INFORMATION IN THE STRATEGY OF SHIPPING COMPANY

Bulov, Anatoly A. *– D. Sc. (Economics), professor of Admiral Makarov State University of Maritime and Inland Shipping, St. Petersburg, Russia.*

Sokolov, Sergey S. *– Ph.D. (Tech.), Associate Professor of Admiral Makarov State University of Maritime and Inland Shipping, St. Petersburg, Russia.*

Novoselov, Roman Yu. *– student at Admiral Makarov State University of Maritime and Inland Shipping, St. Petersburg, Russia.*

ABSTRACT

The article deals with mathematical models of strategic management of a shipping company in international transportation. Modeling guidelines make it possible to estimate the efficiency of the structural elements of the management system and individual transport units. The article provides an overview of functional capabilities of created infoware that is designed to automate the process of identifying main indicators of management activities and construction of resulting graphs.

ENGLISH SUMMARY

Background.

Efficiency of modern shipping company depends on many factors [1, 2], including the quality of accommodation, transport [3], warehousing, resource management, etc. [4]. Consideration of these factors directly affects the future of the company.

Due to the multifactorial nature of the issue of company's effective management and the need for operational decision-making information technologies come to aid [5, 6], which make it possible to automate many administrative processes [7–11].

One way to ensure stable functioning and development of a company is a strategic management, taken together with its own means and methods. In particular, mathematical models and their software implementation are of a great interest, as they help to give a comprehensive evaluation of the transport company in international cargo transportation. [12]

Strategic management of a transport company includes a series of calculations: identification of operational performance indicators, financial analysis, definition of competitiveness of operated units of transport, calculation of performance indicators of the investment project on company's development.

Mathematical relations and developed software, which are considered hereafter, concern specific example of strategic management of a transport company – management of a shipping company.

Objective.

The objective of the article is to demonstrate possibilities of information use, in particular software, for opitization of a shipping company's activity.

Methods.

The authors use mathematical methods, calculations and analysis.

Results.

In terms of determining the operational performance indicators of the fleet, following tasks are solved:

1. Determination of the number of round trips, made by a vessel for a predetermined period of operation, and volume of traffic on vessels.

2. Calculation of the total turnover of the company for all projects during the operation period.

3. Determination of freight rates and the level of its profitability, time-charter equivalent and the prime cost of transportation.

4. Evaluation of breakeven of vessels› projects.

It should be noted that the prime cost of transport services is one of the main economic indicators characterizing the efficiency of production and business activities of a shipping company. Use of full prime cost indicators of transport services involves regulation and control of costs, determination of company's profits and becomes a starting point in choosing pricing (setting tariffs for the carriage of goods), is used to calculate cost estimates and targets for reducing prime cost of transport services, requirements plan for circulating asserts, as well as for economic justification of investments.

To determine breakeven operation of ships and construct the breakeven point, annual income (D_i) and annual operating costs ($Э_i$) are calculated, based on vessels› projects.

Revenues from transportation on each vessel are determined as:

$$D_i = G_i \times F_i, \text{ долл., where долл. means USD.}$$

Annual operating costs ($Э_i$) for navigation period for each vessel:

$$Э_i = G_i \times S_i, \text{ руб., where and after руб. means RUB.}$$

Annual fixed costs (($Э_i^{пост}$) for navigation period are accepted as 30% of the annual operating costs, thus:

$$Э_i^{пост} = j \times Э_i, \text{ руб.}$$

Minimum volume of cargo transportation, providing breakeven operation of a transport company at specified freight rates, is calculated for each type of vessel:

$$G_{min} = \frac{Э_i^{пост}}{F_i - (S_i \times (1 - j))}, \text{ т.}$$

Here j – coefficient of fixed costs.

After identifying minimum volume of freight transportation, vessel's utilization coefficient and minimum income (D_{min}) are calculated, which allow setting the maximum permissible values of the vessel's performance.

$$D_{min} = G_{min} \times F_i,$$

At the same time, vessel's utilization coefficient ($K_и$) is determined

$$K_u = \frac{G_{min}}{G_i}.$$

The best project is selected, basing the lowest volume of freight transportation by a vessel (G_{min}), which ensures breakeven operation. The analysis is carried out; breakeven points are built on vessels› projects.

