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IPO—The Pattern of Hierarchy with a Variety of Alternatives upon Criteria

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***Abstract*—A book is dedicated to the discussion about the ways to find solutions for the questions and closely related questions of IPO's strategy as the pattern of hierarchy with a variety of alternatives upon criteria. Fundamentally, this book consists of a systematic introducing to the theory of relative value of criteria, and this theory had been developing the author during the period of a couple of decades. In the book, there is the axiomatic methodology of presenting is utilized. This methodology is the type of method where previously the set of requirements, named axiom, is formed which then are associated with the group of tasks being under consideration.**

Keywords—IPO; decision-making strategy; multiple-choice; changing of the alternatives; hierarchy analysis

I. INTRODUCTION

The transformation of the economic system of the Russian Federation into the market economy caused escalating difficulties in raising capital within the industry sector in order to strengthen the capability and to maximize profit. Therefore, the need for determining the strategies of augmentation of the funds by attracting third-party investors appeared. The strategy of initial public offering (IPO) is a strategy of raising funds through the enterprise entry into the world financial market; in other words, a company turns into a public enterprise, which gains additional funding by the means of publishing shares on the stock exchange or several of them [35]. The key aspect of successfully implementing this strategy is the legitimacy of the open financial and economic activity of a company. The domestic enterprises experience difficulties in finding a decision about realizing the strategy of IPO [21]. The general approach for the implementing this method could be considered as a model including further steps: firstly, the preliminary analysis of implementation the strategy of the initial public offering; secondly, defining the alternative options of the strategy and the key criteria of the selection; thirdly, collecting the quantitative data and generating the model of mathematical modeling; then mathematical process of the gathering data [25], [26]. The implementing of the IPO as a decision-making approach could be considered as the appearing approach. This kind of approach is included into the dynamic category, due to the fact that it requires constant repeating of the decision making in various time intervals, consequently, the character of its integration could be considered as regular. There are several options exist which could be used for finding the way to make a decision about realizing the initial public offering strategy [30]. In order to achieve success, the indispensable condition is to define the most suitable alternative. The target of IPO is considered as the non-trivial method due to the fact that it consists of several criteria of decisions making process [24]; thus, to decide the method is based on type of gathered information, particularly, the information which illustrates the preferences founded on multi-criteria and multiple-choice in the condition of uncertainty ("Fig. 1")[32], [34].

Choice of the alternatives relying on two criteria:

- The case of the sustained field of alternative;
- The case of discrete alternative.

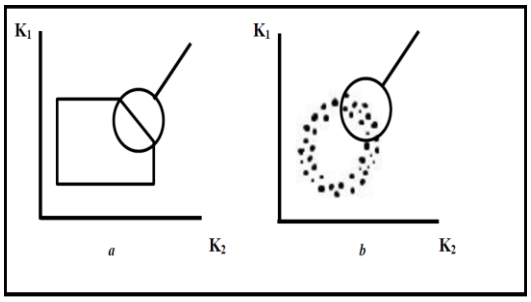

Fig. 1. Area of non-dominate effect.

II. ESTABLISHING THE MODIFICATION OF IPO DECISION MAKING: SCIENTIFIC APPROACH

The literature in this field shows several approaches, which are subsidiary in decision-making within the

