INFORMATION TECHNOLOGY

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THE COMPUTER HANDLING OF QUOTATIONS OF THE STOCK MARKET BASED ON METHODS OF DECISION SUPPORT

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Abstract

The basic positions concerning the technical analysis of stock quotations of the stock market are considered in the article. The need of the definition of stable and unstable elements in the stock market is proved. The scheme of the data processing on the basis of the information technology of high-performance calculations is submitted. The algorithm of sorting of all set of securities through creation of their functions of the optimality by means of using of the methodology's support of decision-making is described. The conclusions about the prospects of the practical application of the described schemes and algorithms in a problem of placement of investments into financial instruments of the stock market are made.

Keywords:

Information technologies were widely adopted now and are used practically in all spheres of human activities. First of all, it is connected with a possibility of computing systems to process considerable data arrays, submitting the user a resulting effect within short terms. One of the actual problems in this area is tracking of quotations of the stock market in real time as it is necessary

to work with a great number of information simultaneously. For determination of dynamics of a change in value of shares the extensive group of fundamental and technical indicators is used. Forecasting of tendencies of change of quotations is made on several time spans that allows to be guided more precisely in a current status of the market, but, at the same time, increases load of the used computing device [1].

Relevance of the considered subject is proved by a difficult situation in the stock markets in case of which efficiency of work with quotations directly depends on availability of a high-quality program mathematical apparatus for carrying out calculations. At the same time, many entities are directly connected with stock exchange quotations of shares and foreign currency. Methods of decision making can provide the modern needs for this area only in case of considerable improvement of approaches to work with technical and economic indicators. The development of the stock market raises extent of participation of the companies in the course of attraction of additional resources for the investing programs by placement of the securities in the market, also developed stock market plays a key role in financing of economy in comparison with the banking sector. This perspective just gains popularity in scientific community though there are already researches directly or indirectly touching this subject. So in S. N. Volodin's [2] researches efficiency of methods of the technical analysis in case of supershort-term transactions is studied, and in D. V. Terentyev [3] thesis approaches to the choice investment strategy in the Russian stock market are described.

The analysis of the condition of the stock markets consists of two components, equal on the importance: fundamental and technical analysis (fig. 1). It is impossible to call any of them determining as each of analysis types covers the special section of economic indicators and only the complex analysis of all range of information will allow to constitute adequate model of an exchange environment [4].

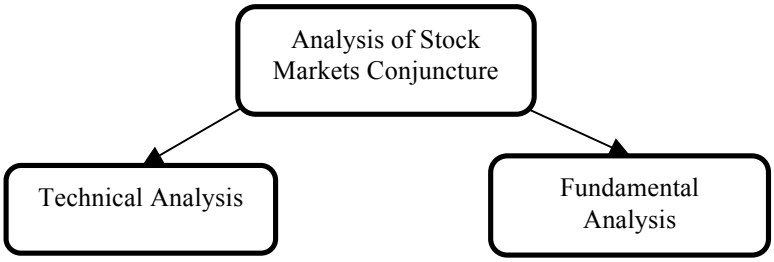

Fig. 1. Levels of the analysis of the stock market

The fundamental analysis is a method of the prediction of future movements of security quotations and goods prices on the basis of the

economic, political and other significant factors influencing the demand and supply on goods or securities.

The technical analysis is a forecasting of the changes in price in the future on the basis of the analysis of the changes in price in the past. Time series analysis of the prices is its cornerstone. In addition to them, in the technical analysis information on the trading volumes and other statistical data is used. More often methods of the technical analysis are used for price analysis, changing freely, for example, at the exchanges. The technical analysis doesn't consider the reason of the direction price changing (for example, owing to low yield of shares, price fluctuations to other goods or changes of other conditions), but considers that the price already moves in a certain direction [5].

Now monitoring of the environment of the stock market specialized software, like OptionsHouse and Metatrader are used first of all. These and similar to them functional programs provide access to financial reports in real time, and also contain a number of tools for carrying out the technical analysis. Their main benefit is possibilities of rapid response to changes in a market situation. For forming of investment portfolios such programs as Alt-Invest are used, however they approach only for the specialized companies and their application at the entities whose activities are only indirectly connected with the stock markets, is very difficult [6].

