E u r o E c o n o m i c a

Issue 2(40)/2021 *ISSN: 1582-8859*

Economic Models used by Shipping Decision Makers

Andra Luciana (Marcu) Turcanu[1], Carmen Gasparotti[2], Alina Beatrice Raileanu[3]

Abstract: Transport economics is the branch of economic science whose object and purpose are to interpret and substantiate theoretically "and practically" the facts, acts, and economic behaviors that meet the needs of movement, distribution, and physical distribution of resources of goods, products, goods, and people, by use of transport capacities. The purpose of this paper is to present different approaches of modeling and simulation economic processes. It is known that those methods managers can apply a wide range of management methods and techniques. From the practice of economically developed countries, the manager uses modeling as an alternative to the exact sciences. Computer-assisted modeling is based on the idea that man cannot be excluded from running a system. He is the primary source of formulating hypotheses about system behavior and the only one to include the results of different evolutionary variants in an integrative action.

Keywords: shipping; management; economic models

JEL Classification: D90

1. Introduction

The economic activity of transport is the complex process, consisting of all the facts, acts, behaviors, and decisions of economic agents, regarding the use of capital and specific resources, in order to produce, distribute and consume transport services, to have as a final reason by satisfying the transport demand on the specific market (Popa & Hăullică, 2008).

The organization's management involves the involvement of managers in creating those organizational structures of the company to ensure the best functioning with a minimum of human, material, and financial resources, streamlining each link of the general mechanism of the company so that the company's ships bring maximum profit. Organization management is the attribute of the general manager.

From a managerial point of view, the shipowners establish the managers, and they agree to act as managers of the ship and the company. The managers understand to act in good faith and maximum promptness for the provision of management services in the interest of shipowners and following the

[1] PhD in progress, Faculty of Economics and Business Administration, Dunarea de Jos University of Galati, Romania, Corresponding author: andra.marcu@ugal.ro.
[2] Professor, PhD, Faculty of Economics and Business Administration, Dunarea de Jos University of Galati, Romania, E-mail: carmen.gasparotti@ugal.ro.
[3] PhD, Faculty of Applied Sciences, Danubius University of Galati, Romania, E-mail: alinaraileanu@univ-danubius.ro.

ship's international management practice (sound practice) to protect and promote the interests of shipowners in all matters related to contracted services. In fulfilling their obligations, managers are responsible for allocating their available resources, labor, and services fairly and reasonably. As owners of the shipowners and acting in their interest during the contract, the managers fulfill the functions established by the management contract (Popa & Hăullică, 2008).

The globalization of national economies manifested as a trend in recent years has produced significant changes in river and sea transport, respectively: new types of ships, new important importing or exporting areas, new river and maritime routes due to the embargoes imposed on specific countries, new policies in the field of specialized human resource training, factors that upset a traditionalist field par excellence (Carp, 2000).

With the increasing complexity of managerial activity in recent decades, the range of management methods and techniques has expanded. Flexible, vague, heuristic, dynamic quantitative methods were designed, and simulation techniques were used while ensuring their location in the company's information-decision system analysis project (Suciu, 1997). Management is defined as "the science of business management techniques," according to Larousse's dictionary, or "studying the processes and managing relationships within the company to discover the legitimacy and principles that generate them, the design of new systems, methods, techniques, and methods leadership, likely to increase efficiency" (Nicolescu, 1992), is in fact "the art and science of driving".

2. Literature Review

To ensure the management performance for a shipping company is necessary to consider resource allocation, investment projects, budget spending, etc. A mathematical model will help the leader to see how a variable will influence another one (Nikulina et. al., 2019). A top manager must adapt to new management conditions, and they have to improve their management tools and mathematical methods to be adequate for a dynamic model.

It is known that a common challenge in these times is to understand the challenges of the business environment. More and more researchers have been experimenting with new concepts, theories, or models to facilitate the understanding of the challenges of the business environment (Dănescu et. al., 2021).

