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Structuring of Industrial Organization Reserves on the Basis of the Golden Section Theory

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***Abstract*—Major task of the research is to develop models and methods of management of material flows taking into account analysis of economic agent's financial resources transferred into stock. Methodological framework of the research includes scientific and specific cognitive methods. Search of solutions to research issues requires application of a set of additional methods: economic and statistical methods, e.g. comparison, grouping, methods used in system and functional analysis, analytical modeling, systematicity, integrity, logical modeling, etc.**

The article describes the approaches of choosing the statistical analysis methods allows to systematize the nomenclature the physical resources.

The article analyzes the existing methods of the classification of the organization's inventories. It represents the results of the selected inventory items' comparison which are determined using the traditional methods and on the basis of application of «the golden proportion's» ratios. The need to improve classification methods of reserves in an economic entity under the conditions of influence of great number of multidirectional internal and external environment factors is proved.

Keywords—tangible assets, classification, management, methods, assortment, golden section, material resources.

I. INTRODUCTION

The variety of approaches to material resources structuring and the existence of various structuring algorithms, sometimes leading to diametrically opposed approaches [1,2,3,4,5,6,7], makes us look for new ways to justify the range of criteria for dividing the inventory nomenclatures into groups.

In this paper we approached to the problem of the material resources' classification differently. Namely, we did it with a sufficient degree of abstraction from the real logistics activity. The following experimental fact (an axiom) should be taken as the basis of our arguments. Temporarily resistant forms of nature and society are characterized by the rule of «the golden proportion» for its component parts; therefore, we can apply the rules of the golden section towards the constituent parts of the material resources' nomenclature.

Johannes Kepler said that the geometry has two treasures – Pythagorean Theorem and the golden section. And if the first of these two treasures can be compared to a measure of gold, the second can be compared to a jewel [1].

Let's consider briefly the nature and the rules of «the golden proportions'» determination. The golden section is proportional division of the segment into unequal parts at which the entire segment so belongs to the most part as the most part belongs to the smaller; or in other words, the smaller part so belongs to bigger, as bigger to the whole.

The experience of economy's development has showed that it is necessary to distribute resources using the rule of «the golden proportion» in order to provide a sustainable development of society and effective public managing. Even Aristotle knew this stable equilibrium rule. The research of literary data shows that the economy and military technology of Great Britain and the USA is constructed with taking into account Fibonacci's method (the theory of «the golden section») [3].

The concept of the golden division was entered into scientific custom by Pythagoras, the Ancient Greek philosopher and the mathematician (VI century BC). In the antique literature which reached us the golden division for the first time is mentioned in Euclid's «Beginnings». The geometrical creation of the golden division is given in the 2nd book of «Beginnings». In Renaissance the interest to the golden division amplified among scientists and artists because of its application, both in geometry and in art, especially in architecture. Leonardo da Vinci paid also much attention to the studying of the golden section. He made sections of the stereometric body formed by the correct pentagons and every time received rectangles with the proportion of the sides in the golden section. Therefore he named that as the golden section. Even the Mathematical Fibonacci association was established in the USA, which has released the special magazine since 1963. One of the achievements in this area is the opening of the generalized Fibonacci's numbers and the generalized golden sections.

The facts confirming the existence of the golden S-sections in the nature are provided by the Belarusian scientist E.M.

Soroko in the book «Structural Harmony of Systems» [8]. The author makes a hypothesis that the golden S-sections are numerical invariants of the self-organizing systems. Being confirmed experimentally, this hypothesis can have fundamental value for the synergetrics's development, which is a new area of the science studying processes in the self-organizing systems. Nowadays even more often say that the synergetrics will become the following stage of logistics's development [9,10,11,12,13,14]. It is one more occasion to pay close attention to the methods of the golden division.

II. Materials and Methods

The number of the PHI, the value of which corresponds to 1,618, scientists of ancient times called divine proportion», because in their view it played a role of building brick in the foundation of all life on the Earth. Let us try to apply the rules of the «golden section» to conduct classification of material resources of the enterprise. The purpose of the work is to share material resources into groups with use the methods of «golden section» and compare the results with the percentage ratio of groups A, B and C.

A common approach to the issue of restructuring of the material resources do not exist to date [15,16,17,18,19,20]. The most common method for the preparation of such a classification is the ABC method. ABC method is a method of forming and inventory control, is to divide the range of N sold inventory items into three unequal subsets of A, B, C on the basis of a formal algorithm.

The positions of the nomenclature that belong to group A are innumerous, but it accounts for biggest share of the money invested in stocks. This is a special group from the point of view of determining the value of the order for each item of nomenclature, monitoring current stock, costs for shipping and storage.

The group B is in the positions of the nomenclature, occupying the middle position in the formation of reserves warehouse. Compared with the positions of the nomenclature A it requires less attention, made them a regular monitoring of current insurance and inventory in stock and order of timeliness.

