

Ad Hoc Expert Meeting on

**Climate Change Adaptation for
International Transport:
Preparing for the Future**

16 to 17 April 2019

**Climate Adaptation in the Arctic Area:
Shipping and Port Infrastructures**

Presentation by

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Climate Adaptation in the Arctic Area: Shipping and Port Infrastructures

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The GENICE Project (genice.ca)

Special thanks to Mr. Al Phillips (Al Phillips & Associates)

Outline

What is the Arctic?



Picture courtesy: https://nsidc.org/sites/nsidc.org/files/images/arctic_map.gif

- Regions around the north pole
- Second largest area by size (13,985,000 km²)
- Area above the Arctic circle (66° 34' N)
- Any area in high latitudes where average daily temperature does not rise above 10 degree

Canada in the Arctic

- Second largest Arctic country
- 200,000 Canadians live in the Arctic
- New Arctic Framework under development
 - comprehensive Arctic infrastructure
 - strong Arctic people and communities
 - strong, sustainable and diversified Arctic economies
 - Arctic science and Indigenous knowledge
 - protecting the environment and preserving Arctic biodiversity
 - the Arctic in a global context

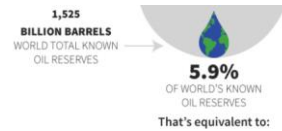
Canada in the Arctic

Applies to

- Yukon
- Northwest Territories
- Nunavut
- Inuit Nunangat
- the Nunatsiavut region in Labrador
- the territory of Nunavik in Quebec
- northern Manitoba, including Churchill

The good

- Resource deposits: oil, gas and other minerals
- Increase shipping saving time and money
- Opening up the northern communities



Graphics courtesy: <https://www.visualcapitalist.com/energy-and-mineral-riches-of-the-arctic/>

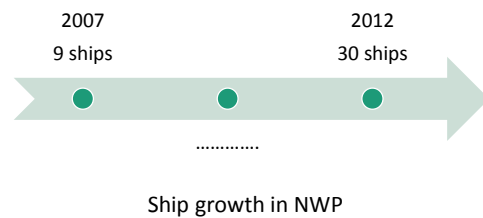
The good

- Nordic Orion NWP voyage from Europe to Asia instead of Panama Canal
 - Saved 4 days (~4000km) and \$200,000

From Shanghai to Rotterdam

Route	Distance
Panama Canal	25,588 kilometres
Suez Canal	19,550 km
Northern Sea Route	15,793 km
Northwest Passage	16,100 km
Transpolar Route	13,630 km

- Russia currently ahead
 - 5 Arctic ice breakers & 3 nuclear powered ones
- Canada now building 1 ice breaker a fleet of 8 patrol boats



The bad

- Shorter lengths of ice free months
- Extremely harsh conditions
- Risk of accident during oil and gas exploration and production
- Accidental release during shipping



Source: <https://www.visualcapitalist.com/energy-and-mineral-riches-of-the-arctic/>

The bad

- Accidental releases of oil have negative consequences on the marine environment.
- Need to prepare for emergency control and mitigation of oil spills.
- Countermeasures can only be implemented effectively if the fate and transport is better understood.
- Environmental risk assessment: requires fate and transport models.
- Meanwhile the Arctic is an uncertain terrain with many unknowns
 - Harsh: very low temperatures
 - Timely response is a challenge
 - Darkness
 - Seasonal variations



Courtesy: www.oceanworld.tamu.edu

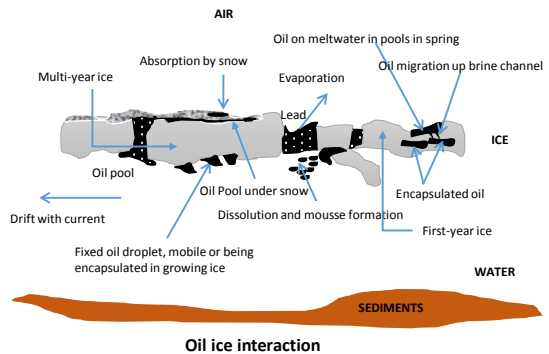
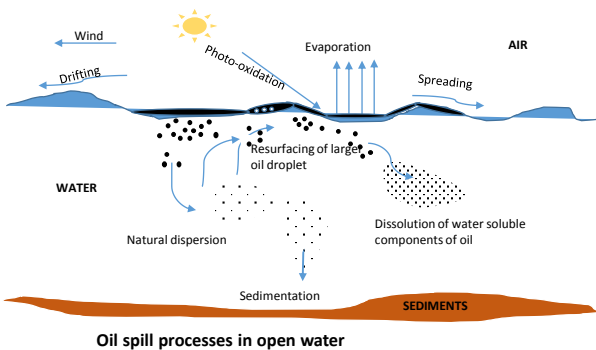
Problem of dealing with the bad

Modeling oil spill in ice is difficult

Lack of data in the Arctic

Limited knowledge

comprehensive ecological risk assessment framework needed



(after Afenyo et al., 2015)

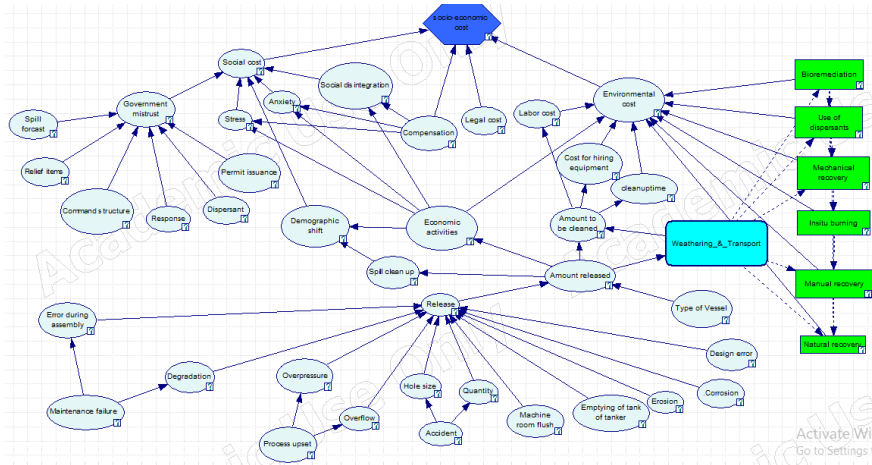
How will ships be insured going into the Arctic?