Financial analysis consists of the following sequence of actions:

1. Analysis of financial condition and construction of the matrix of the balance sheet of the company.

2. Determination of financial indicators of the company.

Financial indicators include three groups: liquidity, business activity, use of resources.

The indicators characterizing solvency include indicators (ratios) of liquidity: absolute liquidity, quick assets, current liquidity, and financial stability.

Absolute liquidity ratio indicates how much of the short-term debt the organization is able to repay in the near future, which is one of the conditions of solvency.

It is usually assumed that for most businesses the current liquidity ratio may be at level 2, as price for current assets could be reduced by 50%, but, nevertheless, a sufficient safety margin will remain to cover current liabilities.

Quick assets ratio reflects the projected solvency of the company subject to the timely transactions with debtors. Quick assets ratio is a more strict estimation of company's liquidity. It is calculated using only a portion of current assets – cash, securities and receivables, which are compared with current liabilities.

The next step of indicators'calculation at the strategic management of a shipping company, operating in international transportation, is to determine the competitiveness of vessels.

Competetiveness of vessels refers to the ability to create and maintain its competitive advantages, ensuring quality and efficiency of transportation and transport services, being in demand, in a particular market segment.

Feature of evaluation of vessels'competitiveness is that, by analogy with the products of the shipbuilding industry, primarily internal competitive advantages of transport are taken into account that are created during its construction and reflect the potential of customer value for the shipping company.

On the other hand, the competitiveness of the vessel which generates products is provided by external competitive advantages, reflecting demand in potential consumer value of a vessel in certain operating conditions.

Thus, competiteveness of a vessel is considered as a competitive strategy – potential of customer value for the shipping company and tactical – the relevance of this potential in the segment of the market for transport services.

Indicators of tactical competitiveness of a vessel.

1. Performance of a service (F_1) is defined as the sum of the products of vessel's loading rates in forward and reverse directions ($Q_{эпр}$ and $Q_{эоб}$) and operational speed of the vessel in the forward and reverse directions ($V_{епр}$ and $V_{еобр}$):

F1= Qэ пр ×Ve пр + Qэ обр ×Ve обр [tkm/vessel-day]

2. Specific revenues (F2) are fixed as a ratio of the product of average freight rate (f ср) and vesell's loading rate in forward and reverse directions (Qэ пр + Qэ обр) to the vesell's turnaround time (тоб) in days:

$$F_2 = \frac{f_{ср} \times (Q_{экр} + Q_{эобр})}{t_{об}} \left[\frac{руб.}{судо - сутки} \right].$$

3. Prime cost of providing services (F3) is displayed as the ratio of vessel's maintenance in running condition (Cx) to performance of a service (F1).

$$F_3 = \frac{C_x}{F_1} \left[\frac{руб.}{ткм} \right],$$

$$C_x = \frac{Э_{об}}{t_{об}} \left[\frac{руб.}{судо - сутки} \right],$$

where Эоб – costs for vesell's turnaround.

4. Marginal yield (F4) is determined as the ratio of time-charter equivalent (ТЧЭ) to the vessel›s tonnage (Qp):

$$F_4 = \frac{ТЧЭ}{Q_p} \left[\frac{руб.}{тоннаже - сутки} \right].$$

5. Carrying capacity of a vessel (F5) acts as a product of vesell's loading rates in forward and reverse directions (Qэ пр + Qэ обр) by the number of turnarounds, performed by that vessel (поб):

F5 = поб × (Qэ пр + Qэ обр) [тонн].

6. Specific profit from a service (F6) is considered as a ratio of gross profit (Пв) from the use of the vessel to tonnage (Qp), i. e. profit, attributable to one ton of cargo.

Indicators of strategic competitiveness of a vessel.

*1. Specific price of a vessel (P_1) is determined as the ratio of the construction cost of a vessel (**K_c**) to register tonnage ($Q_р$):*

$$P_1 = \frac{K_c}{Q_p} \left[\frac{долл.США}{т.тоннажа} \right].$$

*2. Specific price of one gross ton (P_2) is the ratio of the construction cost of the vessel (**K_c**) to net register tonnage- **рег. т.** ($W_{рег.т.}$), 1 **рег. т** =2,83 m^3.*

$$P_2 = \frac{K_c}{W_{рег.т}} \left[\frac{долл.США}{рег.т} \right].$$

*3. Specific module of a vessel (P_3) is calculated as a ratio of the product of length (L), width (**B**) and depth of a boar side (**H**) of a vessel to register tonnage ($Q_р$):*

