International Business Management 10 (21): 5121-5124, 2016
ISSN: 1993-5250
© Medwell Journals, 2016

Multi-Criteria Decision Making in Economy and Preferred Alternatives Selection

[1]G.S. Klychyova, [2]V.P. Kuznetsov, [2]D.N. Lapayev, [3]O.N. Lapayeva and [3]F.N. Avchadiev
[1]Institute of Management, Economics and Finance, Kazan Federal University,
Kazan State Agrarian University, 420015 Kazan, Russia
[2]Kozma Minin Nizhny Novgorod State Pedagogical University,
603950 Nizhny Novgorod, Russia
[3]Kazan State Agrarian University, 420015 Kazan, Russia

Abstract: The study considers methodological aspects and tools of decision-making in the economy by the aggregated indicators. It has outlined the main problems which occur by the implementation of multi-criteria optimization. The authorial methods of the effective plurality formation and the preferred alternatives definition have been formulated.

Key words: Multi-criteria optimization, decision-making, effective set, the preferred alternative, the party concerned, economic forecasting, public management, corporate governance

INTRODUCTION

In many countries, public administration reforms are carried out in the mainstream of the New Public Management (or in short-NPM). NPM requires the adaptive transfer of advanced business management techniques into the public sector of economy (Arvane *et al*., 2013).

One common problem is in the way both of the NPM introduction and the optimization of bureaucratic organization and is coupled with the objective performance assessment. The tools which are contractual in their nature as well as the improved regulations and rules of bureaucratic organization, contain performance criteria in an explicit or latent form (in the form of contracts, regulations or rules of operation). The interpretation of economic and other objectives and criteria authenticity, the adequacy of their performance actions reveals the bureaucracy quality.

MATERIALS AND METHODS

Theoretical substantiation of the issue: The proper enforcement of laws and rules serves as a primary criterion of performance in the traditional system as they reflect the public need. However, the laws often allow a broad variation of definite actions including those which are lucrative to the managers but not to the society. Formation of the law of direct action, specified procedures and rules, coordinated with the priorities is a prerequisite for economic usefulness improving. Similarly, the terms of contracts within the NPM scope specified not quite clearly cannot guarantee the desired results. Detailing and specification of tasks and conditions of their implementation is a key feature of the progress towards management by the results, whether in the traditional bureaucratic model or in the NPM Model.

A major challenge in the field of the corporate governance is the competitiveness of economic entities in the context of global challenges and threats provision. Settlement of this problem requires introduction of complex changes in the elements of the internal environment of the corporation, optimization of a wide variety of criteria, the proper correction of organizational and administrative documents regulating the operation and development of the control system.

The effective management decision-making problem is the cornerstone for all countries and its importance increases with the transition of economy to a new way due to the massive increase in costs for complex projects, programs, activities implementation in the various spheres of activity as well as due to limited resources. The term “alternative” in economics brings together a wide range of objects ranging from business units, business processes, functions, enterprises and organizations and if we go further, sectors of economic activity, regions, federal districts and ending up with the state as a whole. The alternatives are also understood as investment projects implemented by various economic entities (Glebova and Mirsaitova, 2015).

Corresponding Author: G.S. Klychyova, Institute of Management, Economics and Finance, Kazan Federal University, Kazan State Agrarian University, 420015 Kazan, Russia

In practice, we usually distinguish between the analyses of one or several alternatives. In the first case, we are talking about of a certain single object performances with some pivotal values. The latter can be: information of the previous years, the average values potentially achievable or maximum permissible levels and so on. In the second case, a joint analysis of alternatives set is understood as a benchmarking.

Several interested parties (stakeholders) are usually involved in the current economic conditions of projects, programs and other activities implementation. The main stakeholders are public authorities, owners, managers, investors, creditors, employees, suppliers, customers, industry enterprises, in-infrastructure companies and so on.