The type of the generalized function chart of modern program complexes of the technical analysis of price indicators of actions (A1 … An), on condition of information processing on several issuers of securities is presented in fig. 2. Output information (technical indicators of T1 … Tn) represents data array with the dimension equal to the number of the shares loaded into system and therefore perceptions of so impressive amount of information considerably is at a loss. It is convenient to use this approach in case of assessment of financial appeal of separate companies, but in case of complex monitoring of a market situation it is inapplicable [7]. The processing time of data increases in such a way that they simply lose the relevance by the time of receipting of results.

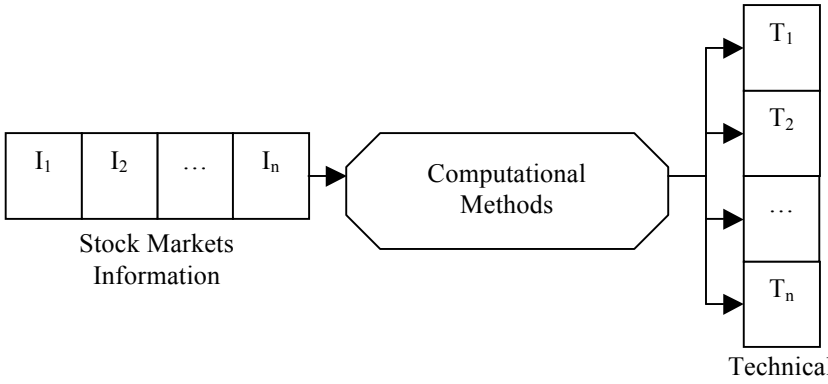

Fig. 2. Classical scheme of the technical analysis of the stock market

The efficiency of using of the computing capacities can be increased considerably using the alternative method of data processing based on the methods of the decision support. Allowing a software to synthesize independently generalized technical indicators of financial appeal, liquidity and stability of issuers, it considerably will accelerate data processing and considerably will simplify work of the companies whose activities were started on quotations of the stock market [8]. The generalized scheme of the offered approach is provided in the fig. 3.

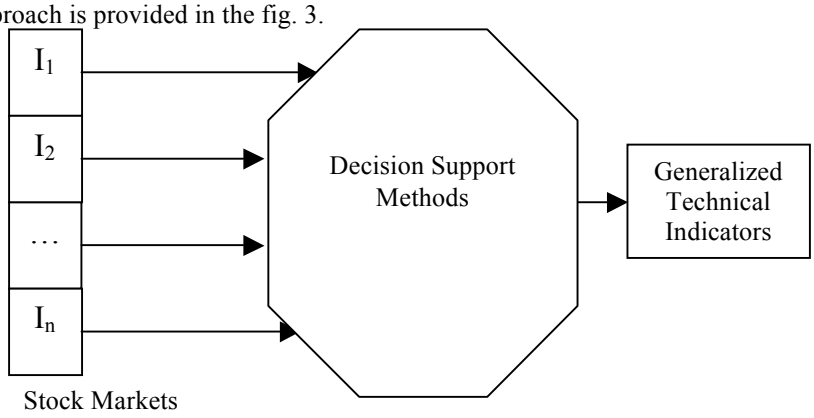

Fig. 3. The scheme of operational monitoring on the basis of methods of decision support

It is obvious that using of such scheme considerably will raise the loading of computer enterprise capacities, however when using the principles of overlapping the problem with carrying out simultaneous handling of big data

array can be bypassed. The implementation of high-productive calculations in the analysis of an exchange environment, will allow to increase information awareness of both direct bidders, and the companies whose activities only indirectly concern this sphere of economic activity.

The following step to development of an effective algorithm of monitoring is transposition of realities of the exchange biddings on methods of multicriteria optimization. Usually it is considered that the best alternative is that most of which fully meets some entry conditions. In mathematical terms these conditions quite often manage to be expressed to some numerical function set on a great number of X as maximization (or minimization). However, in more difficult situations it is necessary to deal not with one, and directly several functions of this sort [9].

As a rule, set a set of the numerical F1, F2 functions … Fm, $m \geq 2$, the possible solutions of X determined on a set. Depending on content of a task of the choice these functions refer to as optimality criterions, criteria of efficiency or criterion functions. In our case it will be criterion functions. The purpose of our calculations were sorting of the received values from maximum to minimum that allow to reveal the stablest and unstable stock market participants.

