The Social Sciences 11 (Special Issue 3): 6446-6450, 2016
ISSN: 1818-5800

Management Style Consideration During Decision-Making Support Concerning Project Manager Selection

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Abstract: The study deals with the problem of information support personnel decisions on the choice of heads of projects. Proposed fuzzy model representation properties bidders, management styles and vacancies. The procedures of estimation and reduction of choice set are suggested.

Key words: Decision making, management style, selection and performance appraisal of the personal, methods of information and algorithmic support of decision-making

INTRODUCTION

The problem of decision making support concerning the selection of a project manager (a program, a project portfolio) is of great practical importance, because the quality of management (in conjunction with other factors plays a key role in in a project investment attractiveness provision (HPI, 2012). The collection of personal and professional qualities of each candidate for a management post is appropriate to consider in the light of a management theory conceptual apparatus, putting it in line with a certain style of leadership (Averin, 2014). However, this compliance (as well as the compliance of management style with management tasks and the conditions of their solutions) can only be carried out to some extent and thus, it has a fuzzy character (Averin *et al*., 2015a, b).

The aim of the study is the development of a formal process concerning the reduction of candidate number for a managing post on the basis of candidate representation fuzzy model development, the management styles and management vacancies.

Manager selection task setting and the proposed approach to its solution: Suppose that there are many candidates for a vacant managing position CAND = {Cand= ($Cand_1$, $Cand_2$, ..., $Cand_m$)}, the personal and professional qualities of each $Cand_1$, $Cand_2$, ..., $Cand_m$ are supposed to be set. The vacancy Vac = (Vac_1, Vac_2, ..., Vac_n) is determined by a set of attributes and requirements, including the data on project objectives and the conditions of these tasks solution.

The traditional problem formulation for an employee selection to a vacant position involves the evaluation of each vacancy candidate compliance extent f = F (Cand, Vac). However, the complexity of a functional dependence F development limits the application of this approach by the tasks with a small number of accounted attributes for candidates and positions which reduces the practical value of the recommended personnel decisions.

The proposed approach uses additionally the concept of management style, the information model of which Style = ($Style_1$, $Style_2$, ..., $Style_p$), contains the indicators characterizing the ways, methods and forms of a manager practical activity as attributes, coupled with the adoption of administrative decisions.

The essence of the proposed approach is the division of candidate compliance level estimation procedure into two stages:

Step 1: The evaluation of candidate personal and professional characteristic compilance extent to leadership styles.

Step 2: The assessment of compliance degree with the management style characteristics and a project manager vacant post.

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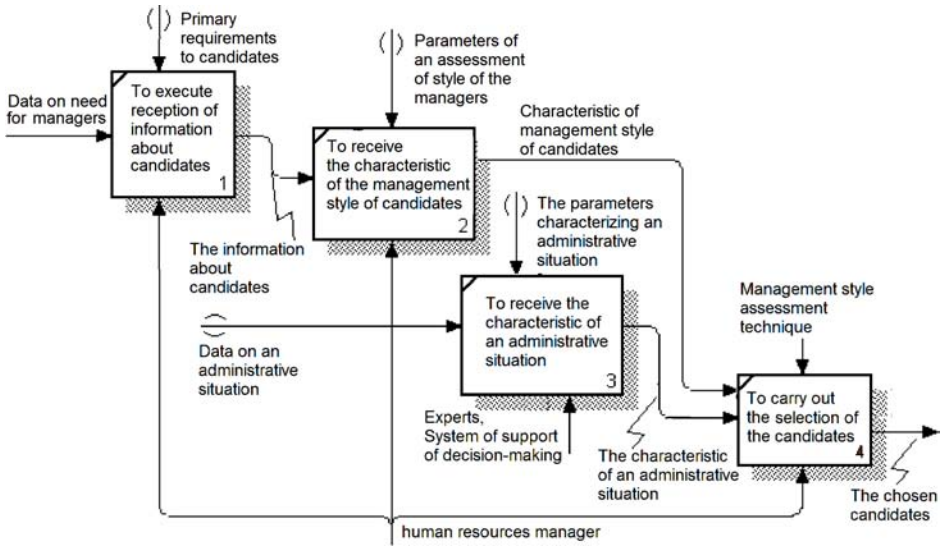

Fig. 1: The scheme of decision making support procedure for the selection of candidates to a project manager post on the basis of management style assessments

The general scheme of the set problem solution is presented in the form of business process model performed in IDEF0 notation (Fig. 1).