The scientific and economic literature usually distinguishes one-criterion from the multi-criteria problems. In the first case, the alternatives are described by a single performance indicator. The use of multiple indicators is intended to provide a multidimensional assessment. However, the aggregate figures significantly complicate benchmarking of alternatives. This is explained by the presence of conflicting indicators, i.e., their use fails to focus an aggregate result. Improvement of one of the indicators leads to deterioration of other ones and the optimum for each of them is achieved at various points. This fact introduces an uncertainty into the selection process. To solve these problems, it is necessary to use the relevant principles of multi-criteria optimization (Burganova *et al*., 2014).

There are also retrospective, current and future challenges (Gupta and Krishnan, 1999). The economy applies both formalized and expert methods of forecasting in their complex. We distinguish individual and collective expert methods. The extrapolation, correlation-regression and adaptive methods belong to the formalized ones. Recently forecasting, based on neural networks and genetic algorithms has received its significant development. The analysis of planned and forecast values allow, if necessary, to reach the adoption of specific management decisions.

We distinguish three types of tasks for comparative evaluation of options by the indicators plurality: the selection of a single object, forming a certain combination and the study of all the alternatives (Mahoney, 1992). Traditionally, the first type is considered to be the mainas the identification and application of advanced economic results is relevant at all stages of social development regardless of their form of ownershipand should cover all levels of the hierarchy in the economy. In multi-criteria formulation and in the presence of criteria contradictions the clear choice is rather hard (Kuznetsov *et al*., 2015).

The ultimate goal of the second type problems consists in the formation of a set of objects. This situation occurs when you need to disperse the resource between several alternatives. As a rule, the limitation of the number of alternatives is contained in an implicit form, i.e. is expressed in terms of resources limiting, the financial for example. Often there is a third statement-the analysis of all alternatives. It is coordinates with the national economic approach In economic studies. This type of tasks is characteristic of the cases when the alternatives have a common owner or a corporate management.

RESULTS AND DISCUSSION

In case the aggregated indicators are applied, the principle of domination will give the unique solution. However, it is not always implemented in practiceand in this case the Pareto principle is used. According to the latter, a set of effective alternatives is formed not dominated by any other ones. The article offers the effective solutions determination technique for the analysis of multi-criteria problems. It consists in a stepwise selection of effective options possessing optimal values and formation of tolerance regions. The technique includes the following steps: the initial set of comparable options (alternatives) is prescribed: $S = \{S_i\}$, $i = 1, I$. Sampled and calculated are the parameters $K = \{K_j\}$, $j = 1, J$ for each alternative. The preferred direction of change and the initial areas of permissible values are specified.

Determined are the effective options for each indicator in the first stage of analysis Sj_{opt1}. The index means the serial number of the analysis stage (iteration). The alternative $S1_{opt1}$ having optimum value of the indicator K_1 will be the first to be included into the effective solution. The second will be the alternative $S2_{opt1}$, characterized by an optimal value of the indicator K_2, etc. The stage will be completed by the alternative SJ_{opt1}, having the optimum value indicator K_J. The cases of dominance are quite rare, especially when using many criteria, so usually additional analysis is required.

The range of permissible values of the indicators is formed in the first stage of PVA_1 analysis. For this, we pre-allocate the dominated areas with respect to all effective Sj_{opt1} options.

Then the range of permissible values of indicators is formed by the exclusion of the dominated areas from the original area.

Check of S_i options is conducted for their belonging to the tolerance region. Alternatives included in the resulting area are subject to further analysis. The stages 2-4 actions are conducted. The only difference is that

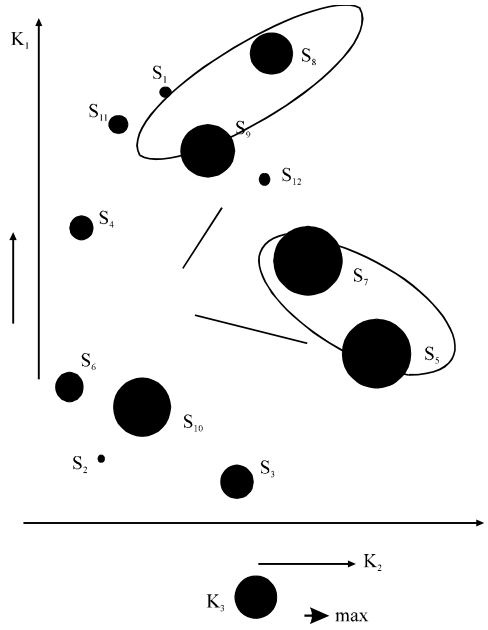

Fig. 1: Effective alternatives determination

the optimal values of K_j are determined among the non-dominated alternatives obtained in the previous iteration. This stage is considered completed, when at a certain iteration t = T less than two alternatives remain in the TR_T area. The effective solution is formed by uniting of effective alternatives identified at all stages of the analysis:

