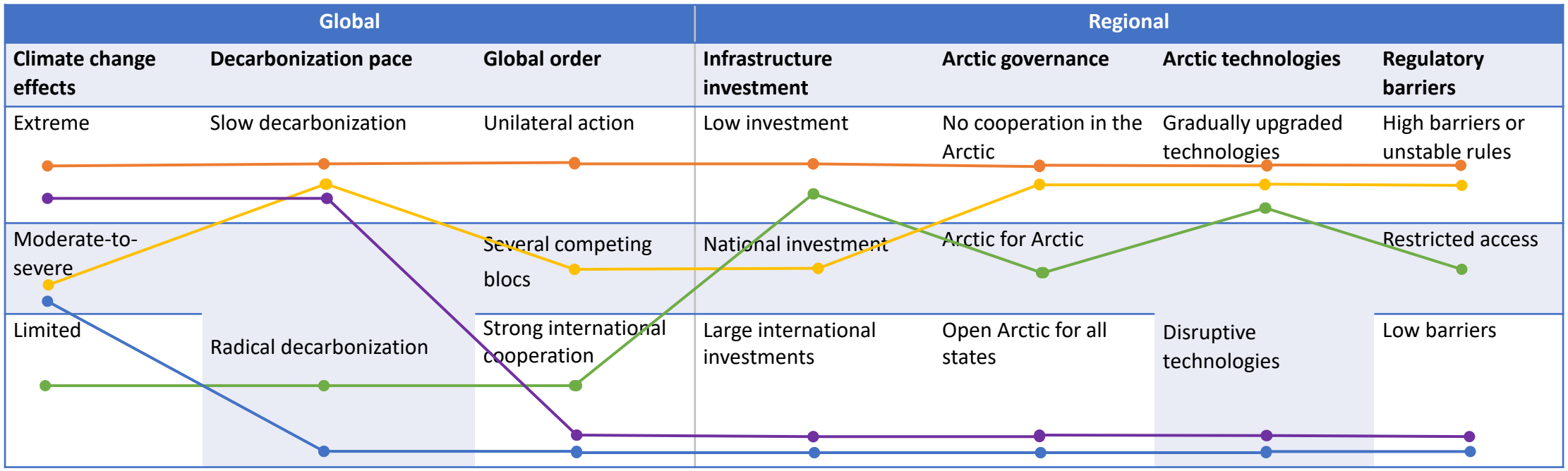
Cold grey day

Thunderstorm – wildcard!

Zwicky, F., 1969. Discovery, Invention, Research through the Morphological Approach. Macmillan, New York.
Ritchey, T., 2006. Problem structuring using computer-aided morphological analysis. J. Oper. Res. Soc. 57, 792–801.

Morphological matrix

Global			Regional			
Climate change effects	**Decarbonization pace**	**Global order**	**Infrastructure investment**	**Arctic governance**	**Arctic technologies**	**Regulatory barriers**
Extreme	Slow decarbonization	Unilateral action	Low investment	No cooperation in the Arctic	Gradually upgraded technologies	High barriers or unstable rules
Moderate-to-severe		Several competing blocs	National investment	Arctic for Arctic		Restricted access
Limited	Radical decarbonization	Strong international cooperation	Large international investments	Open Arctic for all states	Disruptive technologies	Low barriers



Legend

Scenarios

Global Resource Base	Global Route	Abandoned Land / Sanctuary	Transpolar Shortcut
High volume of destination & low volume of transit shipping	High volume of destination & high volume of transit shipping	Low volume of destination & low volume of transit shipping	Low volume of destination & high volume of transit shipping

Scenarios

High volume of destination & low volume of transit shipping

Scenario “Global Resource Base”

The world is divided into several geopolitical and geoeconomic blocs. The global trade shifts from Asia-to-Europe to other regions. Technological progress and decarbonization are slow. The demand for Arctic fossil resources rises. Climate change brings about moderate-to-severe effects including more frequent and dangerous natural hazards such as drifting ice and icebergs, as well as stronger winds and higher waves. Marine infrastructure develops gradually and is often of dual purpose. Militarization of the Arctic increases, however, it does not lead to an armed conflict. Investment in large-scale land-based transport infrastructure proves infeasible due to climate risks and an unstable geopolitical landscape.

High volume of destination & transit shipping

Scenario “Global Transportation Route”

Global cooperation facilitates rapid technological progress. International organizations lead the collective action of countries to combat climate change. The Arctic acts as a key source of indispensable metals for the low-carbon economy. However, high climate sensitivity hampers reaching the Paris agreement goals. As a result, the warming of the Arctic continues. Modern infrastructure supported by large-scale international investment is deployed to support destination shipping which develops rapidly.

Economic growth in the Global South

Globalization and global cooperation

Technological progress and digital transformation

High demand for metals, timber and freshwater

High demand for metals, timber and freshwater from the Arctic

Radical decarbonization

Moderate-to-severe climate change

High climate sensitivity

Empowered international organizations

Harsh weather conditions in the Arctic

Stable rules and regulations; low barriers

Increased risk of natural hazards

Large-scale international investment in infrastructure

Important role of international corporations

Low volume of destination & transit shipping

Scenario “Abandoned Land”

Countries act on a unilateral basis. The global economic recession continues. Energy security concerns slow down decarbonization worldwide. Innovation is lacking. Extreme climate change effects manifest. Activities and investment in the Arctic are limited and focus on extracting fossils which are mostly used domestically.