MATERIALS AND METHODS

Information modeling during a project manager selection: As the part of a formulated task solution you must perform the informational description of candidates, management styles and a vacancy.

Each of the candidates for a managing position within the framework of information modeling can be described by a large number of attributes, from which we will specify the basic qualities of a manager presented in Table 1. The list of these attributes can be extended within a specific task.

Analyzing the most widespread types of management style (Averin, 2014), let's develop an attribute composition of the information model for management style (Table 2), reflecting the aim of control, the information used in decision-making and the technology of managing decision acceptance. Various combinations of considered parameter values make it possible to obtain $2^6 = 64$ variants of management styles.

As the part of an information model attributive content concerning a project manager post (Table 3) it is advisable to select the attributes that characterize the range of solved production problems (Vac_1-Vac_5) and a team, performing this project (Vac_6-Vac_8).

During a candidate, a management style and a vacancy information modeling one can be limited only by two possible polar values of each of the attributes using

Table 1: Quality attributes of a candidate for a managing post

Attribute name	Attribute designation	Attribute possible values
Management experience	$Cand_1$	Insufficient, great
Professional level in a subject field of a project	$Cand_2$	Low, high
Education level	$Cand_3$	Low, high
Motivation level	$Cand_4$	Low, high
Intelligence level	$Cand_5$	Low, high
Communication level	$Cand_6$	Low, high
Mental outlook scope	$Cand_7$	Low, high
Tolerance level	$Cand_8$	Low, high
Psychological type of personality	$Cand_9$	Weak, strong
Health status level	$Cand_{10}$	Low, high

Table 2: Attributes-properties for management style

Attribute name	Attribute designation	Attribute possible values
Management orientation	$Style_1$	The solution of production problems, staff development
The nature of information used during decision-making	$Style_2$	Verbal, quantitative
Time horizon taken into account during decision-making	$Style_3$	Tactics, strategy
Decision development means	$Style_4$	Intuition, logic
Control centralization	$Style_5$	Low, high
The use of information technologies during decision-making	$Style_6$	Manual mode, automated mode

Table 3: Attributes and requirements for a vacancy information model

Attribute name	Attribute designation	Attribute possible values
The importance of solved industrial problems	Vac_1	Low, high
The complexity of solved production problems	Vac_2	Low, high
The time period of industrial problem solution	Vac_3	Short, long
Tools for production problem solution	Vac_4	Weak,powerful
Work conditions for production problem solution	Vac_5	Liberal, authoritarian
Team professional level	Vac_6	Low, high
Staff motivation level	Vac_7	Low, high
Psychological microclimate in a team	Vac_8	Low, high

the binary symbols: 0 (the first value in Table 1-3) and 1 (the second value). The increase of informative level for model representations can be achieved by setting the intermediate attribute values in the range from 0-1 which corresponds to fuzzy modeling procedure (Averin and Zviagintseva, 2013). At that the values of these characteristics can be obtained within an expert survey using the methods of result reliability improvement (Averin and Zviagintseva, 2015).

RESULTS AND DISCUSSION

Candidate evaluation procedure: Let's consider the correspondences between the set of candidates qualities and the individual characteristics of management styles in the form of all possible binary tuplet representations CAND = {Cand = ($Cand_1$, $Cand_2$, ..., $Cand_m$)|$Cand_i \in \{0, 1\}$} β $Style_j \in \{0, 1\}$}. This correspondence is completely determined by the logic functions G_j ($Cand_1$, $Cand_2$, ..., $Cand_m$), taking the value of 1 at ($Cand_1$, $Cand_2$, ..., $Cand_m$) ~$Style_j$ and 0 in an opposite case. Let's assume, that the table tasks of the function G_j can be performed by experts. The analytical representations of G_j functions can be obtained by the development of perfect normal disjunctive or conjunctive forms with a subsequent optimization of the obtained representations (e.g., onthe basis of Quine's method or Karnaugh maps).