The numerical f1, f2, … fm functions stated above form vector criterion

$$F = (F_1, F_2, \ldots F_m), \quad (1)$$

which accepts values in space of m-dimensional vectors of Rm. This space is called criteria space or space of estimates, and any F (x) value = (F1(x), F2(x),…, Fm(x)) ∈ refer to as Rm of vector criterion of F in case of certain x ∈X vector assessment of an alternative x. In the case under consideration infinite number of possible vectors (decisions) finding of a great number of Pareto by direct search is impossible in principle. Therefore, the special tools facilitating process of creation of this set are required. Necessary and/or sufficient conditions of a pareto-optimality can serve as such tools [10].

The considered situation is quite similar to that which exists in the regular theory of extreme tasks: by means of necessary conditions the set of decisions (vectors) is allocated, from the received set it is possible to select those decisions (vectors) which really are pareto-optimal.

For determination of optimum alternatives in our case there is mxn matrix where m – quantity of the considered alternatives, and n – criteria by which they are compared is under construction. So, in the fig. 4 it is possible to see an approximate type of the similar design including X1 alternatives … Xm and a set of criteria of Y1 … Yn which accept certain values for each of the considered alternatives. It is obvious that the task of finding of criterion function when using several technical indicators is multicriteria. For carrying out ranging in such tasks often use scalarization methods. As criterion function

of a task of multicriteria optimization has vector values, it is turned into function with scalar value.

*	Y_1	Y_2	…	Y_n
X_1	Y_{11}	Y_{21}	…	Y_{n1}
X_2	Y_{12}	Y_{22}	…	Y_{n2}
…	…	…	…	…
X_m	Y_{1m}	Y_{2m}	…	Y_{nm}

Fig. 4. A matrix of the offered alternatives

Thus, the task of multicriteria optimization comes down to an optimization task with one criterion function:

$$G_i \quad \sum_{i=0}^{n} Y_{ji} * W_j \tag{2}$$

Where Y_{ji}– all this set of the considered criteria, and the W_j-massif of the set weight coefficients. In the simplest couples all elements are equal among themselves and equal 1/n, however each expert can independently mark out the most adequate criteria from the point of view.

In case of the correct matching of criteria we have an opportunity to sort, compare and break alternatives into categories, as is a necessary condition for creation of the generalized mathematical indicators. For a change prediction (or preserving) tendencies special technical indicators, oscillators whose value specifies an overbought or an oversold of a certain asset [11] are used. Let's consider some of them:

The stochastic oscillator is an indicator which shows the attitude of current price of closing to a maximum/minimum for the established period. The most widespread and classical formula of calculation Stochastic is following:

$$Y_i \quad 100 * \frac{C_0 \quad \min(L_n)}{\max(H_n) \quad \min(L_n)} \tag{3}$$

where max(Hn) – a maximum price for period n, min(Ln) - minimum price for the period n, C0 - closing price of a current period.

The index of the relative force (RSI) - compares the size of rises in asset price to the size of its falls lately and provides this information in the form of the number which is in the range from 0 to 100 [12].

It is necessary to remember that RSI is calculated proceeding from the price of one asset.

$$Y_2 \quad 100 \quad \frac{100}{1 + RS} \tag{4}$$

$$RS \quad \frac{CU}{CD} \tag{5}$$

where

CU(n) - average value of the positive changes in price of closing;

CD(n) - average value of the negative changes in price of closing;

One of the simplest and effective oscillators is the moment Indicator. Momentum shows with what speed (speed) the prices change.

The indicator of the moment is calculated by a formula:

$$Y_3 \quad 100 * \frac{C}{C_n} \tag{6}$$

where:

C — closing price of a current period.

Cn — closing price N periods back.

Apparently from the provided examples, each of oscillators has the, unique method of calculation and the received result appears within certain borders. In case of approach to these borders, the market for the considered share is considered bought up or resold. From here a conclusion follows that for calculation of criterion function for each security, it is necessary to use normalized criteria and to consider not absolute value of oscillators, but their module [13]. It must be done for finding of extreme (extreme) values of criterion function in case of which the tendency turn is the most probable. At the same time the minimum values of criterion function will be specified the stablest elements of the stock market.