Unilateral action

Energy security concerns

Shift to renewable energy in Europe

Low demand for Arctic fossil resources

Slow decarbonization

Extreme climate change

Deterioration of living conditions in the Arctic

Economic recession

Limited investment in infrastructure

High barriers to innovation

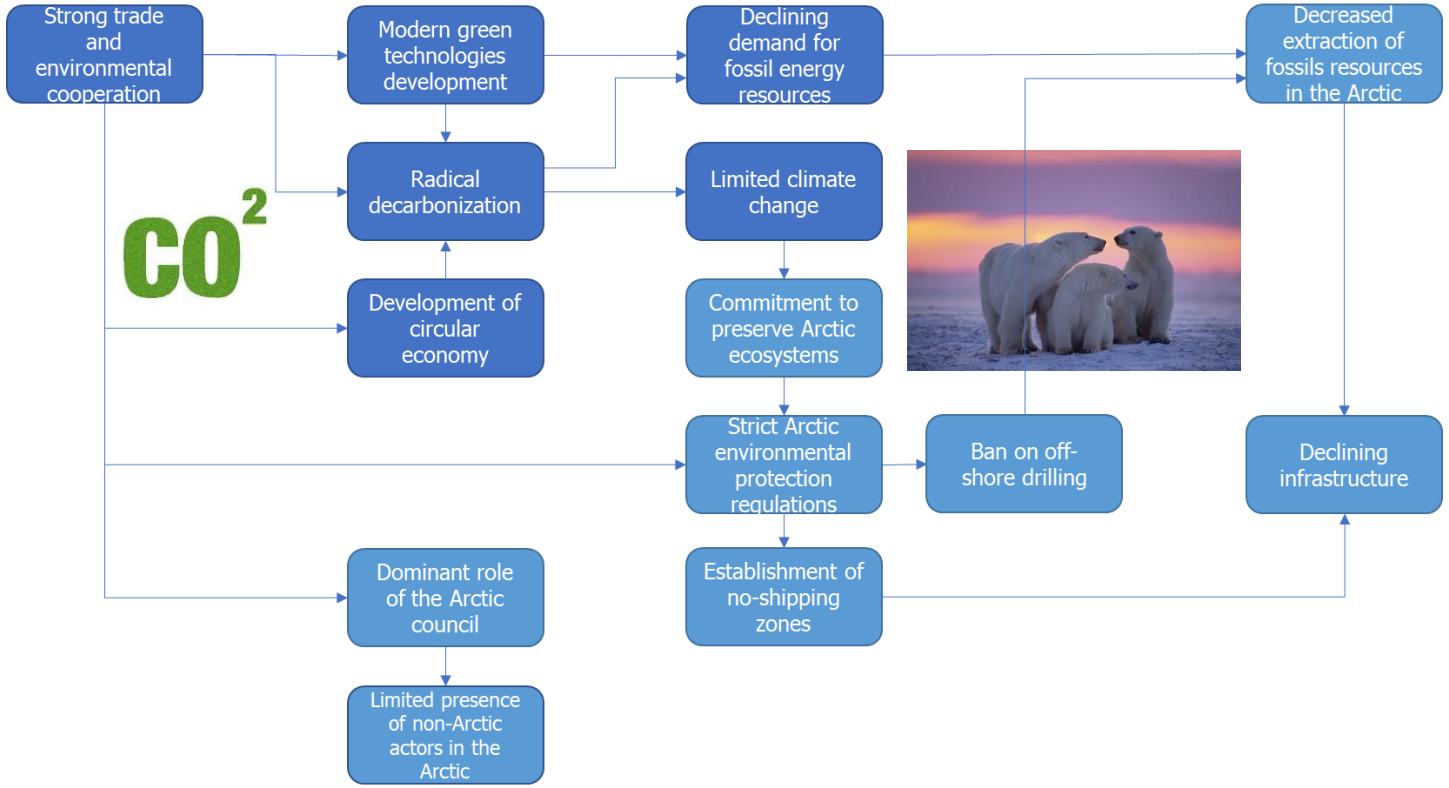
Shrinking of world trade

Weak compliance with environmental regulations

High risk of anthropogenic disasters

Scenario “Sanctuary”

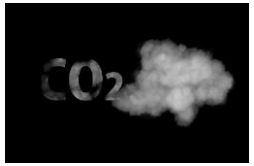
Strong political and economic cooperation among all countries develops. Growing national and citizen aspirations for modern green technologies facilitate rapid decarbonization. The climate change effects in the Arctic are relatively limited. The Arctic Council plays a prominent role in the governance of the Arctic. The Arctic states ban economic activity of non-Arctic actors in the Arctic and stop any new fossil extraction projects to conserve the unique nature. The Arctic economies diversify. Infrastructure development is limited.