conditions of multi-criteria. The further explanation explores this issue more extensively. The method of hierarchy analysis (MHA) is a method of separating the problems or targets into the elements of the lower level and assessing a person, which is officially assigned for the responsibility of decision-making. The method of hierarchy analysis (MHA) is graded by the feature of links among criteria and alternatives [27], [28]. There are two types of hierarchy, which are defined by the nature of the connectivity among the criteria and alternatives. The first type of hierarchy constitutes the pattern where each criterion has a connection with the particular alternatives and at the same time have the connection with every considering set of alternatives [16], [17]. In other words, this is the type of hierarchy which has a particular number of alternatives and the similar functioning of these alternatives within the group which is determined by criteria. Another type of hierarchy contains the criteria, which are linked to the alternatives, are not in connection with every other considering alternative. This is a type of hierarchy which includes the alternatives with the differences in the number and the diversity in functions of alternatives which are settled by certain criteria (1, 2). In accordance with this statement, the modification of the multicriteria choice upon hierarchy with a variety of number and structure of alternatives formed by criteria appears for practitioners in practice as the extremely beneficial for getting closer to the main target, particularly to the finding the most beneficial strategy in the initial public offering [24]. Considering the practical experience, there is the approach of the ranking of numerous of criteria and alternatives for finding the right solution, and these criteria and alternatives could be assessed by the expert review and evaluation as well as using the established standards and norms. An example of the hierarchy of decision-making strategy within the initial public offering field could be illustrated by the method where each criterion K_j out of the variation $\{K_1, K_2, \dots K_p\}$ includes the different number of alternatives out of the variation $\{A_1, A_2, \dots A_i\}$. Alternatives "A_r" are estimated accordingly the criteria K_p. The pattern of hierarchy with a variety of alternatives upon criteria is illustrated in "Fig. 2", where part "a" is synthesis and part "b" is decomposition.

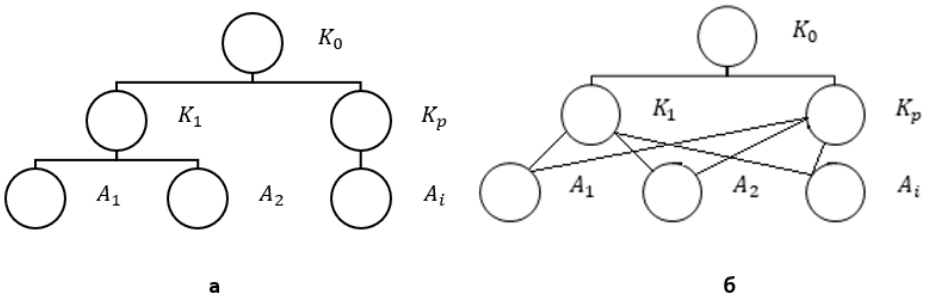

Fig. 2. The pattern of hierarchy with a variety of alternatives upon criteria.

In the case when the hierarchy has one level, there could be emphasized the methodology of identifying the vector of prioritized alternatives combined by the focus relying on the value of the criteria and the number of alternatives of the criteria. This methodology implies the completing of the series of particular procedures in order to frame the information for conducting the estimation [26]. The implementation of this methodology for meeting the challenge in IPO consists of several stages. It is essential to make the initial step which is to structure the task in the hierarchy which defines the interconnection among the multiplicity of comparing alternatives $\{A_1, A_2, \dots A_i\}$ and multiplicity of criteria $\{K_1, K_2, \dots K_p\}$. Criteria and alternatives for the compilation of the hierarchy of initial public offers are taxons.

The further step includes the formation of a binary matrix based on the hierarchical structure [B] establishing the accordance among the alternatives and criteria. The matrix [B] consists of the components $b_{ij}=\{0,1\}$. With the conditions of the conduction of measurement in a way where the estimation of alternative A_i is made upon criteria K_j, the element $b_{ij}=1$; otherwise the element $b_{ij}=0$. The following stage is to conduct the expert estimation of alternatives according to the suitable set of criteria. In order to achieve this aim, the method of doubled-paired comparison, the method of comparison of relative standards, or the method of replication. Taking as a basis the expert assessing results, which relying on matrix [B], the matrix [A] is built reflecting the model what is illustrated in the following matrix [22], [25].

$$[A] = \begin{array}{c|cccc} & K_1 & K_2 & \dots & K_p \\ A_1 & a_{11} & a_{12} & \dots & a_{1p} \\ A_2 & a_{21} & a_{22} & \dots & a_{2p} \\ \dots & \dots & \dots & \dots & \dots \\ A_i & a_{i1} & a_{i2} & \dots & a_{ip} \end{array}$$

Matrix [A].

