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Collective expertise through the prism of network technologies

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Abstract

This article is dealing with the increasing of efficiency of collective expertise applying the important success obtained in the domain of computer technologies. The network technologies including Internet services save necessary time for applying many methods of collective expertise

The decision making is the most important process of our daily activity. Responsibilities involved in this process require effective methods and procedures. Collective expertise is one of the methods used in decision making process. Collective expertise represents a procedure of estimating the set of objects, called alternatives, by the group of persons, called experts, passing then to the processing of obtained estimations aiming to the selection of the best alternative. Each expert has his own opinion about the selection of alternatives and the mechanism of influence of generating the collective decision. These facts determine the procedure of obtaining the collective solution from individual ones.

Collective expertise includes three main figures called: the decision maker (DM), responsible for taking the decision, the expert (EX), involved in the process of alternatives estimation and the administrator (AD) responsible for the organization of entire process of collective expertise. These figures can be represented by one person or by the group of persons. Estimation processes are linked with decision making therefore expertise is made from initiative and for the necessities of DM.

The reason for application of expert methods consists in supposition that experts are capable to estimate truthfully the properties of objects

involved in process of expertise. Collective expertise is the complex method including some key stages [1]:

1) the creation of administration group, the obligations of which consist in organization of expertise process with the processing and analyzing the obtained information; 2) the formation of expert group: a) the selection of candidates and b) the assigning of competence to each expert; 3) the elaboration of attribute model; 4) the process of expert orientation something like "scaling alive apparatus"; 5) the estimation process; 6) the processing and analyzing expert estimations; 7) the elaboration of final document.

Each of enumerated stages represents by itself complex and independent procedures that are realized by numerous methods. We'll describe some methods concerning some stages revealed above. The aim of the description is to find the weak sides in application of collective expertise hoping to find those sides that permit the possible increase of efficiency applying advanced technologies in computer domain.

1 The formation of expert group

1.1 The selection of candidates

The creation of experts group can be realized by numerous methods [2]. We'll give some short descriptions of some of them:

- The "snowball" method. The essence of this method consists in the fact that one expert is revealed for the beginning proposing him to name the group of persons good enough to be included in the list of experts. Some experts are selected from this list on purpose to make the same thing: to name persons good enough to be included into the list of experts. This procedure is the iterative one. There are some possibilities to interrupt this procedure: a) procedure is finished when the first repetitions occur; b) the procedure is finished in the forced manner when the given number of experts is reached. After the procedure is finished the obtained group is included entirely in the list of experts or the selection from this group is made by the DM or by the AD.

- The documentation method. Some parameters of estimation the candidates are proposed on purpose to select the best from them. Such kind of parameters may be scientific degree, position, length of service and other. The selection of experts is done after the candidates have been estimated. This is something like a micro expertise.

- The test method. Some tests are prepared and proposed for estimation to the candidates. They estimate accordingly to their capabilities and they are selected accordingly to the results of estimation.

1.2 The assigning competence to experts

Other side concerning the experts and the politics of aggregation is presented by information characterizing experts, such information that will be used in procedures of processing the estimations. The parameter of competence is an important parameter of this kind. Expert competence is characterized by his previous experience, by his capabilities to face the estimation tasks, on the purpose to have more objective and thus more truthful estimations. Therefore the competence is the crystallization of 'public' opinion obtained in the process of some estimation activities. Some methods dealing with competence will be described:

- The reciprocal estimation method. The essence of this method consists in the fact that experts are engaged in reciprocal estimation of competence of each person from experts group. This estimation can be made either by ordering experts in dependence of their competence, or by assigning to each expert a numeric weight. After this estimation is completed, one may obtain by aggregation either the ordering of experts, or the numeric weight for each expert.

- The documentation method.

- The test method.

The essence of these methods was explained previously therefore we'll not consider them again.