Thus, in the elementary case function of an optimality i-go of an element will take a form:

$$G_i \quad Y_{i1} * W_1 + Y_{i1} * W_2 + Y_{i2} * W_3 \tag{7}$$

where W1=W2=W3 = 0,33.

The general scheme of the algorithm used when sorting exchange data is presented in fig.5.

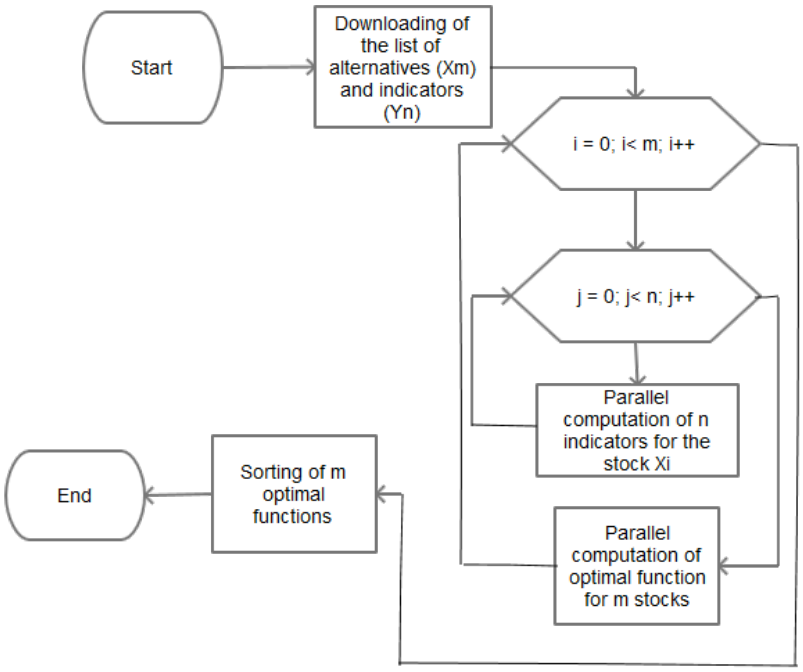

Fig. 5. Algorithm of parallel handling of exchange data

Each stage, except sorting of functions of an optimality (because of performing mathematical transactions over single and indivisible data array) represents multiline handling of the same information, as is a basis for using of parallel calculations. Splitting alternatives and the indicators relating to them into separate groups will allow to accelerate considerably accomplishment of mathematical transactions, as leads to the acceleration of work of an algorithm [13].

Thus, after sorting of the functions of an optimality constructed on the basis of oscillators, instead of a usual set of shares we receive the ordered set of elements. The more the amount of the calculated function is, less is the stable element of the stock market and the chance that the current price tendency will be replaced with opposite is higher. This information can be used for forming of effective investment strategy or, based on her, to make other administrative decisions which require carrying out the comprehensive analysis of an economic situation.

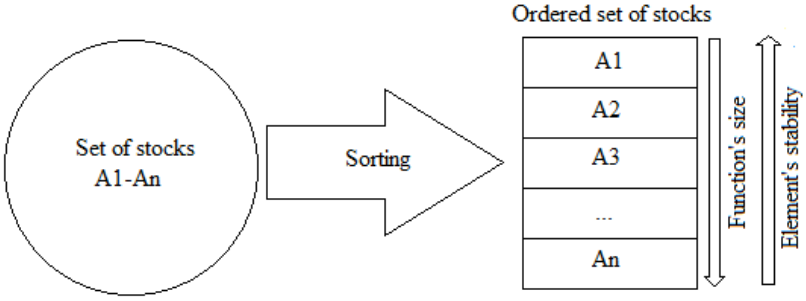

Fig. 6. Ordering of a set of actions in the stock market.

Thus, it is possible to claim that the problems connected with data processing of the stock market can be solved by means of the methodology based on using of the principles of mathematical decision support. Besides, considering uniformity of the provided tasks, such as calculation of oscillators on a certain array of information, it is fair to draw a conclusion on efficiency of application in calculations of technology of the distributed calculations. The complex using of these two approaches will allow to calculate the generalized indicators of the stock market in real time and to draw conclusions about a condition of an exchange environment at this specific moment.

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