- Material ship is made of
- Experience of crew
- Single hull or double hull
- Length of Voyage
- Speed of vessel
- Age of vessel
- Days expected at sea
- Socio-economic consequences

The assessment tools

- Source modelling
- Dispersion modelling
- Partition modelling
- Exposure modelling
- Socio-Economic Model for the Arctic (SEMA)

Socio-Economic Model for the Arctic (SEMA)

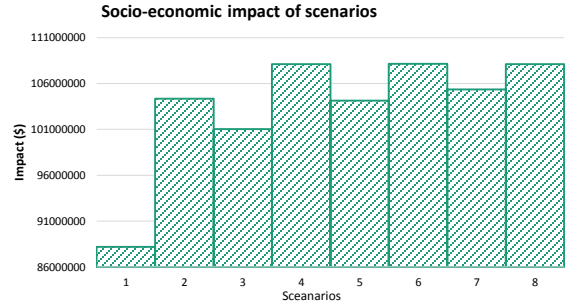


Socio-economic Impacts

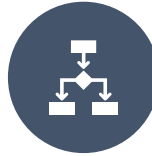


Scenarios matrix & output for SEMA

Scenario	Season	Type of oil	Recovery method	Type of ship
1	Summer	Light	None	small
2	Summer	Light	None	Large
3	Summer	Heavy	None	small
4	Summer	Heavy	None	Large
5	Summer	Heavy	Dispersant	Small
6	Summer	Heavy	Dispersant	Large
7	Summer	Heavy	Insitu-burning	small
8	Summer	Heavy	Insitu-burning	Large



Significance of
SEMA's
outputs



FOR DECISION MAKING
BY GOVERNMENTS



USE BY INSURANCE
COMPANIES



OTHER ENVIRONMENTAL
AGENCIES

Challenges for the Northern Supply Chain – Port and Maritime

- Operating late June to early November
- No port infrastructure
- shallow moorings
- lack of market size at most “ports”
- Port infrastructure is often limited, with vessels using lightering tugs and barges
- Essentially, the sealift brings its own ports on board



Source: Desgagnés

Challenges for the Northern Supply Chain – Road & Rail

- Hard to adapt to a sparse archipelago (both road & rail)
- Where linked to mainland, permafrost and poor substrate limit load capacity (both road & rail)
- construction and maintenance costs are difficult to justify due to sparse markets and difficult conditions (both road & rail)
- insufficient load factors to take advantage of potentially low tonne-kilometre freight rates or GHG benefits (rail)



Arctic/Northern Operating Environment – Road & Rail



Source: Adolf K.Y. Ng (photo taken in about 100 km away from Churchill, 2017)

Maritime Transportation and Regional Sustainability

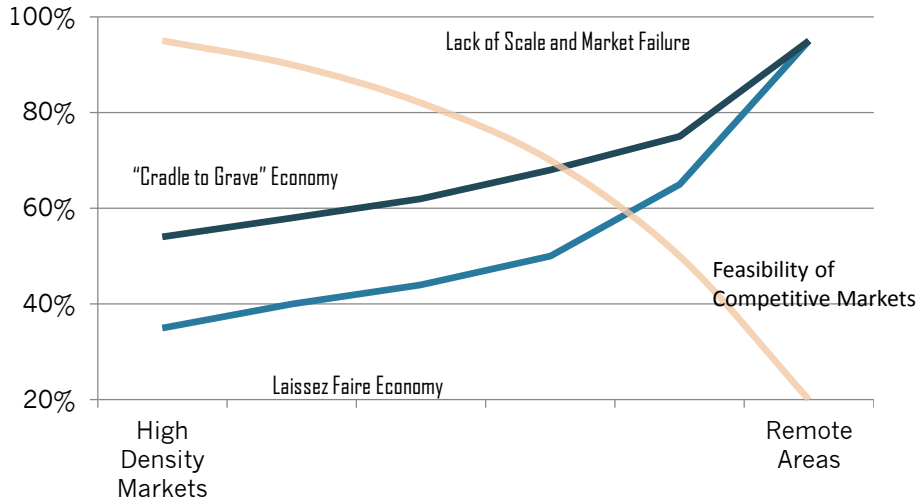
Adolf Ng, Jason Monios,
Changmin Jiang



Policy Recommendations

- **Public involvement in the Arctic is still necessary:** how to convert a politically-driven to a (largely) socio-economic-driven system?
- **‘Resilient hearts’** are equally important to Resilient Facilities – a **‘balanced’ approach to Arctic development** is necessary, including the installment of shipping-related facilities.
- **‘Specialization’** in different Arctic areas would ensure the optimal use of limited resources

Effects of Remoteness and Sparse Markets on Public Sector GDP Equilibrium



A 'Balanced' Approach to Arctic Development

