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RELIABILITY OF EXPERT'S GROUP EVALUATION AT MAKING DECISIONS

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Making decisions represents the very core of human conscious and purposeful activity. Decisions are taken by heads of states, public employees of any rank, businessmen and simple persons in their day-to-day activity.

The made decisions differ in their significance, contents, complexity, the area affected by the results of a decision and extent of responsibility for taking a sound decision.

It goes without saying that activity of businessmen implies the necessity of solving different complexities. Where to place trade outlets? Who is to be appointed to a vacant seat? Which goods should be purchased? These are only some of a great many of decisions to be taken by a businessman. At that many decisions are to be made over and over again under various circumstances. These are so called repeated decisions. Choice of goods and choice of a creditor are an example of such decisions. Apart from repeated decisions a businessman has also to make unique decisions the necessity of taking of which appears either once per life or very seldom.

In spite of a huge variety of problems that require taking a relevant decision, the process of decision-making can be brought to one knowingly simplified scheme. The person who makes a decision must, firstly, formulate possible variants of his actions, i.e. alternatives, and, secondly, choose the best one of them or to rank alternatives, i.e. arrange them in quality deterioration order.

Variety and richness of interests of a decision-maker (DM) makes him to evaluate alternatives by many criteria. But how to make the final choice among the alternatives in common? The problem here is that one alternative can exceed the other one by one criteria while yield by other criteria. It is exactly the moment when DM must show preference for one of variants, i.e. establish significance of criteria by some means or other. Quality coefficients of alternatives are defined both based on this information and with taking into consideration evaluation of each alternative by each criterion which, for its turn, allows either to select the

most preferable one of available alternatives or to rank them. Therefore evaluations of alternatives' quality which have been calculated using such an objective method turn out to be subjective ones that mirror DM's preferences.

Validity and a professional level of the decisions to be made determines eventually efficiency of operation of a company or a branch, and of a state on the whole. Choice of a sound decision is complicated to a considerable degree by the necessity of account at making managerial decisions relative to a great many of political, economical, social and moral issues. Most of all it is connected with need for collecting information required for making a decision. State-of-art information systems are of considerable assistance for a head in this respect. However possessing required information is a necessary but inadequate condition in itself for taking a true solution. The following analogy can be drawn here: having available merely all analyses, X-ray photographs, cardiograms, echograms and similar is insufficient for diagnosing and taking a sound decision about means and methods of treatment as doctor's knowledge and, as a rule, attracting several relevant medical experts in complicated cases is necessary here to solve the set problem.

Attracting various experts in different areas of knowledge is of crucial importance for taking indeed complex decisions. It is impossible for a single person, gifted as he may be, to be a real expert in many knowledge domains. But in order to make good use of experts' knowledge you must, in the first place, know which experts have to be invited, in the second place, which tasks have to be set for them, and, finally, how to employ their knowledge in the process of decision-making. Commissioning an expert with taking a decision will be a mistake. Making a decision is up to a judge, investigator, public prosecutor or head who has set the problem.

Let us further assume that you have managed to get required experts and obtain information needed for basing a decision. But according to the experts there will be a great number of interrelated factors that have an influence upon efficiency of a decision. Each expert knows only how the factors being exactly within his competence are interrelated. While interrelation of all factors relating to competence of different experts should be taken into account so as to take a correct decision. Such ties can run into ten or even more in case of a complicated problem (for instance, determining a direction for strategic development of a company). It must not be forgotten at the same time that a head taking a decision is an ordinary person with human-inherent psychophysiological limitations; in particular, he is capable of operating with a maximum of 7-9 objects simultaneously. So, where one has to look for the methods of resolving this contradiction? It can be resolved only on the grounds of application of strict mathematical methods used in modern computer decision-making support systems (DMSS).