The group C includes the positions of the nomenclature, being the majority of stocks: they account for a significant portion of funds invested in stocks. As a rule, the positions of the group are not permanent records are maintained, and the availability check is carried out periodically (once a month, quarter or half-year); calculating the optimum size of the order and the order period are not made.

The importance of the use of the ABC method in the enterprise is seen in almost all large literature supply. Typically, in the process of ABC method quantitative and cost characteristics of the resources are correlated, in the result a small number of items of raw materials, semi-finished products and components are a large part of the costs for the acquisition of resources, while for larger amounts of resources that share costs very small. But in determining the coordinates of points A and B between scientists there is no unity. Consider the existing approaches to the definition of the boundaries of the nomenclature groups.

Based on the Pareto`s rule was established empirical method of determining the boundaries of the nomenclature groups, based on survey data. The method has two varieties: 1. The A coordinates will be follows: Ya = 80%; Xa = 20%, and the B coordinates: Yb = 95%; Xb = 50%. Thus, point A specifies 20% of the nomenclature border, (A + B) - 50% of nomenclature. 2. The A coordinates will be follows (75/10), the B coordinates - (95/35).

When using the differential method is the following algorithm partitioning material resources into groups. It counts the total number of requests received during a certain period, and divided by the total number of positions in the nomenclature N, as a result the average index of requests P per position of nomenclature N is derived. All material resources, the number of applications is about 6 and more times higher than P is included in A subset. The subset includes all the material resources, the number of applications that are more than 2 times less than P. All other material resources are included in the subset B.

In the calculation of the analytical method of calculation of the following sequence:

1. Number of pieces N is normalized in the range of 0-1and x the argument is introduced.

2. Sets the form of the functional dependence of

$$y = f(x, ap), \quad (1)$$

where ap- coefficients.

3. The coefficients ap are determined using least-squares methods.

4. In determining ap- coefficients the following conditions must be observed factors: the first – at x = 0, y = 0; second when x = 1, y = 1; thereby reducing the number of equations to determine the coefficients ap.

After that step pass to the nomenclature, which divides the nomenclature into two groups.

The new system of coordinates is entered, taking for a reference mark an abscissa Xa and ordinate Y (Xa).

Each of the methods of definition of nomenclature groups described above has both the advantages, and shortcomings.

In our opinion, methods of theory of «gold division» can be applied to classification of stocks as follows.

We will begin with cost aspect of classification of stocks

Putting a ratio between the most liquid positions of the nomenclature (group A) and all other positions (groups B and C), we obtain the following equation: A/(B+C)=1,618 or A/(1-A)=1,618

As a result of calculations we receive that material resources have to be divided into classes as follows: the group A has to make 61,8% of the cost of stocks, and group B and C in total – 38,2%.

The ratio of groups B and C also has to submit to the principles of «golden ratio»: B+C=0,382, B/C=1,618.

Then B=0,236, and C=0,146.

Therefore the point B determines 23,6% limit of the nomenclature, and a point C – 14,6% of the nomenclature by the cost of stocks.

As show researches, «golden ratio» is present not only at cost classification of stocks, but also at classification by quantitative aspect.

Thus the system of the equations assumes the following form:

$$A+B+C=1 \quad (2)$$

$$B/A=1,618; \; C/B=1,618.$$

III. Results and Discussion

As a result of simple mathematical calculations we receive the following results concerning classification of stocks by quantitative aspect. The group C can make 50%, group A – 19,1% and group B – 30,9%.

We carried out the comparative analysis of results of «gold division» of material stocks and the existing percentage ratios of nomenclature groups. It testifies to the following:

1. Using the Fibonacci method (the theory of «the golden section») gives reliable results of material resources division into classes.

2. The range of the obtained groups' boundaries similar to the percentages of a number of other sources.

Thus, we tried to prove division of material resources into classes taking into account regularities of creation of the nature in general and to transfer the principle of construction of all of definition of nomenclature groups of material resources live much.

IV. Conclusions

In our opinion, the researches of classification methods and structuring of physical resources have to be continued in a number of directions that will allow to reduce the expenses connected with inventory control and to correct the inventory and orders policy. Our technics of use of «gold division» of material stocks allows to carry out the scientifically based group of physical resources, to allocate resources uniform groups on several indicators and that, as a result, will allow to lower costs of management of many thousands resources nomenclatures.

Correctly made and structured stocks classifier is the main source of information allowing to analyze the range and to come to decisions on its updating or rotation. The received results of material assets grouping based on gold division will allow increasing the effectiveness of assortment formation actions in the conditions of resource limitation. The developed stocks optimization system has to be formed proceeding from general and special principles of management characterizing it as actively functioning, aimed at achievement of the greatest possible economic and other results according to the resource opportunities. However the final management decision has to be made taking into account particular conditions of enterprise performance, features of its organizational culture, communication with suppliers and consumers, a development level of logistic infrastructure, etc. While the application of automated control stocks system, using the mathematic economic models, assurance of reliability and efficiency of information acquisition with state-of-the-art IT solutions, integration and automation of logistic operations and functions promotes the improvement of the inventory control system effectiveness.

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