2 The elaboration of attribute model

Another important side of expertise is presented by drawing in evidence the parameters of decisive importance for the given domain of expertise. This task can be fulfilled by the special group of persons. This may be independent group or a subgroup of experts group. It is natural that they must know very well the expertise domain to reveal its essential sides. The process of revealing the essential sides of expertise we'll call the attribute model definition of expertise domain. There are different methods of defining attribute model:

- The individual method, when each person responsible for the corresponding stage of the expertise proposes the own attribute model. As general attribute model the model obtained by the aggregation of individual models can be accepted.

- The collective method, when attribute model is revealed during one or many meetings.

The attribute model includes not only the revealing the essential parameters but also the defining of estimation types. The following types of scales will be revealed:

a) nominal scale; b) order scale; c) intervals scale; d) ratio scale.

3 The estimation process

After the solving of problems concerning attribute model the objects estimation begins. The estimation process disposes of different strategies: a) estimation with opened information, when expert has the possibility to confront the information from other experts. That is he has the possibility among other things to compare his estimations with other expert ones; b) estimation with closed information, when expert don't has access to other experts information.

The estimation realized on the base of these strategies can give different results determined by the amount of information dealing with in the process of estimation.

Two principal strategies of estimations engendering exist. These ones are determined by the number of persons involved simultaneously

in process of estimations engendering and namely: a) individual strategy, in the case when estimations are generated directly by one expert and b) collective strategy, when more persons are involved. Each of these strategies has multiple method of estimations engendering. The most important methods will be briefly characterized.

- The investigation method. The essence of this method consists in making up of one questioner, with the structure determined by the vision of the author. This questioner must contain, besides the so-called questions the additional information concerning estimated object and the area of their existence. All the information contained in questioner must be strict, without ambiguities, investigation being like an estimation by correspondence. The questions from questioner can be as of opened type as of closed one too. In the first case the expert can compose the answer to the questions in free form, but in the second case besides the question there are the possible answers too, which must be selected by the experts.

- The interview method. Some characteristics of the method can be guessed from its name. The method consists in establishing the discussion between the expertise organizer and the expert. Discussion flows according to the previously prepared program. The interview success depends greatly of expert quality to present prompt answers.

Some types of interview organization exist: interview of the form of the simple discussion; interview of the form "question-answer" and "simultaneous investigation". In the case of the last form many interviewers participate (something like the judiciary investigation). Some of them stride to gather as more information as possible, when the other part of them is concerned not to cross the expertise bounds.

- The morphologic analysis method. The essence of this method consists in engendering, counting and classifying of all possible variants involved in decision making process even those that seem unbelievable. As the result of this method application the multidimensional morphologic schemes are built in which base criterions of given set of object are enumerated. For the method application there is the need of persons endowed both with the capability of developed analysis and with reach imagination that can drive to apparently unbelievable

conclusions.

- The brainstorm method. The essence of this method is the organization of the discussion oriented to solving the given problem. Discussion group consists from 4 to 12 persons. There are some rules which have to be taken into account in the organization of brainstorm meeting. First of all any kind of pressure on the participants must be excluded. Therefore the jointly interested persons are not invited at the meetings. In the second place the tedious wording of the problem is not admitted. As a rule the wording is reduced to a series of brief questions containing the essence of the problem.

- The Delphi method differs from traditional method of putting in concord the experts opinions by the opened discussion opening for the interdicting of this kind of method with the view to diminish the psychological influence on the individual estimation of the expert. In this case the discussion is replaced as a rule with individual consecutive investigations.

4 Some useful remarks

To concentrate the attention to some representative sides of the methods the information about them will be gathered in the following table:

GENERAL TASK	APPLIED METHOD	ITERATIVE	COLLECTIVE	HIGH COMMUNICATION LEVEL
Formation of expert group	"Snowball" method	+	-	+
	Documentation method	-	-	+
	Test method	-	-	+
Assigning competence to experts	Reciprocal estimation method	-	-	+
	Documentation method	-	-	+
	Test method	-	-	+
Elaboration of attribute model	Individual method	-	-	+
	Collective method	-	+	+
Objects estimation	Investigation method	-	-	+
	Interview method	-	+	+
	Morphological analysis method	-	-	+
	Brainstorm method	+	+	+
	Delphi method	+	-	+

The examination of information about these methods suggests us the increased level of complexity in the application of collective expertise because of the following reasons:

a) The iterative manner of methods, which increases the necessary time to obtain the final result;

b) The implication in procedures of many persons, which increases in fact the level of difficulty to coordinate the joint actions;

c) The necessary interaction time between the expertise figures.