Decision-making support systems are used more and more extensively by state organizations and private companies (U.S. NAVY, NASA, IBM, GENERAL MOTORS, and other). The results of applying DMSS in various areas are known, and the following ones can be mentioned among such areas: location of investment; at designing and producing military weaponry; in ecology; for distributing manufacturing resources; for driving transport facilities; for substantiating locating investments into high education system; for allocating labour resources. Here are some other tasks accomplished with the help of applying DMSS: substantiating directions of development of high education systems in the USA for the period of 1985-2000; selection of methods for household appliances' market penetration; assessment of appeal of the USA regions for collegians within the next 10 years; disposition of funds on measures intended to reduce banditism; assessment of envisaging further development in respect of alternative fuel for cars; choice of promising directions of informatization in the state. DMSS have been used recently in fields of small entrepot and medium business (for

example, choice of the place for trade outlets, choice of a nominee for a vacant seat and so on).

It seems expedient to divide DMSS into three classes depending on their applications and functional capabilities.

The first-class DMSS being the most powerful ones in terms of functionality are intended for application in top level state run public authorities (such as administration of president, supreme court, general prosecutor office, government) and regulatory bodies of major firms at working out complex purpose-oriented programs for substantiating decisions regarding inclusion of various political, social or economical measures into the program and allocating resources between them based on assessing their influence on achievement of primary target of a program. DMSS of this class represent multiuser computer systems the databases of which are created by many experts in different knowledge domains.

The first-class DMSS are single-user systems with the databases created by a direct user. These systems are designed for use by middle-rank public employees as well as heads of small and medium firms for the purpose of supporting making a decision in the situations when the subset of variants being more preferable to the rest of ones should be chosen from the given multitude of variants. The variants are evaluated by qualitative criteria, and each expert evaluates only a part of variants from the full multitude. The system can be employed when conducting contests for enhancing one or another work at the given total amount of financing, at selecting types of objects and so on.

Functional capabilities of DMSS of this class are as follows: choice by DM of the set of criteria from already prepared list of criteria and defining their significance using a paired-comparison method in mode of dialogue with the system; defining a relative degree of preferability of evaluations in mode of DM's dialogue with the system too; defining a degree of conformity of experts' opinions with regard to each variant; calculation of weight of variants with account of the data obtained from DM and results of experts' evaluation; provision of ordered information about the processing results.

The third-class DMSS represent single-user systems that adapt to experience of a user. They are designed for supporting making decisions on often encountered management problems (for example, choice of a crediting subject or a work performer, assignment to a position and so on). Such systems ensure finding a solution of the current task based on information on practical application of solutions of the same task that have been taken before.

Let us now use an example to consider some applications of DMSS. Let us suppose that you have faced a problem of selecting a tour for trip. The diversity of offers is really immense! Let us address our intellectual consultant, i.e. DMSS. It might turn out to be the only assistant here. At the outset it will propose you to formulate as a criteria those options of the tour that are of importance: transport conveniences, climate, beauty of surrounding nature, the offered entertainments, opportunity to become acquainted with cultural values, comfortability of a hotel room, prestigiousness of the tour and price. After that DMSS will present you all pairs of the above criteria and propose a question to answer relative to each pair "What is, in your opinion, crucial for taking a rest?" (for example, ''opportunity to become acquainted with cultural values'') or (for instance, "comfortability of a hotel room''). Your possible answers are: '"The first option is more important'', "The first option is less important'', "Both options are equally important''. In both cases DMSS will propose you to specify a degree of excellence (" slight", "usual", "strong", " overwhelming", and ''absolute''). DMSS will use the obtained comparison results to calculate an importance coefficient for the criteria. There exists also a more simple (but less accurate) procedure for evaluating importance of criteria:

DMSS will propose you to express your opinion on importance of each criterion by means of indicating a number within the range of, for instance, 1-100. Should possible tours be not many (not exceeding 7-9) DMSS will further propose you to compare these variants in pairs by each of qualitative criteria or enter a value of quantitative criterion (for instance, price). DMSS will employ this information to offer you the best variant.