The matrix [A] comprises the components of expert judgment {aip} are represented by vectors of alternatives priority regarding the criteria Kp. If the alternative Ai is not evaluated according to the criteria Kp, the matrix [A] has the meaning of aip= 0. The vectors of the considering matrix have various AIP meanings, therefore, they could be classified as nominalized or non-nominalized depending on the applied method of alternatives comparison. The determination of the category of the vector of prioritized criteria $\bar{Y}$ is the result of the doubled-paired comparison of the Kp criteria. In this case, the criteria G and S are generated named structural criteria, which are reflected in the relevant diagonal matrix [G] and [S]. The matrix [G] has the pattern illustrated in the following matrix.

$$[G] = \begin{bmatrix} E_1 & E_2 & \dots & E_p \\ \left(\sum_{i=1}^{r} a_{i_1}\right)^{-1} & 0 & \dots & 0 \\ 0 & \left(\sum_{i=1}^{r} a_{i_2}\right) & \dots & 0 \\ \dots & \dots & \dots & \dots \\ 0 & 0 & \dots & \left(\sum_{i=1}^{r} a_{i_p}\right) \end{bmatrix}$$

Matrix [G].

The normalizing of the vectors of priority alternatives forming the matrix [A] is ensured by means of matrix [G] if the matrix [A] is completed by the method of comparison regarding standards or coping regardless the preliminary normalizing. The matrix [S] has the pattern shown in the following matrix.

$$[S] = \begin{bmatrix} E_1 & E_2 & \dots & E_p \\ Q_1 / N & 0 & \dots & 0 \\ 0 & Q_2 / N & \dots & 0 \\ 0 & 0 & \dots & 0 \\ 0 & 0 & \dots & Q_p / N \end{bmatrix}$$

Matrix [S].

The element Qp is the number of alternatives Ai which is placed regarding the criteria Kp,

$N = \sum_{j=1}^{p} Q_j$ is the cumulative number of the alternatives referred to all criteria

The implementation of the structural criteria S allows practitioners to alter the weight of alternatives if there is a necessity for it. The changing of the alternatives could be made if they are linked to the relevant criteria according to the proportionate ratio: Qp/N. This proportion guarantees the increase of the value of the priority alternatives represented by the large groups, as well as ensures the decreasing of the priority of the group which has a relatively small number [25]. It could be explained in another way where the group is determined by the set of alternatives constituted by the "projection" of the criteria Kp. The necessity of the provided pattern of calculation is caused by the fact that the criteria appearing as "founders", which have the high priority in the hierarchy, can contain a large number of alternatives classified as "followers". However, the category of the criteria "founders" with a low level of priority has significantly less number of alternatives of the "follower" category [39]. The algorithm of determination the vectors of prioritized alternatives within hierarchy consisting of several directions. The example of the process of determining the vector of prioritized alternatives in the hierarchical structure of the initial public offering is illustrated in detail further. This includes several directions formed according to "Fig. 3".

