

CONCEPTUAL APPROACH TO THE SELECTION PROBLEM OF JOB APPLICANTS AND ITS MODELING THROUGH FUZZY MATHEMATICAL APPARATUS

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Introduction. Necessity of raising efficiency of applicant selection to vacant work places is one of the basic problems for each organization. It should be done through perfection of selection mechanism of applicants and realization of the selection process on scientific bases considering national and foreign experience [1,2].

First conception corresponds to Japanese model and is based on the lifelong recruitment principle. According to this model, applicants are comprehensively evaluated in the first stage and their personal qualities and abilities like executive and cognitive skills, responsibility towards the tasks set, ability to find common language with people etc.) are checked.

Ultimate goal here it to select applicants having enough intellectual potentials and high moral and educational qualities and who are more reliable as well. Mastering certain professional knowledge and ability is realized according to corresponding development program of the organization. Staff development program of the organization aims to train qualitative workers in different profiles after a certain period of working.

The second conception reflects American model, which intends to meet demand for workers through lucidity of the organization and considering high mobility the work power. During evaluation process applicants' suitability to his her post or job's requirement is considered, that is to say employees are selected expediently.

In the process of evaluation through this process along with professional qualities of the applicants, the following are mostly considered: level of the direction of profession and professional education, skills and a range of different requirements of the applied job like knowledge of certain computer programs, knowledge of foreign language, driving skills etc.

According to this model, personal qualities and skills of applicants are considered minor factors. Organizations tend to recruit "ready" specialists meeting all the requirements of the job.

Such organizations usually have an evaluation system, which aims to improve high labor productivity and professional development of recruited personnel.

At present, both approaches are used. Even sometimes depending on the worker contingent, organizations apply both first and second approaches in selection of the cadres. Generally speaking, the second variant (American model) is preferred in areas with wide range of activities and high mobility and the first variant (Japanese model) is preferred in the areas where formation of a cadre potential is intended.

Stages of the problem of applicant selection to vacant positions. Selection process of the personnel in organizations is usually carried out by stages and many of applicants are removed. Let us note that succession and necessity of the stages and necessity of the selection criteria of the applicants may differ depending on the post and profile of the establishment and depending on the preference of selection model. The structure of requirements proposed for applicants by organizations is usually as follows:

First stage: General features: sex, age, place of accommodation, marital status etc.

Second stage: Education: higher, higher - secondary, secondary - technical etc.

Third stage: Work experience: he/she has a length of service for this post; has previously worked at an appropriate post; has worked in the area of profession suitable to this post, has no length of service completely;

Fourth stage: special abilities: has computer skills, knowledge of a foreign language (English), driving skills, good boxer etc.

Fifth stage: personal qualities: restrained, communicative, emotional, restrained etc.

Sixth stage: Health: completely healthy; he/she had an illness for a time definite, has an illness now etc.

Seventh stage: convenience: he/she is a suitable cadre; he/she is not a suitable cadre.

General features and education of the applicant are specified based on the documents he/she presented. Work experience is affirmed based on work-book, references and recommendations, special abilities are tested by specialists of the same area through analytical methods in the corresponding areas, state of health is defined through check-up. One of the complex problems is defining accordance of personal qualities of the applicant to the post offered.

Methods used in selection of applicants to vacant posts. These are methods of selection used in most establishments:

- Interview
- Analysis of the documents
- Testing

Truthfulness and reliability of the methods are not perfect. In other words, they do not give comprehensive and exact information about applicants. Each of the approaches has its superiorities and insufficiencies. In the practice nowadays, the most widely used method is *interview*. Beyond doubt, interview is inseparable stage in the selection process of the employee. However, a few problems decrease the efficiency of this method as a tool for selection. Emotional and psychological peculiarities are main causes of this problem.

While interviewing the applicant, some stereotypes, the first impression, physical attractiveness (or lack of attractiveness), manners, title, clothes and other factors influence interviewer and increase his/her subjectivity in forming a thought about interviewee. This necessitates extension of selection process and one more stage - a testing stage becomes inevitable which allows to evaluate the applicants based on their professionalism and creativity reducing dependency on the factors of subjectivity and to come to true conclusions about them. Computerized results obtained on the basis of reducing subjectivity is more desirable in a decision making process.

Indicators defining job applicant. Survey of Kettel - a test of complex evaluation of personality (16 qualities) - allowing to evaluate degree of each applicant's personal qualities has been chosen to model the stage of selection of the applicants according to their personal qualities [3].