In the considered example, significance of criteria was determined by experts or

DM.

Let us estimate the efficiency of using several experts for the comparatively simple case.

It is necessary to estimate some scale parameter, e.g. the best time for coming to the market with the definite production. Let us suggest that such optimal time to exists.

Having analysed the answers of "n" experts, we will get the time t1 based on the suggestion of the 1-st expert, time t2 based on the suggestion of the II-nd expert, time tn based on the suggestion of the n-th expert etc.

Let us suppose that $t1 = t0 + \Delta t1$, where $\Delta t1$ – the deviation from the optimal value given by the 1-st expert. It is a random value. It could be probably distributed with the dispersion defined by the expert's qualification.

Then we have:

$$t_1 = t_0 + \Delta t_1$$

$$t_2 = t_0 + \Delta t_2$$

$$t_i = t_0 + \Delta t_i$$

$$t_n = t_0 + \Delta t_n$$

Let us sum up the right and left sides :

$$\sum_{i=1}^{n} t_i = n\ t_0 + \sum_{i=1}^{n} \Delta t_i \qquad (1)$$

But after dividing to "n"

$$\frac{\sum_{i=1}^{n} t_i}{n} = t_0 + \sum_{i-1}^{n} \frac{\Delta\ t_i}{n} \qquad (2)$$

If the selected experts have approximately the same qualification, the dispersion of their mistake will be the same. But after dividing to "n" (as we see from (1)), we will have the sum of random values $\frac{\Delta t_i}{n}$ in the right side. The dispersion of the sum of these random values is known to be lower n2 times than the primary dispersion. Thus, the simple processing of experts' evaluation results will reduce mistakes and increase the efficiency of estimation.

If the mistake or the estimation is of the vector nature, then, the process of getting the error estimation will be more complicated. If it is necessary to make solution in case of existing

two different criteria, the situation will resemble one with the resulting vector. The random vectors are known to sum up as square root of squares sum and “the estimation dispersion will gain “n” times.

If the task of estimation becomes multicriterion, it is the same situation, when every expert’s estimation being the vector of its direction and the resulting vector being multicomponent in its nature, thus, the estimation of the efficiency of using the experts – specialists of different directions (everyone with his (her) criterion) always demands its own estimation.

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T.Hodakovska. Ekspertu grupas vērtējuma ticamība lēmumu pieņemšanā
Pieņemot sarežģītus lēmumus, ir nepieciešams iesaistīt darbā ekspertus - dažādu zināņu jomu speciālistus. Tomēr pastāv ļoti daudz savstarpēji saistīti faktori, kuri ietekmē lēmumu pieņemšanas efektivitāti. Pieņemtie lēmumi atšķiras ar savu nozīmīgumu, saturu, sarežģītību, rezultātu ietekmēs lauku un atbildības pakāpi par pareizu lēmumu pieņemšanu. Tāpēc ir nepieciešama nopietnu matemātisko metožu pielietošana, kura realizējas mūsdienu datoru sistēmās.

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Attracting various experts in different areas of knowledge is of crucial importance for taking indeed complex decisions. But according to the experts there will be a great number of interrelated factors that have an influence upon efficiency of a decision. Variety and richness of interests of a decision-maker (DM) makes him to evaluate alternatives by many criteria. It can be resolved only on the grounds of application of strict mathematical methods used in modern computer decision-making support systems (DMSS).

T.Ходаковская Достоверность групповой оценки экспертов при принятии решений
При принятии сложных решений необходимо привлекать экспертов- специалистов в различных областях знаний. Однако существует великое множество взаимосвязанных факторов, влияющих на эффективность решения. Принимаемые решения различаются значимостью, содержанием,сложностью,областью влияния результатов и степенью ответсвенности за принятие правильного решения. Поэтому необходимо применение строгих математических методов, воплощенных в современных компьютерных системах поддержки принятия решений(СППР).