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Decision support systems for teambuilding

Natalia Yanova *

Department of Psychometrics and Educational Qualimetry, Altai State University, pr.Lenina 61, Barnaul 6560049, Russia

Abstract

The article discusses the problem of soft factor in decision support systems for teambuilding. This paper initializes a match approach to solve the team formation factors with psychological nature. The subject of this article includes theoretical concept, experimental method and software technology for optimization and automation coacher decisions about team organization. Author's approach concerns the new technique of target group formation, taking into account the effectiveness and efficiency of teamwork. The technique implements optimization algorithm based on mathematical analysis of non-additive and complex factors of group interaction. Match models for measuring and prediction to such effects as complimentarily and participation are proposed. As an engineering solution, an expert system for teambuilding simulation is demonstrated. This type of decision support system is called the test expert system and is based on the professional and psychological diagnostics of teamwork.

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Keywords: Mathematical psychology; psychometrics; soft factors; team formation; group performance; competence spaces of skills; match modeling; decision support systems; test expert systems.

1. Introduction

Approaches of probabilistic modeling to solving problems associated with incomplete information or fuzzy computations are the most common, but not the only ones. Among the important actual mathematical problems, the

* Corresponding author. Tel.: +79039109081; fax: +7-3852-36-6327.
E-mail address: yanova.ng@yandex.ru

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following tasks stand out: team selection and team composition, functions and roles distribution, team cohesion, performance level, transformational leadership. Mathematical models of team formation, as a rule, reflect the described properties of the teams: models of autonomous and joint activity, models of formal and informal teams, temporary and permanent teams, functional and creative teams. For example, models of synergistic effect in the theory of corporate games take into account emergence. Reputation models (Jean Tirole's model or Shapiro-Stiglitzmodel) take into account stability, collaboration and unity of purpose. On the contrary, most models, like the well-known Holmstrom's model, do not reflect such features as specialization and complimentarily of roles in the team, individual contribution to the overall result of the activity. Game theory describes a wide repertoire of agent strategies and includes reflexive games, evolutionary games and behavioral games. All of them are aimed at strategies of "decision-making" by agents (team members) in a statics or dynamics. Such models are widely used in economics, management and production.

The interest of this study is assignment problem as classical match problem of team optimization, but in a neoclassical setting (not same for game theory). Universal parameters for modeling remain the same: team composition (multiplicity of agents); total performance (target function), functions and states of agents, team effectiveness. A new formulation of team formation problem is connected with the characteristics of collaboration: specialization (distribution and redistribution of roles), complementarities (interdependence), compatibility (individual and group) and participation. The search for the solution is aimed at calculating the optimal team composition with maximum of total performance and efficiency of teamwork (maximum result at minimum cost). This task is most relevant for sport games and requires a mathematical model for assessing the objective and subjective factors of dynamic interactions.

2. Methods

2.1. Technique of formation

A new method of team formation is based on the distinction between the group and command functionality interaction. It assumes the calculation of the direct and indirect contribution of the group and its members to the task solution. Direct contribution is related to professional assessment (professional group work), whereas indirect contribution is related to psychological assessment (teamwork). New computational options:

Professional assessment of the team (group) or direct contribution to the task implementation

The team is understood as a target group, the total performance of which is maximally oriented towards the goal (a specific organizational\sport task). By topological representation, this is a group of professionals who have the optimal tool set needed to solve the task. In vector space, the group is described as objects (members of a group) defined in the property space (professional knowledge, abilities, skills) in the form of a set of vectors oriented to the target vector. Technologically it is carried out by constructing a target vector (as the optimal direction of the task solution) and a total performance vector (sum vector of group resulting), the angle between which diagnoses the target principle of team selection and allows quantifying the productive and non-productive costs.

Computational options: an integrated assessment of the professional qualifications of the group towards the task solution (*Group Rating*) and an individual professional contribution to the task solution (*Professional Index*).

Table1. Group Team options:

Team options	Optimal variant	Custom variant
Group Rating	0,43	0,4
Group Efficiency, %	6	6
Average Compatibility Threshold	0,53	0,51
Negative Choices, %	14	19

Psychological and team assessment of the group or an indirect contribution to the task implementation

The team is understood as the integrated functional unity of the group members, providing team stability by principle of group complementation, compatibility and cohesion. In this sense, a team from a group distinguishes the optimal correspondence to the target task, not so much due to the professional qualifications of its members (optimal for the task), but rather due to the optimal way of mutual participation in achieving it (e.g., the concept of "teamwork" or "chemistry" in sports teams and concept of "harmony" in project teams).