$$P_3 = \frac{L \times B \times H}{Q_p} \left[\frac{м^3}{т.тоннажа} \right].$$

4. Specific power of propulsion unit of a vessel (P_4) is determined as the ratio of engine power of a vessel (N) to register tonnage of a vessel ($Q_р$):

$$P_4 = \frac{N}{Q_p} \left[\frac{л.с.}{т.тоннажа} \right].$$

*5. Specific prime cost for maintenance of 1 ton of tonnage per day without fuel (P_5) is the ratio of the prime cost of the vessel's maintenance per day without fuel (**C_o**) to register tonnage of a vessel ($Q_р$):*

$$P_5 = \frac{C_0}{Q_д} \left[\frac{долл.США}{тоннаже - сутки} \right].$$

6. Time costs for 1 km run of a vessel with cargo (P_6) is a ratio of register tonnage of a vessel ($Q_р$) to the vessel's speed at full load ($V_{гр}$):

$$P_6 = \frac{Q_p}{V_{гр}} \left[\frac{тоннаже - сутки}{км} \right].$$

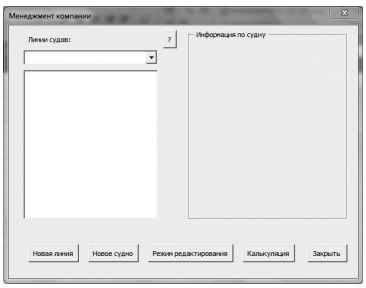
7. Deadweight ratio (P_7) is a capacity of vessel's holds (W_c) to register tonnage of a vessel ($Q_р$):

$$P_7 = \frac{W_c}{Q_p} \left[\frac{м^3}{т.тоннажа} \right].$$

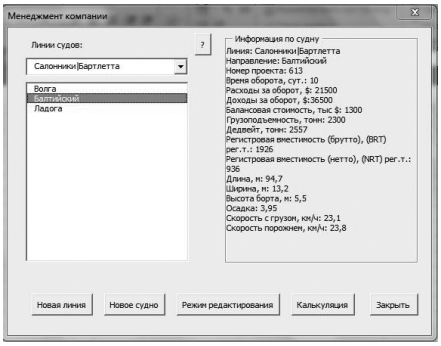
*8. Specific loading of a vessel (P_8) is a ratio of register tonnage of a vessel ($Q_р$) to water draft at vessel's full load (**$T_г$**):*

$$P_8 = \frac{Q_p}{T_г} \left[\frac{т.тоннажа}{м} \right].$$

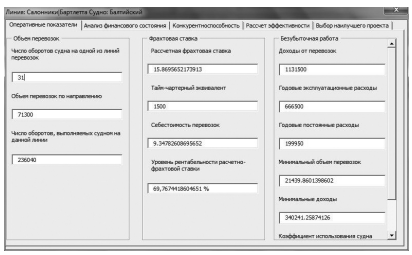
9. Specific fuel consumption per/km run of a vessel (P_9) is a ratio of fuel consumption per voyage ($Q_т$) to the run of a vessel (L):



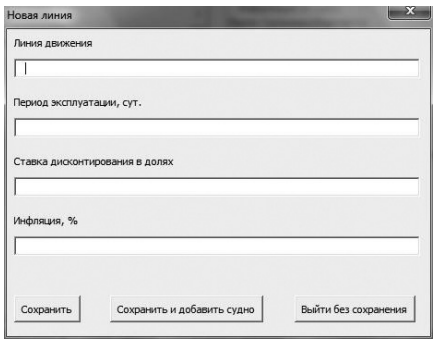
Pic. 1. Main window of software «Automated determination of breakeven of vessel`s projects».



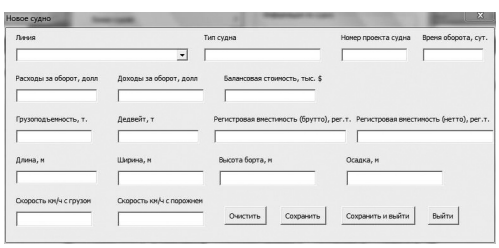
Pic. 2. Information about vessel's project.



Pic. 3. Window «Calculation».



Pic. 4. Input of information about a new line.



