

The Northern Sea Route as a reefer container transport corridor

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Abstract. The use of the Northern Sea Route as a transport corridor between the European and Asian continents is currently attracting increased interest in the trade, economic and logistic communities. The possibility to deliver cargo from Europe to Asia and back much faster is extremely attractive for cargo owners in the conditions of instability of the development of modern regional economic trends, turbulence of the global economy as a whole. In the conditions of rapidly changing market demand and supply in the markets of food products in Europe and Asia, the use of the Northern Sea Route as the shortest route between two continents is becoming especially popular for operators in the field of perishable goods logistics. Nevertheless, the possibility of using the Northern Sea Route is significantly limited by the complexity of transporting cargo in the autumn-winter period due to the need for ice pilotage. Assessment of the competitiveness of the Northern Sea Route compared to traditional routes seems to be an important aspect of the formation of consumer preferences among the owners of perishable goods and operators of transportation in reefer containers. The paper proposes a method for assessing the competitiveness of the Northern Sea Route with respect to alternative routes, taking into account the specifics of transportation of perishable goods in reefer containers. Criteria and indicators of competitiveness of the compared routes are presented, covering the full range of economic and technological components that determine the handling and transportation of perishable goods in reefer containers.

1 Introduction

The competitiveness of any product or service is defined as an assessment of certain properties, characteristics of this product or service in relation to other competing services of this kind, which are most preferable for real and potential customers. In a comparative analysis of the competitiveness of transport routes, such properties or characteristics may be the regularity of shipments, the speed of cargo delivery, the speed and quality of cargo handling at the starting and ending points of the route, the safety of goods along the way, shipments in lots. Of course, the cost of the service should be identified separately, as well as the possibility of a flexible approach by the transport operator to pricing depending on

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various factors. Since the paper considers the competitiveness of the transport route for perishable food products, it is extremely important to take into account the seasonality factor.

The competing reefer container routes of the Northern Sea Route are the Trans-Siberian Railway and the “Deep Sea” navigable route through Singapore, Suez Canal and the Mediterranean Sea. The ports of Vladivostok and St. Petersburg can be considered as the starting and ending points of the compared routes. The specificity of assessing the competitiveness of transportation along the Northern Sea Route lies in the fact that it is necessary to compare different types of transport, different types of infrastructure that ensure the transportation process itself, different types of cargo and container handling infrastructure at the starting and ending points of the route.

Assessment of the competitiveness of the transport route as an element of the transport and logistics infrastructure is reduced to a comparative analysis of the parameters of competitiveness, i.e. such characteristics of objects that have the highest consumer preferences. The above characteristics of transport routes are subject to an assessment of significance or weight to represent them as parameters of competitiveness. The coefficient of significance of the competitiveness parameter can be calculated by the formula:

$$k_i = \frac{\sum_{j=1}^N K_{ij}}{NQ}, \quad (1)$$

where

k_i – the coefficient of significance of the competitiveness parameter,

i – index of competitiveness indicator,

j – index of the number of the expert, $j = 1, N$,

K_{ij} – scoring point of the j -th expert on the i -th indicator,

N – total number of experts,

Q – total number of points.

However, it seems that more objective results can be obtained due to the methodology, when the significance of individual indicators is given as a percentage, and the sum of all values should always be constant, i.e. 100 %.

$$\sum K_{ij} = \text{const} = 100\%, \quad (2)$$

Accordingly, an increase in the significance of any indicator can occur only at the expense of a decrease in the significance of other indicators.

To better structure the results of the comparative analysis, it is proposed to combine the competitiveness indicators into groups according to the main competitiveness criteria. Each indicator can be determined by its significance K_{ij} and relative assessment A_{ij} .

To obtain a comprehensive assessment that takes into account all the adopted indicators, you can use the weighted average arithmetic final assessment:

$$A = \sum (K_{ij} \times A_{ij}) \times K_{\text{seas}}, \quad (3)$$

where A – integral index of route competitiveness;

K_{ij} – the importance of competitiveness;

A_{ij} – relative assessment of competitiveness;

K_{seas} – seasonality coefficient.

Determination of the integral assessment of the competitiveness of each route should be carried out in stages.

1. Formation of a system of criteria and indicators in tabular form.
2. Determination of the significance of criteria and indicators in percent on the basis of expert assessment.

3. Tabling specific values of indicators.
4. Identification of direct and inverse proportionality between the values of indicators and their significance.
5. Obviously, for individual indicators, the greater their numerical value, the higher their level of competitiveness, for example, the speed. There is a direct proportional relationship between the values of indicators and their values. For individual indicators, the smaller their numerical value, the higher their level of competitiveness, for example, the price. There is an inverse proportional relationship between the values of indicators and their values.
6. Determination of scores of indicators based on existing dependencies.
7. Assessment of the level of competitiveness of the compared routes by adding scores on the criteria.

