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# SUPPLY CHAIN PERFORMANCE (SCP) IMPACTS ON ARCTIC TRANSPORT

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# INTRODUCTION

## Supply Chain Performance (SCP)

- Transport logistics makes a substantial contribution in service based economies
- The measurement of supply chain performance (SCP) is crucial for transport logistics providers in creating value for the supply chain members
- Supply Chain Performance (SCP) Parameters:
  - Cost-a primary criterion (cost of inventory, production, transportation)
  - Other criteria include, Service effectiveness for shippers and consignees, output, flexibility, resources, and responsiveness to the external environment , operations efficiency for transport logistics service providers etcetera.

# Supply Chain Performance

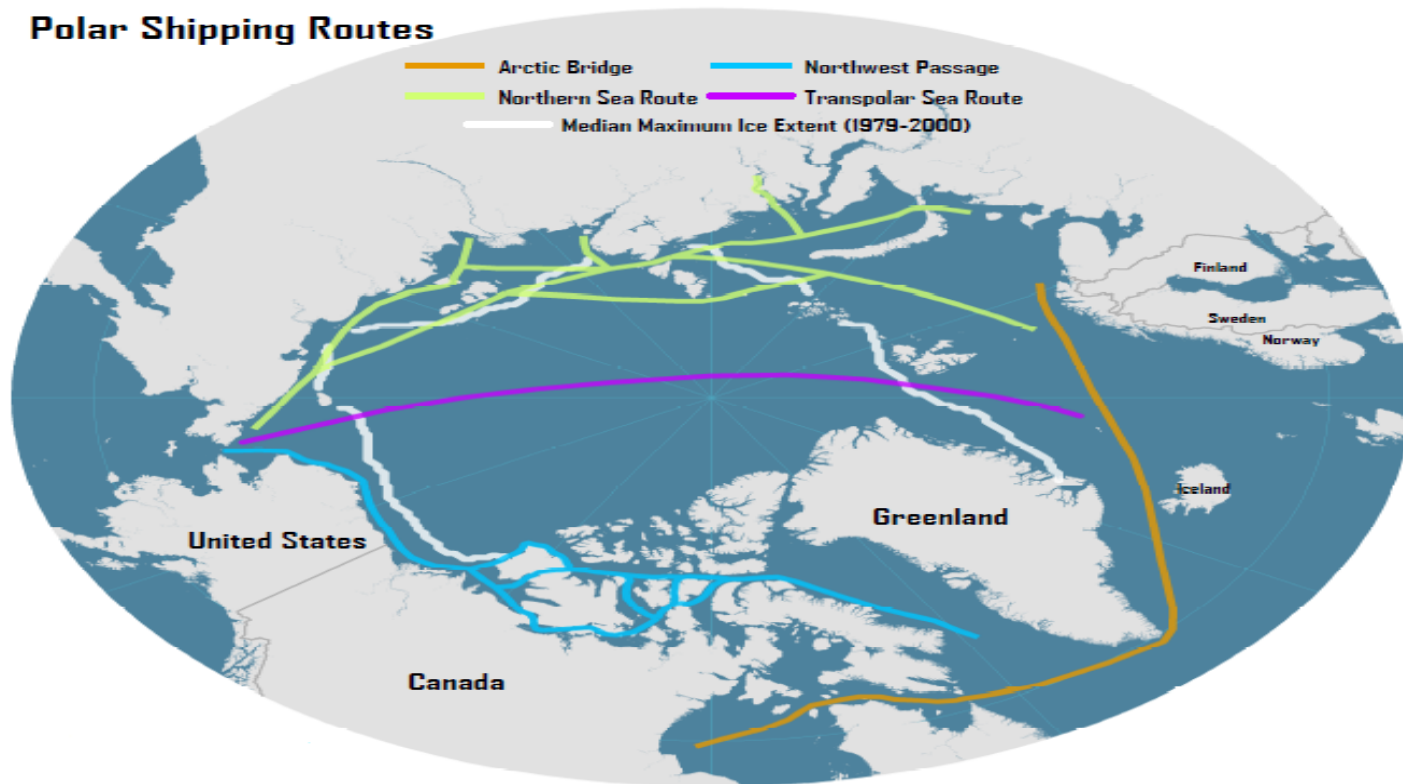
- Mentzer and Konrad (1991)'s defined SCP as :
  - Effectiveness (on-time service delivery, fulfillment of promises, assist the customer in reaching their goals)
  - Efficiency (operating cost, production efficiency, energy efficiency, and profitability)
- Langeley and Holcomb (1992) extended Mentzer and Konrad (1991)'s definition
  - Logistics differentiation as a key element of logistics performance