$$M_{ef} = \{S1_t, S2_t, \ldots, SJ_t\} = \overline{1,T}$$

Check of effective options is conducted for com pliance with the a priori requirements put forward by the party conducting the analysis. In case of identified differences, we adjust indicators and repeat the calculation. Let us consider the example of the technique realization. The background information by the options S_1-S_{12} is shown on the Fig. 1. Hereinafter, the preferred directions of indicators change are shown by arrows. The value of the K_3 indicator corresponds to the diameter of the circle.

We separate the effective options S_8, S_5 S_7, having optimal values of indicators (in bold type) and form dominated areas. The first area includes options S_1-S_4, S_6, S_{11} and S_{12}, the second and third areas-options S_2, S_3, S_6 and S_{10}. The range is concluded by an alternative S_9 (in bold type). Thus, the effective set will be as follows $M_{ef} = \{S_5, S_7, S_8, S_9\}$.

For the more detailed comparative evaluation of options we offer multi-criteria technique of preferred alternatives selection. The technique involves initial determination of pivotal options with optimal values of indicatorsand the subsequent formation in their respect of the acceptable alternative sets, the transition to which is accompanied by improvement in other indicators. Then, we get a joint solution by the partial sets intersection and isolate the only option by analogy with the previous stages (Lynn *et al*., 2009). The technique includes the following steps: the initial set of comparable options (alternatives) is proscribed $S = \{S_i\}$, i = 1, I. The indicators $K = \{K_j\}$, j = 1, J for all alternatives are selected and calculated. The preferred direction of change and the initial tolerance regions are specified.

Pivotal alternatives are defined for each indicator. The first pivotal alternative shall be the variant having the optimum value of the indicator K_1. The second pivotal alternative shall be the option characterized by an optimal value of the indicator K_2, etc. The final pivotal alternative shall be an option having the optimal value of the indicator K_J. With respect to each pivotal alternative we form a set of acceptable options M_i, the transition to which is accompanied by the improvement of other indicators. This set will be represented by the most pivotal alternative, in case this transition is impossible.

A joint decision M_Σ is determined by the intersection of acceptable sets M_i. The solution may contain one or several alternatives. In some cases the acceptable sets are mutually disjoint, i.e., the criteria contradictions are essential. There should be applied the main indicator selection technique. The final stage will need the selection of the only alternative to M_{opt} from the M_Σ under the paragraphs 2-4. Check of the best alternative is conducted for compliance with the a priori requirements set forth by the party conducting the analysis. In case the differences are detected, the indicators adjustment is conducted and the calculation is repeated.

Here is an example of the technique implementation. The background information on the options S_1-S_{12} is shown in Fig. 2. The data is presented in the Table 1 and 2 for convenient analysis. We separate the pivotal options S_8, S_5, S_7 having optimal values of indicators (in bold type).

With the improvement of the second in dicator we can move from the S_8 alternative on to the options S_5 and S_7 and with the improvement of the third-to S_5, S_7, S_9 and S_{10}. Then the set of the acceptable alternatives will be in the form $M_8 = \{S_5, S_7\}$.

With the improvement of the first indicator we can move from the S_5 alternative on to the options S_1, S_4, S_7 S_9, S_{11} and S_{12} and with the improvement of the third-to S_7. Then the set of the acceptable alternatives will be in the form $M_5 = \{S_7\}$.