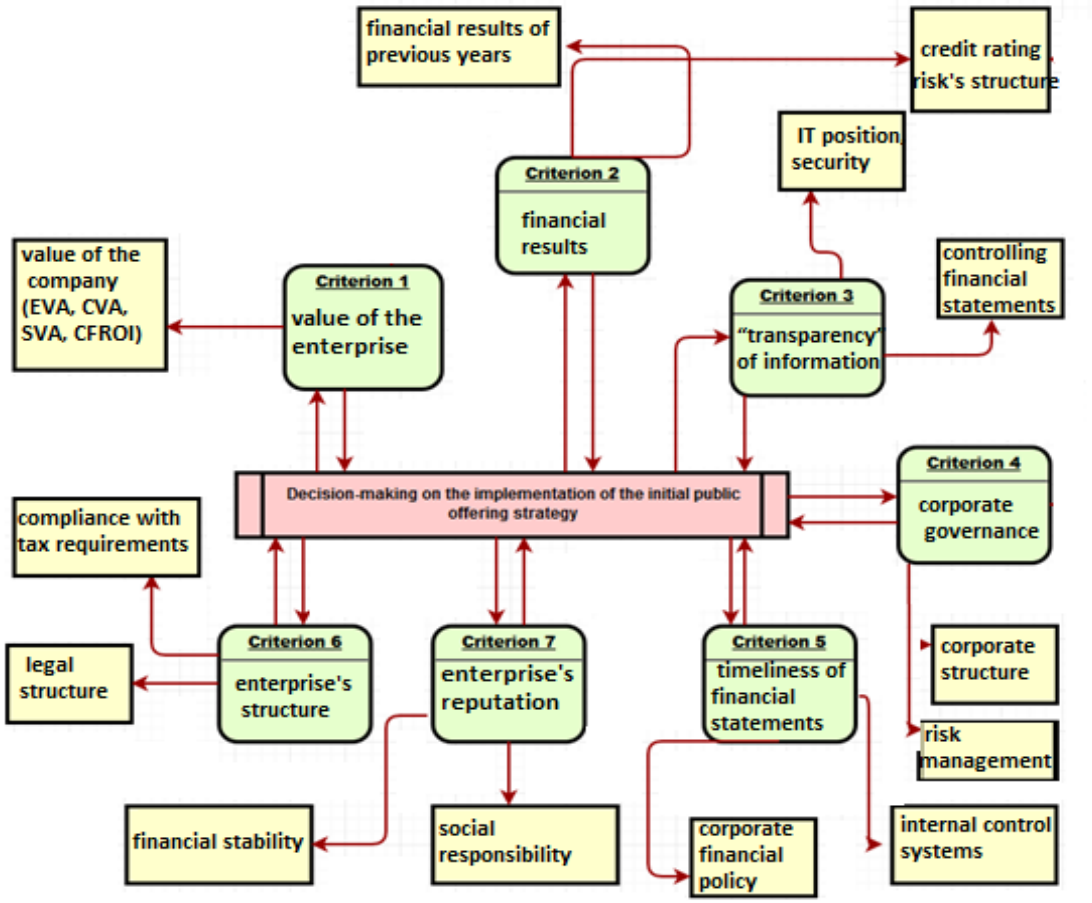

Fig. 3. The algorithm for hierarchy with several limbs.

The further scheme is the computations of the vectors of prioritized alternatives depending on criteria K_{ip}:

$$\begin{Bmatrix} W^A_{K_{11}} & W^A_{K_{12}} & \dots & W^A_{K_{1m}} \\ W^{A'}_{K_{21}} & W^{A'}_{K_{21}} & \dots & W^{A'}_{K_{2n}} \\ W^{A^n}_{K_{n1}} & W^{A^n}_{K_{n2}} & \dots & W^{A^n}_{K_{np}} \end{Bmatrix}$$

The next step is the construction of the matrix [Ai] where the rows are named regarding the alternatives and the columns are the criteria K_{ip}. The element "i" of the vectors of prioritized alternatives W^A_i (i = 1,r) is calculated according to criteria Ki. This is illustrated in the next model:

$$W^A_1 = [A_1][G_1][S_1]\overline{x_1}[B_1]$$
$$W^A_2 = [A_2][G_2][S_1]\overline{x_2}[B_2]$$
$$\dots\dots\dots\dots\dots$$
$$W^A_r = [A_r][G_r][S_r]\overline{x_r}[B_r]$$

The element $[G_i]$ is the matrix for rationing the matrix $[A_i]$; the element $[S_i]$ is a structured matrix for modification of the value of alternatives. The process of building the resulting matrix $[A_o]$ is depicted in the model: ("Table I")

TABLE I. THE PROCESS OF BUILDING THE RESULTING MATRIX $[A_o]$

$[A_0] =$

	K_1	K_2	…	K_r
A_1 A_2 … A_m	W^A_1	0	…	0
A'_1 A'_2 … A'_s	0	W^A_2	…	0
A'' A''_2 … A''_t	0	0	…	W^A_r

In this model the rows are represented by all considering alternatives ($\{A_i\}$, i=1,t; $\{A'i\}, i = 1, s$; $\{A''i\}, i = 1, t$); the columns are the criteria K_p. The result is the matrix $[A_o]$.

This research paper is based on the information relating to the companies of the Russian Federation which are intended to implement the strategy of the initial public offer. Taking into account the challenges of collecting the data from earlier periods, the period included in this research is one year before applying IPO for preliminary IPO measure of the traditional performance [23], [37]. Therefore, the initial data gathered for twelve Russian enterprises which include the meaning of vectors of alternatives during the estimation of them regarding the explained criteria of the one-year period before starting IPO and the one-year period after implementation the strategy of IPO.