A model must approximate the natural system, which includes as many of its essential features as possible, and not be very complex so that it is not understood and we cannot experience it. The model that satisfies us must be a compromise between realism and simplicity. Simulation specialists recommend increasing the complexity of iterative models. One of the critical issues in the modeling process is validating the model, which can be used in simulation activities (Cucu, 2014). Afflerbach et al. (2016) has said that an acknowledged source of corporate performance is business process management.

Much of economics requires an understanding of mathematics and statistical methods, so we always ask: What can a manager solve through mathematical economics?

Moffat (2021) says this can be defined as a field that examines mathematical aspects combined with economic theories.

The modeling and simulation of economic processes help substantiate the managerial decision in conditions of efficiency for the producer, with the help of flexible economic-mathematical models and the possibility of using the simulation technique (Isbăsoiu, 2021).

Today, mathematical modeling is an objective technique when science and technology evolve because it ensures rigor and abstraction in analysis, discovering the phenomenon's essence. The model (Hâncu & Florescu, 2006) is an isomorphic representation of reality that provides an intensive yet rigorous image in the logical structure of the phenomenon studied.

Different studies show that shipping policy contains multiple constraints (Frankel, 2007). That is a factor that developed the decision-maker's interests to different ways and tools for decisions.

3. Mathematical Approach

The mathematical approach offers the possibility to test hypotheses and topics from different fields of activity (Moffat, 2021). The results allow the possibility to explain different terms and phenomena, which means that those methods are suitable for many sciences.

Mathematical models generally start from numerous simplifying hypotheses; they refer to minor problems that lead to the so-called "optimal" solution based on a single criterion; they only provide an opening to economic problems, not viable solutions, recognized by the practice faced with multiple and complex aspects. The model can be defined as an abstract and simplified representation of an economic process, according to figure 1.

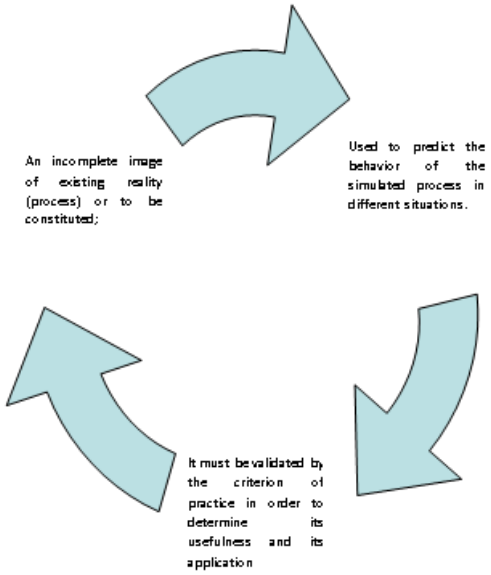

Figure 1. Model Definition

The fact that the solution of managerial problems in enterprises cannot be achieved with a "pure" mathematical model has necessarily led to the appeal and design of highly elastic economic-mathematical models, which capture both the legitimacy of the phenomenon and the dynamics he used: probability theory, Markov chain theory, heuristics, vague set theory, dynamic programming, as well as simulation techniques.

4. Economical Process

The model concept is relatively new compared to the modeling method, which appeared with people's concern for scientific knowledge. The term was taken up by technicians, mathematicians, and system analysts to be used in economic processes. Also, in the construction of a model is mandatory to respect some principles and requirements. This is explained in Table 1.

Table 1. Principles of Mathematical Modeling of the Economic Process

Principles	Example
Any model is based on an economic theory created in advance to explain the modeled process, the parameters with which it operates are, as a rule, economic categories or their sides;	They are used not only for describing general theories in these social sciences but also for practical management and optimization tasks. They are behind the information systems that drive the significant manufacturing, commercial, and transport companies (Nikulina et al., 2019).
Models ignore several sides and features of the re-read process. The isomorphism of models is not a mandatory condition for an object to be the model of another object;	The built model constitutes the basis for the developing balanced development algorithms; (Polumiienko & Gorda, 2017).
The model expresses the similarity not only of an isolated economic process but of an entire class of processes so that any model is a generalization, a synthesis of a certain degree.	One mandatory requirement in mathematical modeling is the precise formulation and justification for each step. In that way, the results will be more precise (Prazak & Kovarnic, 2019); (Nikulina et al., 2019).
A model cannot be constructed without using a system of symbols representing economic categories that do not overlap with the current alphabet or figures used.	To create a model is mandatory to be concentrated on two models used in economic theory, and the expert should create a dynamic system by selecting the correct variables (Medio, 2009).