The following criteria of competitiveness of comparable routes are proposed.

Table 1. Criteria of competitiveness of compared routes.

Criteria of competitiveness of compared routes		
	Name of a criterion	Significance, %
1	Complex of services for handling reefer containers en route	20
2	Volumes of perishable goods transportation per year	20
3	Financial potential (stability) of leading companies regularly using the route	10
4	Technical and technological equipment of the route infrastructure, as well as leading companies that regularly use the route.	20
5	Level of non-discriminatory access to route infrastructure, route reputation	30

In the above table, as well as further, in tables 2-5, the proposed composition, content, and assessment of the significance of the indicators according to the criteria are given conditionally.

Table 2. Indicators on the criterion "Complex of services for handling reefer containers on the route".

Indicators on the criterion "Complex of services for handling reefer containers on the route"			
	Name of a criterion	Unit	Significance, %
1	Possibility of cargo owners to load cargo into their own reefer container	Yes/no	3
2	Implementation of PTI (pre trip inspection) of reefer containers before loading	Yes/no	4
3	Possibility for cargo owners to choose the type of refrigeration unit (Carrier, ThermoKing, Daykin, etc.)	Yes/no	3
4	The average number of days from submitting an application for shipment of a reefer container to shipment of container	Days	10
5	The average number of days of delivery of a reefer container on the route Vladivostok - St. Petersburg	Days	30
6	Average price (freight, tariff) of reefer container delivery on the route Vladivostok - St. Petersburg	USD	50

Table 3. Indicators on the criterion of “Volumes of transportation of perishable goods per year”.

Indicators on the criterion of “Volumes of transportation of perishable goods per year”			
	Name of a criterion	Unit	Significance,%
1	Volumes of perishable goods transportation by all vehicles	thousand tons	25
2	Volumes of traffic in the reefer containers	thousand tons	65
3	Maximum dispatch batch	thousand tons	10

Table 4. Indicators on the criterion of “Financial potential (stability) of the leading companies that regularly use the route”.

Indicators on the criterion of “Financial potential (stability) of the leading companies that regularly use the route”			
	Name of a criterion	Unit	Significance,%
1	Annual turnover of companies	thd roubles	25
2	Annual profit of companies	thd roubles	35
3	Annual profitability of companies	thd roubles	30
4	Time of the company's presence in the market in the leading group	years	10

Table 5. Indicators on the criterion of “Technical and technological equipment of the route infrastructure, as well as leading companies that regularly use the route”.

Indicators on the criterion of “Technical and technological equipment of the route infrastructure, as well as leading companies that regularly use the route”			
	Name of a criterion	Unit	Significance,%
1	Container capacity of the fleet of vehicles of companies	TEU	40
2	Possibility of round-the-clock monitoring of the dislocation of reefer containers and cargo temperature	Yes/no	20
3	Speed of handling of reefer containers at the starting and ending points of the route	Hours	30
4	The average age of reefer containers used on the route.	Years	10

Further, after identifying the direct and inverse proportionality between the values of the indicators and their significance, the scores of the indicators for all the compared options are determined and entered in the tables for each criterion. As an example, the table is proposed below according to the criterion “Complex of services for handling reefer containers on the route” (Table 6). Multiplying the values of the significance of the indicators on the corresponding score, we get the final scores on the indicators of the criterion. It should be noted that the prices for delivery by Transsib (USD5000) and the Deep Sea route were taken as average for the year (USD 3200), with fluctuations of 10-20% during the year, but the price for transportation by the Northern Sea Route is given only for navigation on the Northern Sea Route in the most favorable conditions during the navigation period from July to November 15 in conditions of “light ice conditions in accordance with Rosgidromet official information”. “The rules for navigation in the waters of the Northern Sea Route” dated January 17, 2013, as well as “Tariffs for icebreaker assistance to vessels rendered by

FSUE "Atomflot" in the waters of the Northern Sea Route" dated March 4, 2014 determine the specifics of the calculation of costs associated with ice pilotage of vessels.

Table 6. Complex of services for handling reefer containers on the rout.