The further calculation needs to be continued with computing the right site vector of the doubled-paired comparison matrix. Within this process, the experts answered the questions related to defining the alternatives, which have higher impact, and to what extent is this impact when the strategy of the company's entry into the global market is realized.

The subsequent step after assessing is to conduct hierarchical synthesis resulting in the determination of the integral vector of alternative priorities regarding the relative focus of hierarchy [35], [38]. For considered matrix the integral vector is:

$$W = \{0{,}5\ \ 0{,}6\ \ 0{,}5\ 0{,}5\ \ 0{,}2\ \ 8{,}2\}$$

The analysis of this vector allows providing the conclusion where there most suitable alternative is A_7 only if it has the index 8,2 conventional units, what, thereby, specifies the most valuable alternatives, which is the cost of the enterprise, where the indicators are: EVA, CVA, SVA, CFROI [20]. There are several issues need to be solved during the process of forming the matrix of the alternative priorities significations within the estimation procedure according to their criteria. The first question is relates to the selection of prioritized criteria for comparison; the anther question is what category of functioning could influence the company's strategy for making the decision about entering into the stock market.

III. CONCLUSION

The success of the selected solution within multi-criteria conditions relating to applying the IPO requires utilizing the diversity of information about the cost of the company. In this case, the most valuable criteria for the assessment of the efficiency of the company's cost are EVA, CVA, SVA, CFROI. The element EVA means the short-term perspective, specifically the period of the cycle reporting, where the profit of accounting, consisting of more than 150 variants, serves as the basis for calculation. The accounting profit is characterized by an overstatement of the indicators, therefore, the alternative of decision-making regarding this characteristic appears as the mistaken for practitioner form the beginning. The next element named CVA is the short-term and long-term perspective where the basis for calculation is the time of the payback period for investments. The other two components, which are SVA and CFROI, similarly to CVA are connected to the money flood, nevertheless, they have a difference in the duration of the forecasting (or estimation) and the area of implementation. There are several advantages, which are needed to be taken into consideration, appearing due to usage of the main criteria for estimating the cost of a company. These advantages are: it allows to determinate the type of funding and the amount of capital for reaching the necessary outcome; it allows closely monitor the spending on procedures for fundraising; it is could be implemented for the estimation of

investment attractiveness in general and also for the variety of separated directions of the company' activity.

The results of the model do not depend on the accounting policy of standards and norms established in a company. It is suitable for public companies as well as for the private sector of business. The expenditure on vocational education and training the employees during the implementation of this approach is extremely low. There is more accuracy of capitalization calculation of the net profit NOPAT based on the market information about the initial value of invested capital. The method provides certainty to some extent about the effectiveness of committed investments considering the uneven distribution of the amount of value added by years.

The computation of the money flows is conducted with regard to inflation; and the accountant reserve funds are eliminated from the computation, due to this, the manipulations with the indicators are infeasible; the amount of shareholders refunds is measured in percent rather than in monetary terms, what improves the process of comparison of the profitability among the companies.

One of the most important resources for this is the information about the relative values of the criteria. However, before starting learning how to identify and to utilize this information, there are several issues which are needed to be solved. The first one is highly important to understand what does mean the information about the relative values of the criteria. Also, the question, which could appear for specialists, which are recently involved in this area, is what the meaning of the meaning of criteria, or a group of criteria, is more valuable than other criteria, or a group of other criteria. Furthermore, being in the state of awareness of information about the relative value of the criteria, how this information can make a contribution to the process of making a decision. An additional question is: whether there are the principles of building the border for using the set of similar random questions and the questions about decision-making strategy. A book is dedicated to the discussion about the ways to find solutions for these questions and closely related questions. Fundamentally, this book consists of a systematic introducing to the theory of relative value of criteria, and this theory had been developing the author during the period of a couple of decades. In the book, there is the axiomatic methodology of presenting is utilized. This methodology is the type of method where previously the set of requirements, named axiom, is formed which then are associated with the group of tasks being under consideration. Moreover, the core concepts are rigorously determined and the results are formed in the theorem, which is substantiated by applying the applicable mathematics tools.

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