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METHODS FOR EVALUATION OF HUMAN RESOURCES PERFORMANCE IN VIRTUAL ORGANIZATIONS

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1. Introduction

The massive spread of Internet technologies and the globalization of the economy in the late twentieth century have allowed the enterprises to form a temporary partnership, and subsequently have led to the formation and expansion of virtual organizations (VO) by establishing such links over the Internet [6]. Consequently, virtual firms, virtual corporations, virtual department, virtual groups, and virtual working spectrum have enlarged in the sphere of employment. The process of virtualization of organizations has changed the social-labor relations and traditional governance mechanisms in the labor sphere, which has led to the change of staffing functions, the content of labor contracts and the change of traditional institutions for information collection. Unquestionably, the success of VO depends on appropriate organization of human resources management (HRM) and selection, deployment, socialization, motivation and evaluation of employees and partners. In this regard, this paper analyzes the features of HRM in VO and proposes a method for the assessment of the performance of virtual employees (contractors).

2. Features of HRM in VO

In each organization, the goal of HRM is to form, employ and develop human resources [2, 3, 4].

The use of human resources in VO envisages the evaluation, rewarding, and motivation of each employee in achieving efficient production and common outcome.

The characteristics of VO may include dynamics, informal communication, multidisciplinary teams, uncertainty of organizational boundaries, objective-oriented, working from home, lack of visible organizational structure, reference to mental work of integrated employees, etc., which define the following specific features of HRM issues:

(1) incomplete and inaccurate information provided to the decision-maker about the capabilities of companies, co-workers and partners included into VO and about their performance;
(2) establishment of relationships of VO's operation on the basis of trust factor, and consequently, dependence on the results of the operation on individual and psychological aspects;
(3) dependence of general corporate outcome on local results, and the latter's inaccuracies and uncertainty;
(4) dependence of the results of VO HRM issues on quantitative and qualitative aspects, and the emergence of uncertainties arising from the time factor;

(5) uncertainty emerged in the assessment of the performance of a virtual employee or partner, etc.

These aspects characterize HRM issues in VO, particularly selection and evaluation of employees as poorly structured and hard-to-formalize issues, and necessitate the use of fuzzy logic theory [5, 7].

3. Use and assessment of human resources in VO

Performance of VO's staff is "short-term", and therefore, the lack of mechanisms to measure each employee's contribution to the achievement of the overall objective and to stimulate "short-term" activities is one of the key issues to be solved in VO [1, 2].

The use of human resources in VO is accompanied by a variety of goals. Since VO is a temporary organization consisting of different employees (groups, companies) performing independent functions and different objectives for problem solution, unsurprisingly their interests in achieving a common goal will be different, and assessing the outcome of each employee's performance is topical. Assessment of the performance of virtual groups (or corporations) in VO depends on the nature of their work. Thus, assessment of the work of virtual groups performing the same function can be essentially characterized as the assessment of the objects that are categorized by the same criteria and functioning in a fragmented environment. If virtual groups perform different functions, their activities can be characterized as the assessment of the objects that are categorized by the same criteria and functioning in a fragmented environment. Abovementioned determine the dependence of the overall corporate outcome on the local results and the latter's inaccuracy and uncertainty. From this point of view, the evaluation of employees in VO is characterized as a system of fragmented subsystems, i.e., VO consists of several groups of identically organized network nodes [6, 7]. Each of these groups has individual objective, however does not have sufficient information and resources to solve the common problem. Depending on the nature of the function performed by the virtual groups, three types of distribution are distinguished: 1) virtual groups are performing the same functions - horizontal distribution; 2) virtual groups are performing the functions of different characteristics - vertical distribution; 3) virtual groups are performing the functions of blended characteristic - blended distribution. The physical fragmentation of the needed information depends on the criteria that characterize the alternatives (employees) and the relations with the sub-criteria. Using the fuzzy logic apparatus, the methods are offered for decision-making in a distributed environment for the assessment of employees' performance in VO and a fuzzy relay model is used for this purpose.