The value of the indicators and their scoring according to the criterion "Complex of services for handling reefer containers on the rout" (conditionally)							
Value of indicators	Significance, %	Value of indicators			Scoring of indicators		
		Transsib	Deep Sea	Northern Sea	Transsib	Deep Sea	Northern Sea
Possibility of cargo owners to load cargo into their own reefer container	3	no	yes	no	-	10	-
Implementation of PTI (pre trip inspection) of reefer containers before loading	4	yes	yes	yes	10	10	10
Possibility for cargo owners to choose the type of refrigeration unit (Carrier, ThermoKing, Daykin, etc.)	3	no	yes	no	-	10	-
The average number of days from submitting an application for shipment of a reefer container to shipment of container	10	15	7	30	4,7	10	2,3
The average number of days of delivery of a reefer container on the route Vladivostok - St. Petersburg	30	22	45	30	10	4,8	7,3
Average price (freight, tariff) of reefer container delivery on the route Vladivostok - St. Petersburg					6,4	10	8,0
Total on criterion	50	5000	3200	4000	677	844	682

The cost of ice pilotage S_{ice} depends on the variables shown in equation 4.

$$S_{ice} = \{GT, Arc, T, F, N\} \quad (4)$$

where, GT – gross tonnage of a vessel,

Arc- ice class of a vessel,

T – calendar period of the year on the route,

F - Rosgidromet official information on ice conditions,

N - the number of vessels following the route in the "caravan".

Under certain circumstances, the cost of ice pilotage of the vessel along the Northern Sea Route may increase the cost of shipping a reefer container twice and more. Of course, this is the main limiting factor in the development of the reefer container traffic along the Northern Sea Route. Summing up the final scores for all criteria and multiplying by the seasonality coefficient, we get a comprehensive estimate expressed as an integral indicator of the competitiveness of the route. The competitiveness of the route when transporting a certain cargo in a reefer container significantly influenced by the seasonality coefficient K seas. All perishable goods are subject to the seasonal factor: there is a beginning and end of the fishing season, the harvest of vegetables and fruits, meat and dairy products has demand differences associated with religious posts (Fig. 1). When several reefer containers are shipped at the same time, the competitiveness of the reefer container as a transport unit of a particular route with products produced (caught) at the beginning of the season is more in demand among shippers. For example, a reefer container provided on August, 1 for the transport of salmon will be more competitive than a reefer container provided for Chinese garlic. The first days of August are the beginning of the season for salmon and the end for garlic. To take into

account the seasonality factor, it is proposed to enter the following coefficients: the beginning of the season - 1.0, the middle of the season - 0.8, the end of the season - 0.5. Of course, the duration of the seasons for different perishable goods varies. For salmon, the season lasts three months, for pollock - five months, for herring - two and a half months and so on.

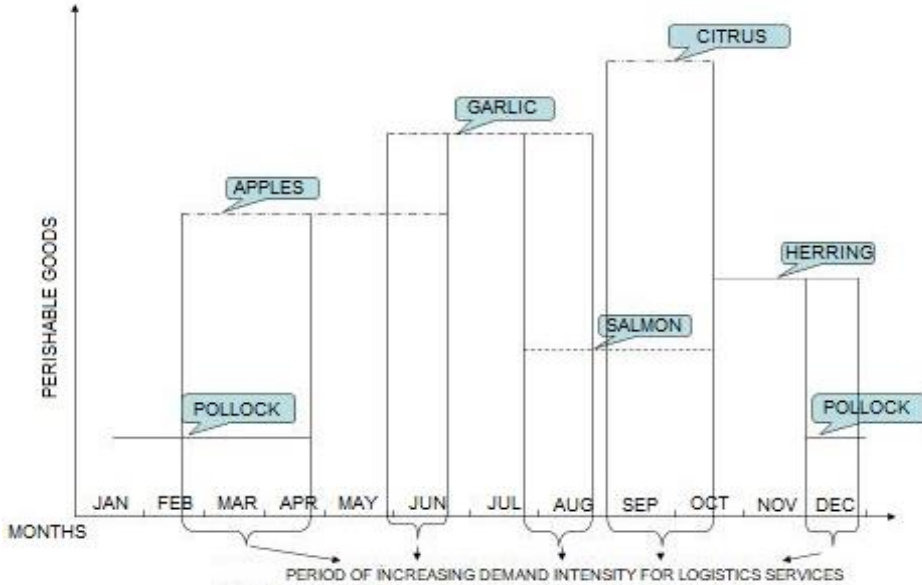


Fig. 1. Periods of the beginning and end of the seasons of perishable goods in the Far East, the direction to Central Russia.

Considering the above, for a correct assessment of the competitiveness of the Northern Sea Route using the formula $A = (K_{ij} \times A_{ij}) \times K_{seas}$, (3), it should be taken into account that the price of transportation (sea freight) is significantly dependent on the cost of ice pilotage through the North Sea Route in the autumn-winter period and is a major obstacle to the development of this route. Nowadays, the Northern Sea Route cannot be regarded as sustainable regular reefer container traffic. However, this route can be considered as an effective transport corridor for ensuring the implementation of seasonal targeted programs at the federal level, such as supply of goods to northern Russia or delivery of Far Eastern salmon to Central Russia.

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