5. Economic Models Frequently Used

The methods used to solve mathematically formulated economic problems consist of a coherent sequence of logical and arithmetic operations known as algorithms. The solution of the model obtained with the help of an algorithm is analyzed, and finally, if it is convenient from a technical-economic point of view, with its help, the economic decision is substantiated.

The requirements imposed on an economic-mathematical model are:

- Be representative (represent as accurately as possible the system or at least its essential characteristics);
- To have cognitive and applicative value (to be based on a rigorous scientific theory and to reflect the actual structure of the economy);
- To be able to quickly adapt to changes in the alliance or the evolution of the process;
- To be flexible when combined with other criteria than the economic, political, social ones;
- To be valid;
- To ensure the observance on a scale of the dimensions of variable and constant quantities;
- To be solvable with the existing calculation technique;
- To be cheaper and easier to handle than the original system.

Andonie and Gârbacea (1995) observed the approach of algorithmic thinking with fields that have nothing in common with mathematics. That comes from the universality of an algorithm, and that results bring routine like an essential element of an algorithm.

Algorithms can be exact (rigorous), approximate and heuristic, like the modeling and processing methods presented. An algorithm must satisfy the conditions presented in figure 1.

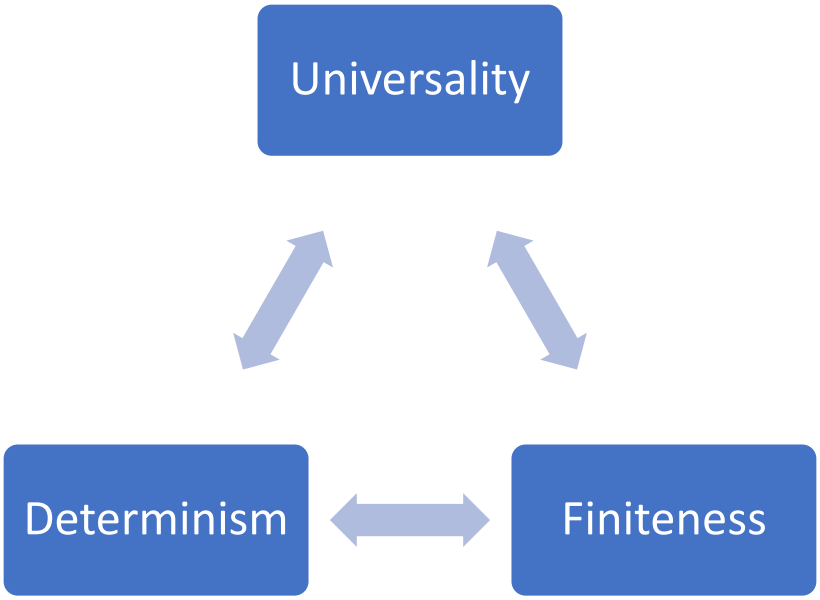

Figure 1. Algorithm Conditions

When we refer to universality, we speak about the possibility for the algorithm to ensure the processing of a vast number of input data, the finiteness refers to the time of obtaining the results that must be at most of the order of hours, as well as the necessary memory). For determinism are excepted the fuzzy algorithms.

Frankel (2006) observed that in shipping companies, like in other businesses, a decision can influence the strategy, the administrative, and operations process. The path taken since the appearance of the first modeling works until now proves the permanent preoccupation of specialists in the sense of finding methods, accessible ways, as close as possible to the economic reality, in order to improve the decision-making processes in enterprises.

In general, the most common problems in shipping are those given by the optimization of the transfer of goods from seller to the buyer. Different optimization techniques are used to solve them and are classified into three categories: enumerative, deterministic, and stochastic.