Decision-making methods in distributed environments. The following conditions in horizontal distribution of Virtual Groups are ensured: $X = \bigcup_{g=1}^{G} X_{ig}$, where X - is a set of alternatives, X_{ig}-alternatives in the g-th fragment (sub-system) and $X_{ig} \cap X_{ij} = \emptyset$ and $K_g \cap K_j = K_g = K_j = K$ for $\forall g \neq j$. That is, the alternatives distributed by fragments are characterized by the same criteria [3, 4]. Criteria have a hierarchical structure and different weight coefficients, i.e.:

$K = \{K_m,\ m = \overline{1, M}\}$, $w_1, w_2, \ldots, w_T$ - are the relative importance ratios of criteria $K_m, m = \overline{1, M}$.

$K_m = \{k_m, t = \overline{1, T}\}$ $w_{m1}, w_{m2}, \ldots, w_{mT}$ - are the relative importance ratios of sub-criteria characterizing the criterion K_m. Assume that, in each fragment, the membership function of sub-criteria is known:

$\{\varphi_{k_{m1}}(x_{ig}),\ \varphi_{k_{m2}}(x_{ig}),\ \ldots,\ \varphi_{k_{mT}}(x_{ig})\} - \{\varphi_{k_{mt}}(x_{ig}),\ t = \overline{1, T}\}$.

Decision making process is performed on the following steps:

1. The membership function of alternatives to the criterion K_m in each fragment is defined: $\varphi_{K_m}(x_{ig}) = \sum_{t=1}^{T} w_{mt}\, \varphi_{k_{mt}}(x_{ig})$.

2. The membership function of alternatives to the generalized criterion K in each fragment is defined: $\varphi_K(x_{ig}) = \sum_{m=1}^{M} w_m \varphi_{K_m}(x_{ig})$.

3. The maximum of alternatives by fragments is selected:$\varphi(x^*) = max\varphi_K(x_{ig})$, $g = \overline{1,\ G}$, $i = \overline{1, N}$. The alternative with the maximum value is the final decision on horizontally distributed virtual groups, and it is found out of set of decisions with the maximum values on fragments, i.e., $x^* \in \left\{x^*_{ig}, g = \overline{1, G}\right\}$. The following conditions are ensured for vertical distribution of virtual groups: $K = \bigcup_{m=1}^{M} K_m$, where K consists of a set of criteria $K = \left\{K_m,\ m = \overline{1,\ M}\right\}$, with different importance degree, and M – the number of fragments (groups). $K_m = \left\{k_{mt}, t = \overline{1, T}\right\}$ is a set of sub-criteria with different importance degree in each fragment, and $w_{m1}, w_{m2}, \ldots, w_{mT}$ are the relative importance factors of sub-criteria.

In this case, the following conditions are ensured: $K_{mg} \cap K_{mj} = \emptyset$ and $X_g \cap X_j = X_g = X_j = X$ for $\forall\ g \neq j$. That is, the same alternatives for vertically distributed VO by fragments are characterized and evaluated by different criteria [3, 4]. Assume that membership function of the alternative xi to the sub-criteria in the m-th fragment is known: $\{\varphi_{k_{m1}}(x_i),\ \varphi_{k_{m2}}(x_i),\ \ldots,\ \varphi_{k_{mT}}(x_i)\} = \left\{\varphi_{k_{mt}}(x_i),\ t = \overline{1, T}\right\}$.

The final decision on the employees' performance in the vertically fragmented VO is made as follows:

1. The membership function of alternatives to the criterion Km in each fragment is defined:
$$\varphi_{K_m}(x_i) = \sum_{t=1}^{T} w_{mt}\, \varphi_{mt}(x_i)\ .$$
2. The membership function of alternatives to the generalized criterion is defined:
$$\varphi_K(x_i) = \sum_{m=1}^{M} w_m\, \varphi_{K_m}(x_i)\ .$$
3. The alternative with the maximum value for the membership function to the generalized criterion K is chosen: $\varphi_K(x^*) = \max\left\{\varphi_K(x_i), i = \overline{1, N}\right\}$.

Selected alternative with the maximum value is corresponding to the final decision on the vertical fragments, and this decision may not be from the best decisions, i.e., from the set of fragments $\varphi_{Km}(x^*) = \max\left\{\varphi_{Km}(x_i), i = \overline{1, N}\right\}$.

In an environment where the VO is distributed by blended (both horizontally and vertically) fragments, the decision-making process can be accomplished by referencing to decision-making methods in a vertical distribution environment.

Keywords: Virtual organization, human resources management, fuzzy environment, virtual employees, decision-making methods in distributed environment.

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