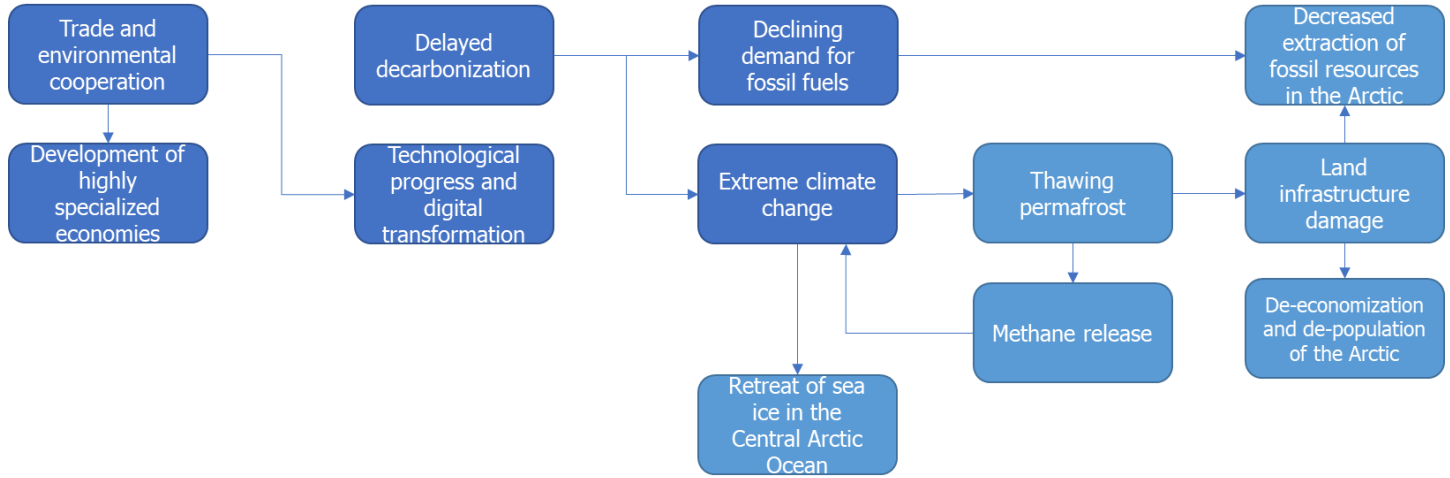


Low volume of destination & high volume of transit shipping

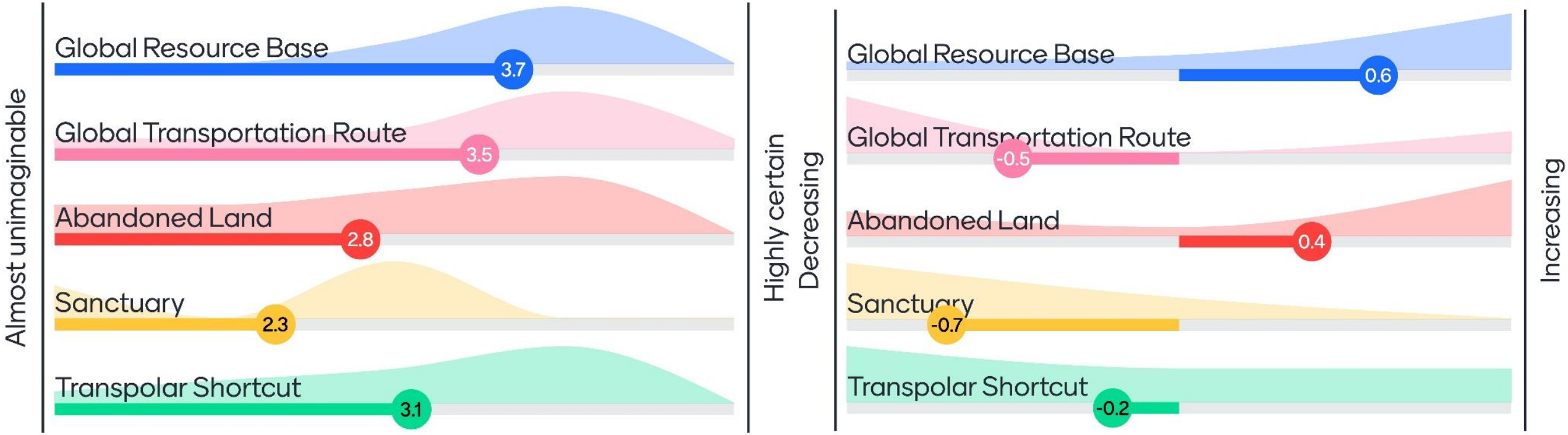
Scenario “Transpolar Shortcut”

Countries cooperate in the economic and technological spheres. The Earth continues to get warmer following suboptimal decarbonization paths undertaken by the international community. Melting permafrost destroys the existing onshore infrastructure. Mining in the Arctic becomes impossible. Economic activities decline. The population leaves the Arctic. Significant retreat of the sea ice in the Central Arctic Ocean is observed.





Plausibility of Euro-Asian shipping scenarios



Thank you!