In not so far-off past the automation process of the collective expertise touches only some of its sides like, for example, the gathering of some types of expert estimations, the processing of expert estimations. This fact and the reasons enunciated above denote some restraints in application of collective expertise in some domains. The present state of things in computers domain permit us to increase the efficiency of applying the existing methods and thus the enlargement of spectrum of automized methods concerning the collective expertise. These methods can be, for example, the formation of experts group, the elaboration of attribute model, the gathering of expert estimations. All the improvements can be done on the base of increased level of communication between the computers. All of these are possible applying the methods concerning the network technologies including Internet services.

5 The network technologies and collective expertise

The possible scenario of expertise proceeding applying up-to-date technologies can be the following. The expertise administrator initiates the creation of the server oriented to the fulfillment of proposed expertise. The information concerning concrete expertise will be placed on this server. The form of information can be diverse: data bases,

some necessary tools, estimation procedures etc. Therefore the information on the server is divided in 6 principal blocs: DATA BASES, EXPERT GROUP FORMATION, OBJECTS ESTIMATION, OBJECTS INFORMATION, ESTIMATIONS PROCESSING, SYSTEM ORIENTATION. The interaction between the module is represented by the arrows joining corresponding elements. The DATA BASES bloc contains information concerning the experts, estimated alternatives, estimations, tests, previous expertise. Tests can be of diverse type: tests oriented to formation of experts group, tests for assigning the competence to each expert, tests for putting in concord the experts, etc. EXPERTS GROUP FORMATION bloc contains methods for creation experts group and assigning them the competence. These methods interact with experts data base and may be with tests data base. This fact depends on the method involved for the formation of experts group. OBJECTS INFORMATION bloc contains methods dealing with gathering information about estimated alternatives. This information is useful during the estimation of objects and during estimations processing. OBJECTS ESTIMATION bloc contains methods to perform estimation of alternatives involved for the collective expertise. Therefore this bloc interact with all experts and also with DATA BASES bloc to collect the estimations in it. The ESTIMATIONS PROCESSING bloc has the task of creating the opinion about the domain of expertise. All the information concerning the expertise is opened at this stage of expertise. The information about experts, estimated alternatives, estimations is involved to increase the efficiency of estimations processing. The DM determines the strategy of estimations processing. The SYSTEM ORIENTATION bloc is the module that is charged with the selecting of the concrete methods implemented in the concrete expertise.

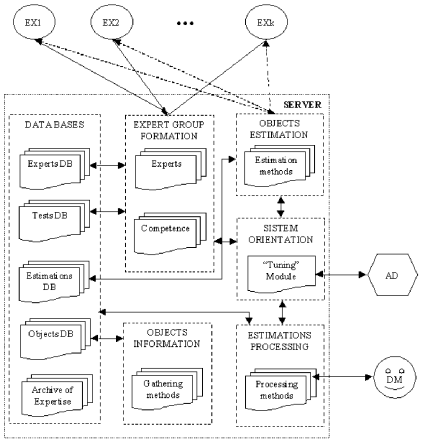

Figure 1.

The AD is the person responsible for the orientation of the system to the concrete expertise. The AD fixes the concrete method of formation experts group, determines method of estimation the alternatives and selects the methods of estimations analyzing.

6 Conclusion

The applying of network technologies, including Internet services saves the necessary time for fulfillment of proposed operations. In result the following moments of collective expertise can be improved:

- the time of iterative methods;
- the efficiency of collective methods;
- the interaction between the participants of collective expertise.

In conclusion one can assert that up-to-date technologies in computers domain applied to the process of collective expertise can make it more accessible for more domains of activity.

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