Pic. 5. Input of information about a new vessel.

$$P_9 = \frac{Q}{L}\left[\frac{кг}{км}\right].$$

Determination of tactical competitiveness of vessels.

Tactical competitiveness of i-th vessel (project) is determined by the totality of considered j-th indicators, presented earlier as a dimensionless quantity (K_{CFji}).

At the same time, it should be taken into account that competitiveness of a vessel by a separate indicator is higher; the higher is the value of the indicator. These include (F1, F2, F3, F4, F5, F6). In this case, the competitiveness of a vessel by a separate indicator (F_{ji}) is calculated by the expression:

$$K_{CFji} = \frac{F_{ji}}{F_{\max ji}},$$

where $F_{max\,ji}$ – maximum value of a j-th indicator in i-th vessels under consideration.

Competitiveness of the vessel in terms of F3 (prime cost of providing service) is determined by:

$$K_{CFji} = \frac{F_{jimin}}{F_{ji}},$$

where $F_{ji\,min}$ – minimum value of a j-th indicator, i. e. the smaller is this indicator, the higher is competitiveness of a vessel.

In both cases the competitiveness of a vessel on the best indicator is equal to 1.

Integral indicator of competitiveness of i-th vessel K_{ci} is determined as the weighted average of indicators under consideration. In case of equivalence of weighted categories:

$$K_{ci} = \frac{\sum_{j=1}^{m} K_{Fj}}{\mathrm{m}},$$

where m=6.

The considered methods and calculations were the basis of software «Automating determination of breakeven of vessel's projects».

Because of the simplicity of calculations and the usual ease of interface, software tool is implemented in language Visual Basic for Application in the environment of Microsoft Office 2010.

The main program window is shown in Pic. 1.

After selecting a line from the dropdown list, an automatically loading of vessel's projects occurs. When choosing vessel, to the right in the window information is displayed about the respective project (Pic. 2).

When clicking on «Calculate», window with calculations opens, the title of which will be the name of the line and the vessel's project name (Pic. 3). Thus, the possibility is given to calculate breakeven of vessel's projects.

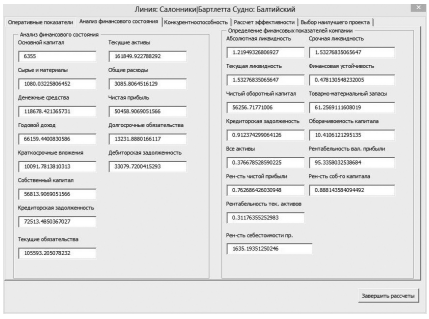
Calculation is carried out automatically when opening the window.

When clicking «New line», window to create a new line opens (Pic. 4). When clicking «Save», a new sheet with the name of a new line is created and its parameters are recorded in the first three cells.

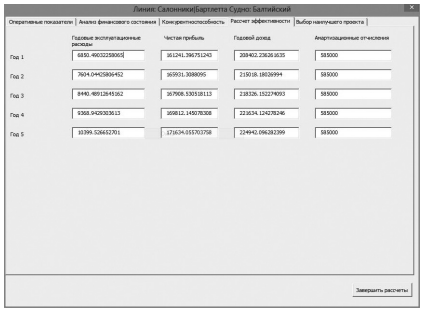
When clicking «New vessel», the form to record the parameters of a new vessel opens (Pic. 5).

Window of financial indicators analysis is shown in Pic. 6.

Analysis occurs when clicking «Calculate» in the main window during calculations of all vessel's indicators.



Pic.6. Analysis of financial indicators.



Pic.7. Efficiency calculation.

Window of efficiency calculation is illustrated in Pic. 7.

Then within the project on automation of breakeven of vessel's projects determination, charts of revenues, expenses, breakeven and other indicators, performance graphics, as well as a selection of the best projects of the vessels on the line will be implemented.

Conclusion.

Methods and models, shown in the article, cover only part of the strategic management and can serve as a starting point for further development using modern software tools.

Keywords: transport, shipping company, strategic management, model, information, performance indicators, automation of administrative processes, international cargo transportation.

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Координаты авторов (contact information): Булов А. А. (Bulov A. A.) – bulovaa@gumrf.ru, Соколов С. С. (Sokolov S. S.) – sokolovss@gumrf.ru, Новоселов Р. Ю. (Novoselov R. Yu.) – rnovoselov93@gmail.com.

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