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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

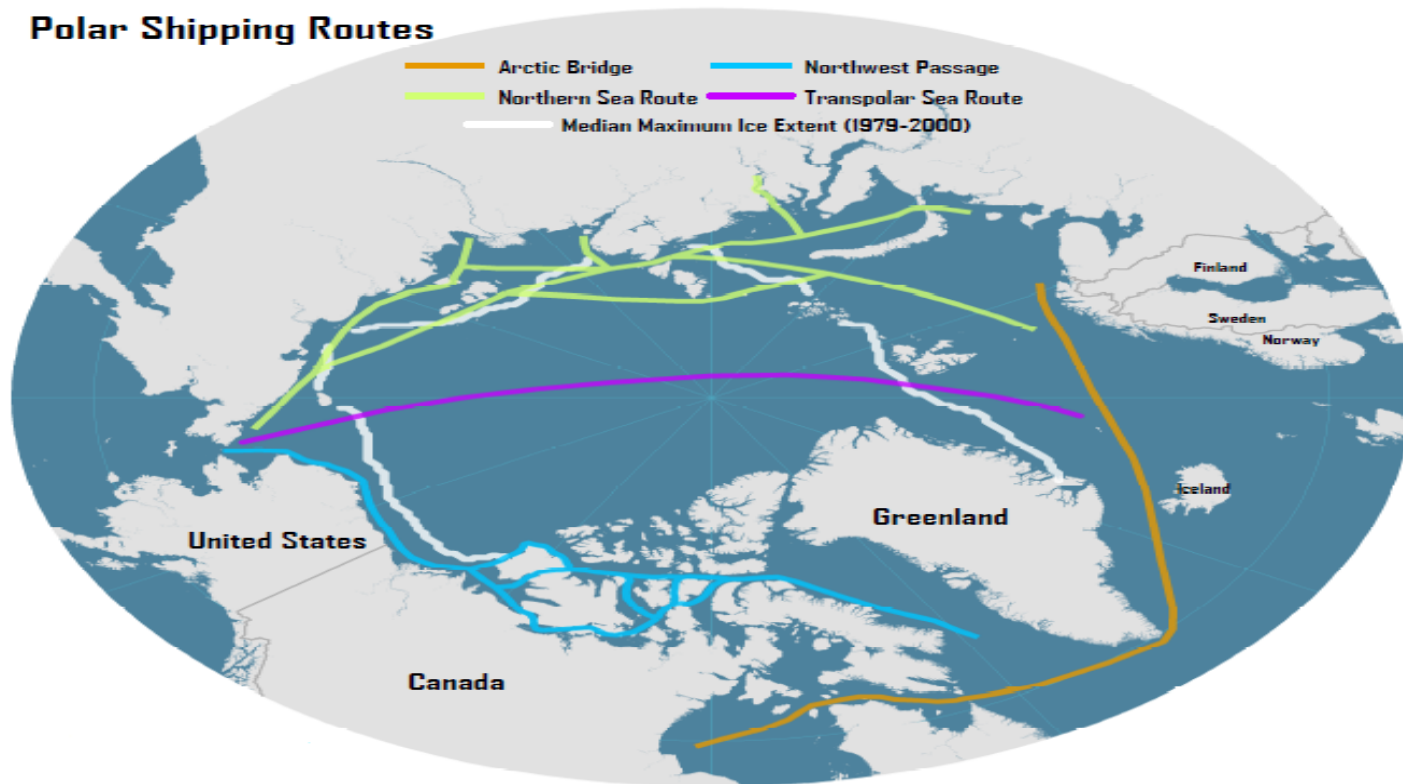
- Mentzer and Konrad (1991)'s defined SCP as :
 - Effectiveness (on-time service delivery, fulfillment of promises, assist the customer in reaching their goals)
 - Efficiency (operating cost, production efficiency, energy efficiency, and profitability)
- Langeley and Holcomb (1992) extended Mentzer and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



Route Distance	
Northwestern Europe (Norway) To Northeast Asia (Japan)	
Northern Sea Route	Suez Canal
6 132	12 144
Nautical miles	Nautical miles

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 ₂ emissions (tons)	6 798	2 579	
CO ₂ emission saving (tons)	4 219 (62%)		
NO _x emissions (tons)	190	72	
NO _x emission saving (tons)	118 (62%)		
SO _x emission (tons)	670	248	
SO _x 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 ₂ emission saving (tons)	-	7 499 (11%)	13 358 (20%)
Annual NO _x emission saving (tons)	-	210 (11%)	374 (20%)
Annual SO _x 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😊