Table 1: Analyzed options presented by the increase of the effectiveness

Indicators	Compared alternatives											
K_1	S_3	S_2	S_{10}	S_6	S_5	S_7	S_4	S_{12}	S_9	S_{11}	S_1	S_8
K_2	S_6	S_4	S_2	S_{11}	S_{10}	S_1	S_9	S_3	S_{12}	S_8	S_7	S_5
K_3	S_2	S_1	S_{12}	S_{11}	S_4	S_6	S_3	S_8	S_9	S_{10}	S_5	S_7

Table 2: Analyzed options presented by the increase of the effectiveness

Indicators	Compared alternatives											
K_1	S_3	S_2	S_{10}	S_6	S_5	S_7	S_4	S_{12}	S_9	S_{11}	S_1	S_8
K_2	S_6	S_4	S_2	S_{11}	S_{10}	S_1	S_9	S_3	S_{12}	S_8	S_7	S_5
K_3	S_2	S_1	S_{12}	S_{11}	S_4	S_6	S_3	S_8	S_9	S_{10}	S_5	S_7

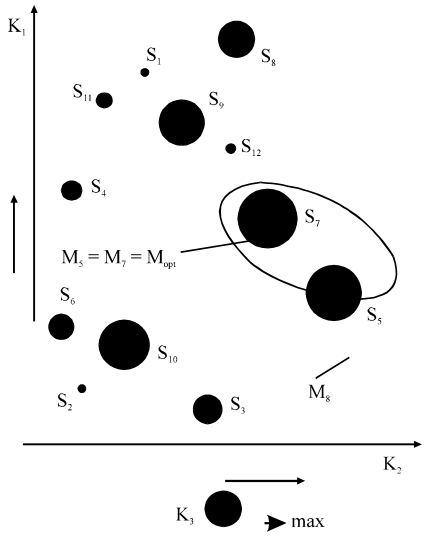

Fig. 2: The best alternative determination

With the improvement of the first indicator we can move from the S_7 alternative on to the options S_1, S_4, S_8, S_9, S_{11} and S_{12}. Thus, the set of the acceptable alternatives will be in the form $M_7 = \{S_7\}$. We formulate the unique solution by way of the acceptable set intersection $I_{opt} = \{S_7\}$ (underlined).

CONCLUSION

Decision-making in the economy is a complex and multi-criteria task which requires systematic accounting of factors combination for its successful research. In particular, the number of the contents of the analyzed alternatives and the used criteria is essential as well as the interests of various parties, the number of hierarchical levels, need to forecast certain parameters, the requirements to the format of the final result and so forth. If the ultimate goal is in shaping of certain set of options, then one should focus on the selection of the Pareto set technique. It consists in stepwise search of effective alternatives, characterized by optimal value of their indicators and building of tolerance range.

For determining of the best option, one may use the search of the preferred alternatives technique. The algorithm prescribes a preliminary determination of pivotal options and further elaboration of the acceptable alternatives sets in their respect, the transition to which is accompanied by the other indicators improvement. Then, the general solution is elaborated by private sets intersecting and the unique option is received by the analogy with the previous stages.

REFERENCES

Arvane, V.G., T. Gal, A. Nabradi, Z. Csapo and K. Peto, 2013. Innovative training methods in business higher education. Apstract Appl. Stud. Agr Bus. Commerce, 7: 75-79.

Burganova, R.A., V.V. Novak and M.F. Salahieva, 2014. Analysis of uing capital asset pricing model for assessing companies return. Mediterr. J. Soc. Sci., 5: 246-250.

Glebova, I.S. and A.A. Mirsaitova, 2015. The analysis of indicators of information illumination of capital cities in mass media as a factor of their appeal. Mediterr. J. Soc. Sci., 6: 289-293.

Gupta, S. and V. Krishnan, 1999. Integrated component and supplier selection for a product family. Prod. Oper. Manage., 8: 163-181.

Kuznetsov, V.P., E.V. Romanovskaya, A.M. Vazyansky and G.S. Klychova, 2015. Internal enterprise development strategy. Mediter. J. Soc. Sci., 6: 444-447.

Lynn, G.S., J.G. Morone and A.S. Paulson, 2009. Marketing and dcoinous innovation: The probe and learn process. California Manage. Rev., 38: 8-37.

Mahoney, J.T., 1992. The choice of organizational form: Vertical financial ownership versus other methods of vertical integration. Strategic Manage. J., 13: 559-584.