The correspondence between the set of possible management styles Style = {($Style_1$, $Style_2$, ..., $Style_p$)| $Style_j \in \{0, 1\}$} and the attribute Vac_j, characterizing a separate requirement of a vacant managerial position is described by the logical functions H_j ($Style_1$, $Style_2$, ..., $Style_p$), taking the value 1, if ($Style_1$, $Style_2$, ..., $Style_p$) corresponds to this vacancy property, 0 is in a opposite case. After the performed table task of logical functions H_j one may proceed to the analytical representation of these functions.

The vector binary function of correspondence (according to set requirements) between a candidate and a vacancy F = (F_1, F_2, ..., F_n) can be obtained as the result of a binary vector function superposition G = (G_1, G_2, ..., G_p) and the binary vector function H = (H_1, H_2, ..., H_0):

$$F_i(Cand_1,Cand_2,...,Cand_m) = H_i(G_i(Cand_1, Cand_2,...,Cand_m),...,G_p(Cand_1,Cand_2,...,Cand_m)) \quad (1)$$

Let's generalize the considered approach for the case when the candidate qualities are expressed only to a certain extent. For example, a professional level of a candidate ($Cand_1$) can be estimated by someintermediate value between a "low" and a "high" one. To describe the degree of candidate quality expression it is advisable to use the mathematical representations of fuzzy logic, in which the truth of a statement can take not only the value "true" (1) and "false" (0) but the intermediate values from the interval (0,1). In this case the set of possible candidate qualities:

$$\tilde{Cand} = \{(\tilde{Cand}_1, \tilde{Cand}_2, ..., \tilde{Cand}_m) | \tilde{Cand}_i \in [0,1]\}$$

represents not only the corner points but the whole m-dimensional single cube and the logical functions are transferred into their fuzzy counterparts:

$$G \to \tilde{G}, H \to \tilde{H}$$

by the way of replacement in the analytical representation of these disjunction, conjunction and negation functions by the fuzzy analogues of these operations. At the same time the pairs of maximum and minimum, the product and Gamaher's sum, the product and Einstein's sum as well as various combinations thereof can be used as T-norms and S-conorms. The selection of norms and conorms is performed by experts on the basis of their of management and test numerical experiment understanding. Obtained by the way of superposition $\tilde{G}$ and $\tilde{H}$ a fuzzy analogue of the binary vector function F, applied to:

$$\tilde{Cand} = \{(\tilde{Cand}_1, \tilde{Cand}_2, ..., \tilde{Cand}_m) | \tilde{Cand}_i \in [0,1]\}$$

provides the vector of estimates Est = (Est_1, Est_2,…, Est_n), $0 \le Est_j \le 1$, reflecting the compliance of a candidate characteristics to a vacant managerial position requirements.

The check of candidate qualities compliance to the minimum requirements of a vacant managerial position (the scheme is shown on Fig. 2) can be considered as a candidate admission procedure for the participation in the following competitive selection, i.e., the reduction of an initial set of candidates CAND to the subset CAND*. In some cases on the basis of the minimum job requirements:

$$\tilde{Vac}^{min} = (\tilde{Vac}_1^{min}, \tilde{Vac}_2^{min}, ..., \tilde{Vac}_n^{min})$$

it is advisable to find (and use as an admission to a competition) the minimum allowable values of candidate qualities:

$$\tilde{Cand}^{min} = (\tilde{Cand}_1^{min}, \tilde{Cand}_2^{min}, ..., \tilde{Cand}_m^{min})$$

