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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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Outline

1. INTRODUCTION
2. THE GOOD AND BAD
3. POTENTIAL SOLUTIONS
4. SOCIO-ECONOMIC MODEL FOR THE ARCTIC (SEMA)
5. CRITICAL INFRASTRUCTURES
6. POLICY RECOMMENDATIONS

THE UNIVERSITY OF MANITOBA’S ARCTIC ECONOMICS AND MANAGEMENT TEAM:
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The GENICE Project (genice.ca)
Special thanks to Mr. Al Phillips (Al Phillips & Associates)
What is the Arctic?

- 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

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

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

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

<table>
<thead>
<tr>
<th>Route</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panama Canal</td>
<td>25,588 km</td>
</tr>
<tr>
<td>Suez Canal</td>
<td>19,550 km</td>
</tr>
<tr>
<td>Northern Sea Route</td>
<td>15,793 km</td>
</tr>
<tr>
<td>Northwest Passage</td>
<td>16,100 km</td>
</tr>
<tr>
<td>Transpolar Route</td>
<td>13,630 km</td>
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</tbody>
</table>

• Russia currently ahead
  • 5 Arctic ice breakers & 3 nuclear powered ones

• Canada now building 1 ice breaker a fleet of 8 patrol boats

Ship growth in NWP

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

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

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

Oil spill processes in open water

Oil ice interaction

(after Afenyo et al., 2015)

Courtesy: www.oceanworld.tamu.edu
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

- Family separation
- Lack of thrust
- Stress
- Loss of income
- Loss of tourists
- Movement of people in and out of the affected community
- Effect on culture
- Effect on hunting
- Weakened social connection
- Psychological effect on populace
### Scenarios matrix & output for SEMA

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Season</th>
<th>Type of oil</th>
<th>Recovery method</th>
<th>Type of ship</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Summer</td>
<td>Light</td>
<td>None</td>
<td>small</td>
</tr>
<tr>
<td>2</td>
<td>Summer</td>
<td>Light</td>
<td>None</td>
<td>Large</td>
</tr>
<tr>
<td>3</td>
<td>Summer</td>
<td>Heavy</td>
<td>None</td>
<td>small</td>
</tr>
<tr>
<td>4</td>
<td>Summer</td>
<td>Heavy</td>
<td>None</td>
<td>Large</td>
</tr>
<tr>
<td>5</td>
<td>Summer</td>
<td>Heavy</td>
<td>Dispersant</td>
<td>Small</td>
</tr>
<tr>
<td>6</td>
<td>Summer</td>
<td>Heavy</td>
<td>Dispersant</td>
<td>Large</td>
</tr>
<tr>
<td>7</td>
<td>Summer</td>
<td>Heavy</td>
<td>Instiu-burning</td>
<td>small</td>
</tr>
<tr>
<td>8</td>
<td>Summer</td>
<td>Heavy</td>
<td>Instiu-burning</td>
<td>Large</td>
</tr>
</tbody>
</table>

#### Socio-economic impact of scenarios

![Socio-economic impact chart]

**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

Maritime Transportation and Regional Sustainability

Adolf Ng, Jason Monios, Changmin Jiang

Policy Recommendations

• Public involvement in the Arctic is still necessary: how to covert 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