# Maritime Transport Routes

- Shipping lanes or maritime transport routes are a substantial strategic part of the maritime transport system
- Present seaborne trade between Europe and Asia is carried through the Suez Canal and Cape of Good Hope
- Maritime transport logistics providers may improve the SCP by navigating through the arctic (NSR) for transit shipping

# Arctic Transport Routes

As a result to the ice melt, major shipping lanes come in to existence allowing the trans-arctic transportation of cargo (Rodrigue et al., 2009)



Arctic shipping routes (Rodrigue et al., 2009)

# The Northern Sea Route (NSR)

The NSR is the seaway that connects the Atlantic and Pacific oceans and follows the northern coast of Russia



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## Route Distance

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Northwestern Europe (Norway)  
To  
Northeast Asia (Japan)

Northern Sea  
Route

Suez Canal

6 132

12 144

Nautical miles

Nautical miles

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Source: Raza & Schøyen, (2014)

# Case: Shipping Crude oil from Russia (Murmansk) to South Korea (Ulsan)- NSR versus Suez Canal

Components	Suez Canal	Northern Sea Route	
		Ice Water	Non-Ice Water
Vessel type	Suezmax crude carrier		
Capacity	1 40 000 (t)		
Distance from Murmansk to Ulsan (nm)	12 507	2 725	3 197 Total: 5 922
Vessel speed (knots)	15	10	14
Number of sailing days (one leg)	35	11.35	9.51 Total : 21
Transport time saving (days)	14 (40%)		
Fuel consumption (HFO in tons)	2 075	764	
Fuel consumption (MGO in tons)	104	63	
Total Energy (fuel) Efficiency (HFO+MGO)-tons/one leg	1 352 (62%)		
Total fuel cost (HFO+MGO) (\$)	1 022 150	3 97 350	
Fuel cost efficiency (\$)	6 24 800 (62%)		
CO <sub>2</sub> emissions (tons)	6 798	2 579	
CO <sub>2</sub> emission saving (tons)	4 219 (62%)		
NO <sub>x</sub> emissions (tons)	190	72	
NO <sub>x</sub> emission saving (tons)	118 (62%)		
SO <sub>x</sub> emission (tons)	670	248	
SO <sub>x</sub> emission saving (tons)	422 (62%)		

Source: Authors

# Cost comparison between NSR & SCR-Single leg

Cost Components	Suez Canal (\$)	Northern Sea Route (\$)
Charter cost	9 13 500	5 48 100
Total fuel cost	1 022 150	3 97 350
Canal tariff voyage	3 82 841	1 040 523
Additional piracy insurance-SCR	14 063	
Additional insurance premium for Increased Values (IV)-NSR		1050
Additional H&M insurance-NSR		39 000
Total Costs (per single leg)	2 332 554	2 026 023
Cost efficiency	3 06 531 (13%)	
Cost per ton (\$)	16,7	14,5
Saving per ton (\$)	2.2 \$ / ton (13%)	



# Scenario Analysis- NSR/SCR-combined annual shipping versus SCR annual shipping

Components	SCR	NSR/SCR-combined annual shipping	
NSR Service Period (days)	NSR: 0 SCR: 365	NSR:105 SCR:260	NSR:165 SCR:200
Annual Voyages	NSR: 0 SCR: 10 Total: 10	NSR: 5 SCR: 7 Total: 12	NSR: 8 SCR: 5 Total: 13
Annual cargo transported (tons)	1 400 000	1 680 000 (20% increased)	1 820 000 (30% increased)
Cost per ton (\$)	17	15,7	15,3
Annual CO <sub>2</sub> emission saving (tons)	-	7 499 (11%)	13 358 (20%)
Annual NO <sub>x</sub> emission saving (tons)	-	210 (11%)	374 (20%)
Annual SO <sub>x</sub> emission saving (tons)	-	770 (11%)	1 366 (20%)

# Conclusion

In the long-run the emergence of Northern Sea Route (NSR) may markedly enhance the SCP of TLPs, it may:

- Ensure on-time cargo delivery
- Save the transportation costs and time that may lead to better customer service (app.13% lower cost + 14 days or 40%time saving)
- Reduce the global environmental GHG and non-GHG emissions (app.20% per year)
- Increase the volume of annual cargo shipment (app. 20%-30% depending on NSR service period)
- Provide the competitive advantage by differentiating service and thus assist the shippers and consignees to reach their goals

# Conclusion

- The identification of these benefits provides insights that how drivers in supply chain management impact on the demand for safe and sustainable shipping services in Arctic waters.
- However, in present uncertainties such as:
  - Unreliable ice conditions
  - Political unrest
  - Lack of standardized ice classed oil tankers
  - Low global oil prices etcetera

May delay the early crude oil transit shipping via NSR

Thank you for your attention😊