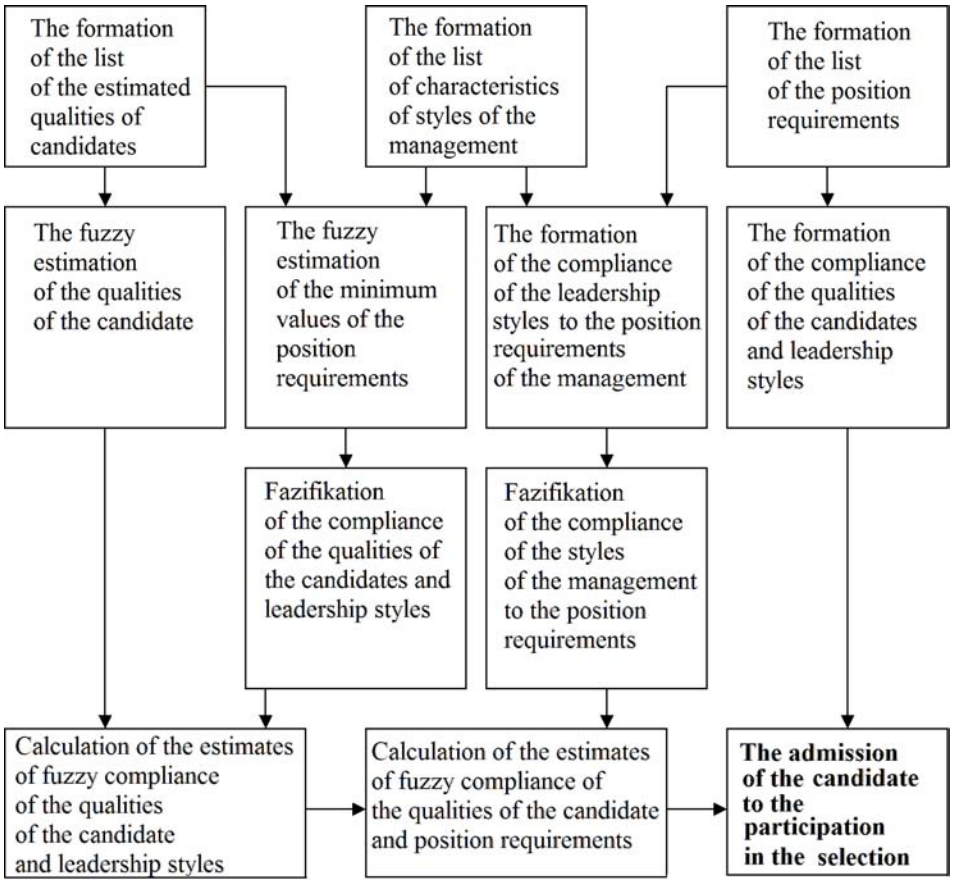

Fig. 2: Admission procedure scheme for the participation in a competitive selection

Applying an inverse correspondence:

$$\tilde{F}_i^{-1}(\tilde{Vac}_1, \tilde{Vac}_2, ..., \tilde{Vac}_n)$$

$$\begin{aligned} \tilde{Cand}_i^{\min} &= \tilde{F}_i^{-1}(\tilde{Vac}_1^{\min}, \tilde{Vac}_2^{\min}, ..., \tilde{Vac}_n^{\min}) = \\ &= \tilde{G}_i^{-1}(\tilde{H}_1^{-1}(\tilde{Vac}_1^{\min}, \tilde{Vac}_2^{\min}, ..., \tilde{Vac}_n^{\min}), ..., \\ &\tilde{H}_p^{-1}(\tilde{H}_1^{-1}(\tilde{Vac}_1^{\min}, \tilde{Vac}_2^{\min}, ..., \tilde{Vac}_n^{\min}) \end{aligned} \quad (2)$$

Candidate number reduction procedure: Let's assume that the result of N estimation concerning the candidates admitted to a competition each of them received its own set of estimates $Est^r = (Est_1^r, Est_2^r, \ldots, Est_n^r)$, r = 1, 2, …, N where the following inequalities are performed for each component Est_j^r: $0 \le Est_j^r \le 1$.