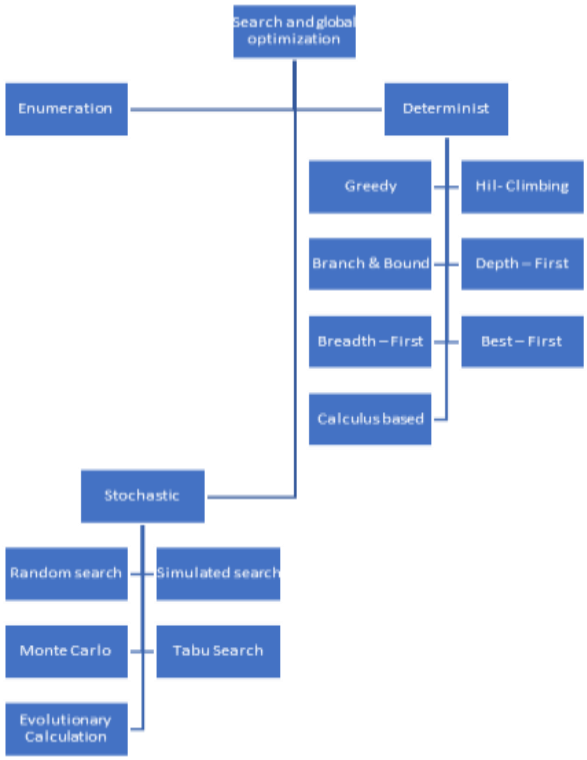

Figure 2. Optimization Process

Source: Adapted from (Rădulescu, 2015)

Greedy algorithms choose local optimal, assuming optimal sub-solutions they are always part of the optimal global solution. "Hill-climbing" algorithms look in the direction of the steepest ascent from a current position. These algorithms work well on unimodal functions, but the local optimum, plateaus, and ridges reduce the algorithms' efficiency. The "Greedy" and "Hill-climbing" algorithms, extending a node repeatedly, examine all possible successors (for an extension to the best node) and do not keep any node records extended that he pursued (Rădulescu, 2015).

Deterministic methods are often ineffective when applied to complete problems or too large issues because they depend on field requirements to direct or limit the search in the ample search space. These problems are called irregular. Because many multi-objective optimization problems are irregular enumerative and deterministic search techniques, they have a low degree of efficiency. As approaches alternatives to solving these "irregular" problems have been developed, other techniques stochastic search and optimization approaches such as Simulated Annealing, Monte Carlo methods, taboo search, and Evolutionary computational algorithms"- EA). They cannot guarantee that the solution found is the optimal one. They generally find reasonable solutions for a wide range of optimization problems in which traditional methods determinists face difficulties (Rădulescu, 2015).

Over decades business process modeling was developed and nowadays are many products help that process (Weske, 2004). Shipping companies should invest in their information technology infrastructure and skilled human resources.

6. Conclusion

The modeling process, respectively simulation, was used long before the advent of computers. The models and simulations have a distant history, the oldest consisting of lines drawn in the sand, using objects such as twigs and stones to represent the characteristics of the terrain, fortifications, the disposition of troops, etc. concerns in this field have progressed rapidly, so with the development of technology in the field, necessary steps have been taken in the use of modeling and simulation in most fields. The concept of modeling represents the process by which we produce a model, representing the construction and the way of working of a particular system that we are interested in.

Economic modeling offers the manager the rigorous side of his actions, multiple ways of reconciling existing material, human and financial resources with the objectives formulated for a certain period, allowing him to think and make the most appropriate decisions.

The modeling method is a tool of scientific knowledge and aims to build representations that allow a better understanding and a more profound scientific knowledge of different fields. The essence of modeling replaces the actual process studied by a model more accessible to the study.

In conclusion, to get reasonable solutions to optimization problems (multi-objective), it is good to use classical deterministic algorithms and algorithms based on artificial intelligence. There are problems in which the best choice for solving them is the classical algorithms known, as well, some problems can be solved only by applying based algorithms on artificial intelligence.