According to this test, personal qualities of each person are defined with the following:

- S₁ – restrained - communicative;
- S₂- intellect;
- S₃ - emotionaldır - silent;
- S₄ - obedient – dominant;
- S₅ - restrained – speaks effectively;
- S₆ - sensitive –has norms of high behavior;
- S₇ – submissive - courageous;
- S₈ – cruel – self-respected;
- S₉ - credulous – doubtful;
- S₁₀ - practical – has high inagination;
- S₁₁ - straightforward - diplomatic;
- S₁₂ – self-confident – hesitant;
- S₁₃ - conservative – radical;
- S₁₄ – melancholic – self-dependent;
- S₁₅ – low self-control – high self-control;
- S₁₆ – apathy - tension

Requirements on these personal qualities or their weigh importance may clearly differ depending on the area of activity, on the post offered and the profile (features) of the organization. In [4], as a result of expert evaluation, the importance weigh of these qualities for workers of administrative and social sphere W_{Sj} has been defined as follows:

$W_{S1} - 0,077; W_{S2} - 0,074; W_{S3} - 0,079; W_{S4} - 0,060; W_{S5} - 0,072; W_{S6} - 0,072; W_{S7} - 0,066; W_{S8} - 0,047; W_{S9} - 0,044; W_{S10} - 0,058; W_{S11} - 0,060; W_{S12} - 0,064; W_{S13} - 0,051; W_{S14} - 0,050; W_{S15} - 0,075; W_{S16} - 0,052.$

It is necessary to note that total of the coefficients of relative necessity specified in each level is equal to 1, that is the condition of $w_{k1} + w_{k2} + \dots + w_{km} = 1$ is true. In order to define the degree of correspondence of each person with these qualities, the indicators of personal qualities must be mathematically formalized. Because these indicators have qualitative character rather than a quantitative, testing conformity of people to them requires usage of linguistic expressions of our natural language and fuzzy conceptions each as less, very, to a considerable extent, a few, set, the most, considerable, too much etc). That is we often come across with such expressions:

- He/she is very emotional;
- He/she is communicative;
- He/she is too courageous;
- He/she has high intellect and so on.

Expressing personal qualities and generally applicant's knowledge, ability etc in this form creates the necessity of involving experts to process of the recruitment.

Thus, all above show that criteria and indicators accepted for applicant selection have the following features. Thus, all above show that criteria and indicators accepted for applicant selection have the following features:

1. Acceptance of the applicants is a problem with many criteria;
2. Univocal defining of the criteria is difficult and their limits of change are highly variable;
3. Involvement of the experts as an information source for defining criteria becomes unavoidable;
4. In evaluation of the criteria with qualitative character, due to indefiniteness, formalization of the linguistic expressions of our natural language is required;
5. Criteria characterizing job applicants are essentially different and it is necessary to take into account their relative necessity;
6. Criteria characterizing job applicants have hierarchical structure; that is each criterion is based on aggregate of its composition parts.

For modeling acceptance and evaluation of the job applicants on the basis of selection criteria, above mentioned features require selection of relevant formalization considering fuzziness of the indicators and indefiniteness of linguistic character connected with formalization of the expert knowledge. From this point of view, usage of the fuzzy mathematical apparatus has become inevitable for modeling acceptance and evaluation of the job applicants on the basis of selection criteria [6, 7].

Mathematical formalization of the criteria. For defining personal qualities of a man, each of the indicators of a personal quality is graded in a verbal scale according to linguistic values of our natural language.

For instance, let us have a look at a gradation of indicator "S restrained-communicative" on verbal scale: "Too restrained", "relatively restrained", "normal", "tending to communicativeness", "communicative", "very communicative".

A group of experts carried out linguistic evaluation of these gradation levels and we should note that linguistic evaluation of the same gradation level might be different depending on the requirements of the offered vacancy. Fuzzy set appointed in the interval of $[0, 1]$ is specified for each linguistic value. Suppose that results of separation of fuzzy majorities in the interval of $[0, 1]$ and linguistic evaluation of gradation level of indicator S_1 is as follows (Table 1):

Table 1. Quality gradations and linguistic value of the indicator "S₁ - restrained - communicative" used in evaluation of the degree of the applicant's personal qualities.

Quality gradations of the indicator "S ₁ - restrained – communicative" (fuzzy variable)	Linguistic variable	Fuzzy set in the interval of [0, 1]
1. Applicant is too communicative	Completely acceptable	[0,8-1]
2. Applicant is communicative	Acceptable	[0,60-0,79]
3. Applicant is tending to be communicative	Normal	[0,36-0,59]
4. Applicant is rather restrained	Not acceptable	[0,10-0,35]
5. Applicant is too restrained	Not acceptable at all	[0,09-0,01]

After such gradation of the each indicator, a fuzzy value is adopted for it among fuzzy set allocated for its linguistic value. This is called applicant's function of possession to the indicator of a personal quality.

Applicant's function of possession to the certain indicator of a personal quality is expressed by $\varphi_{S_j}(x)$. Here x is any applicant, S is set of the applicant's indicators of a personal quality and in the case considered $S = \{s_1, s_2, \dots, s_{16}\} = \{s_j, j = \overline{1,16}\}$. After finding applicant's function of possession to the indicator of a personal quality, by using formula of

$$\varphi_S(X) = \sum_{j=1}^{16} w_j \varphi_{S_j}(X).$$

We can define applicant's degree of personal quality. Here w_j and S_j are relative necessity coefficients of the indicator.

A method of expert evaluation in 10-point system or methods of comparison of the criteria in pairs can be used in order to find coefficients of relative necessity of the criteria. [8,9].

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