In order to select the most suitable candidates let's use the method of an ideal point. Let's assume that an ideal (as a rule, a fake one) candidacy fully complies with vacancy requirements, i.e., $Est_m^{id} = Vac_m^{id}$ m = 1, 2, …, M.

The following may be taken as a metric distance between estimation space points $Est = (Est_1, Est_2, \ldots, Est_M)$ depending on the specifics of a solved problem. The Euclidean distance is calculated according to the following Eq. 3:

$$\begin{aligned} Dist_E(Est, Est^{id}) = ((Est_1 - Est_1^{id})^2 + \\ (Est_2 - Est_2^{id})^2 + ... + \\ (Est_n - Est_n^{id})^2)^{1/2} \end{aligned} \quad (3)$$

Chebyshev distance is calculated according to the following Eq. 4:

$$\begin{aligned} Dist_7(Est, Est^{id}) = \max\{abs(Est_1 - Est_1^{id}), \\ abs(Est_2 - Est_2^{id}), ..., \\ abs(Est_n - Est_n^{id})\} \end{aligned} \quad (4)$$

Manhattan distance is calculated according to the following Eq. 5:

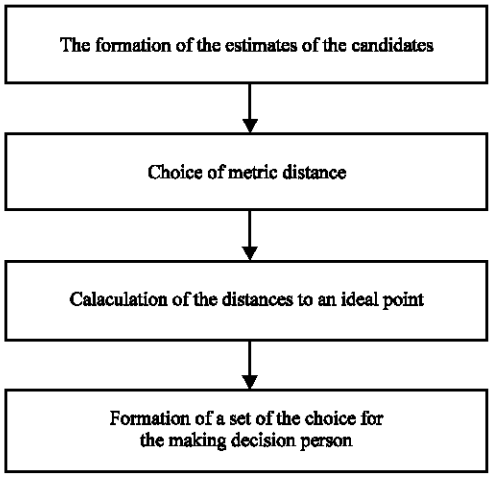

Fig. 3: The reduction procedure scheme concerning the set of candidate reduction admitted to the candidate competition (CAND*) to the set of decision maker selection

$$\begin{aligned}\text{Dist}_{?}(\text{Est}, \text{Est}^{id}) = {} & \text{abs}(\text{Est}_1 - \text{Est}_1^{id}) + \\ & \text{abs}(\text{Est}_2 - \text{Est}_2^{id}) + \ldots + \\ & \text{abs}(\text{Est}_n - \text{Est}_n^{id})\end{aligned} \quad (5)$$

Choosing candidates for which their corresponding estimate space points are the closest one to an ideal point, we reduce a lot of choice to the required number of alternatives, after which the final selection is performed by Decision-maker on the basis of its non-formalizable (sometimes intuitive) preferences. The general scheme of selection plurality reduction procedure is shown on Fig. 3.

CONCLUSION

The decision making support procedure proposed in the article for the selection of candidates to a project manager post, assuming the separation of a candidate compliance degree estimation and a post into two stages (assessment stage of candidate compliance qualities and management style characteristics, the stage of management style features conformity evaluation to certain job requirements), allows the following:

- To separate evaluation stages by time which gives some additional possibilities during an evaluation expertise planning
- To distinguish the tasks involved for the evaluation of experts which can improve the quality of examination due to a narrow specialization of experts
- To reduce the complexity and increase the objectivity of evaluation estimates due to the lack of direct estimation links between the properties of candidates and job characteristics

A fuzzy representation of candidate personal and professional qualities, management styles and management positions made it possible to increase the information content of the resulting estimates.

Based on the ideology of an ideal point method the selection procedure of the most suitable candidates allows to reduce a set of selection to the amount suitable for a final selection, carried out by a decision maker.

The developed procedures are used during design and a software implementation of a research prototype within the information-analytical system "Psi-Analyst", an experienced operation of which may demonstrate a proposed approach efficiency. The consideration of decision sensitivity planned during a system development from possible changes concerning the use of expert judgments (Averin and Zviagintseva, 2012). will enhance the objectivity and scientific validity of project manager assignments.

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