7. Acknowledgement

This work was carried out in the framework of the Project ANTREPRENORDOC, in the framework of Human Resources Development Operational Programme 2014- 2020, financed from the European Social Fund under the contract number 36355/23.05.2019 HRD OP/380/6/13 – SMIS code: 123847.

References

Afflerbach, P., Bolsinger, M., Röglinger, M. (2016). An economic decision model for determining the appropriate level of business process standardization. *Bus Res*, 9 (2), pp. 335–375.

Andonie, R. & Gârbacea, I. (1995). *Algoritmi Fundamentali O Perspectiva C++/ Fundamental Algorithms or C ++ Perspective.* Cluj Napoca: Editura Libris.

Carp, D. (2000). *Management cantitativ in shipping modelare matematice/ Quantitative management in shipping mathematical modeling.* Bucharest: Editura Didactică și Pedagogică București.

Cucu, V. (2014). Consideratii privind conceptul de modelare si stimulare/ Considerations regarding the concept of modeling and stimulation. *Buletinul Universitatii Nationale de Aparare "Carol I"*, pp. 39- 43.

Dănescu, T.; Spătăcean, I.-O.; Popa, M.-A. & Sîrbu, C.-G. (2021). The Impact of Corporate Governance Mechanism over Financial Performance: Evidence from Romania. *Sustainability*, 13(19), pp. 1-14.

Frankel, E. G. (2006). Strategic decision making in shipping. *Marine Policy*, 16 (2), pp. 123-132.

Frankel, E. G. (2007). Hierarchical logic in shipping policy and decision-making. *Maritime Policy and Management*, 19 (3), pp. 211- 221.

Hâncu, D. & Florescu, M. (2006). *Modelarea si simularea proceselor economice/ Modeling and simulation of economic processes.* Bucharest: Editura Fundaţiei România de Mâine

Isbăsoiu, E. C. (2021). Numerical modeling and simulation in various processes. *Annals of Spiru Haret University, Economic Series*, pp. 99-106.

Medio, A. (n.d.). (2009). *Mathematical models in economics*. UDINE, Italy: Encyclopedia of Life Support Systems Vol. III (EOLSS).

Moffat, M. (2021). What Is Mathematical Economics? ThoughtCo. https://www.thoughtco.com/definition-of-mathematical-economics-1146352

Nicolescu, O. (1992). *Management.* Bucharest: Editura Didactica si Pedagogica Bucuresti.

Nikulina, T. N.; Zhirnova, I. S.; Stupina, A. A. & Zhirnov, A. A. (2019). Mathematical modeling of economic processes in complex systems (on the example of Krasnoyarsk municipality). *Journal of Physics: Conference Series*8.

Polumiienko, S. & Gorda, S,. (2017). Game-theoretical resource model of balanced technological development. *Mathematical modeling in economy,* No.3-4, pp. 4-9.

Popa, C. & Hăulică, D. (2008). *Organizarea transporturilor navale/ Organization of shipping*. Constanţa: Ed. Academiei Navale Mircea cel Bătrân.

Prazak P. & Kovarnic, J. (2019). Nonlinear Phenomena in Cournot Duopoly Model. *Modelling of Economic Systems*, 6 (3), 30, pp. 29-32.

Rădulescu, I. C. (2015). Rezolvarea unor probleme de optimizare multi-obiectiv bazată pe algoritmi evolutivi/ Solving multi-objective optimization problems based on evolutionary algorithms. *Revista Română de Informatică şi Automatică/ Romanian Journal of Informatics and Automation*, 25 (2), pp. 39- 48.

Suciu, C. R. (1997). *Modelarea și simularea proceselor economice, ediția a II-a/ Modeling and simulation of economic processes, 2nd edition.* Bucharest: Editura Didactică și Pedagogică.

Weske, M.; van der Aalst, W. M. P. & Verbeek, H. M. W. (2004). Advances in business process management. *Data & Knowledge Engineering*, 50, pp. 1-8.