Multi-objective modeling for Member Selection of Cross-functional Teams

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Abstract: Using cross-functional team (CFT) is a suitable strategy for improving the performance of organizations. The member selection problem is an important aspect of the CFT formation. Several evidences showed the important criteria for choosing true members are: cooperation and coordination, functional expertise, individual abilities, cost, and communication. In this paper, effective features for member selection are identified and a multi-objective 0–1 nonlinear programming model is developed. This model is developed by using individual and collaborative performance. Afterward, it is converted into the linear form by changing variables to solve it more easily. The proposed model is used in the real example in Census cross-functional team in the statistical center of Iran and required data were collected by surveys and interviews. The results indicate that this proposed model has better performance compared to recommendation of experts and can be used in other fields.
Keywords: Binary programming, Cross functional teams, member selection, multi objective modeling, working teams

Introduction: Nowadays using teams is increased; it helps companies and organizations to survive in product markets' competition, business pressure, and customers' expectations (Proehl, 1996; Santa, Ferrer, Bretherton et al. 2010; Fan, Feng, Jiang et al, 2009). Among various teams, cross-functional team is one of the most effective strategy which is used in NPD (Wang, Yan, and Ma, 2003), lean production, TQM and continuous improvement (Love and Roper, 2009).

CFT is defined by a group of members who come from different functional areas (Feng, Jiang, Fan et al, 2010) in the same hierarchy as level within an organization, or even between organizations for a limited time (Saarani and Bakri, 2012). CFT has several advantages such as positive impact on cycle time and project performance (Barczak and Wilemon, 2003), increasing learning, processing optimization, knowledge sharing (Love and Roper, 2009), creativity, problem solving (Santa, Ferrer, Bretherton et al. 2010; Saarani and Bakri, 2012), increasing competition in organization, responding to market changes (Santa, Ferrer, Bretherton et al. 2010), spanning organizational boundaries (Love and Roper, 2009; Feng, Jiang, Fan et al, 2010), and responding quickly to environmental changes (Zhang and Zhang, 2013)

The first stage of team development is forming, therefore organizations must select candidates carefully to ensure CFT's effects and success (Feng, Jiang, Fan et al, 2010). Correct selection prevents wasting time (Feng, Jiang, Fan et al, 2010), financial losses and productivity shortcoming (Saarani and Bakri, 2012). Recently, some researchers have attended to CFT's formation and discuss suitable characteristics to assemble members. In Chen and Lin (2004) study, functional expertise, teamwork experience, communication skill, flexibility in job assignment, and personality traits indicated as five important characteristics of team members that build successful multifunctional team. Fitzpatrick and Askin (2005) regarded innate tendencies, interpersonal skills, and technical skills as important criteria for member selection. Wang, Yan and Ma (2003) listed the selection attributes for the creation ability, management ability, utilization rates, cooperation levels, and so forth. Jiang et al. (2010) reported the criteria for selecting members for cross-functional teams: individual performance (such as work experience, ability to solve work problems, and technical knowledge), exterior organizational collaborative performance (such as the extent of external cooperation), and interior organizational collaborative performance (for instance mutual communication among members and collaboration in solving problems). Zhang and Zhang (2013) stated that the effective NPD team should have four capabilities: expertise and experience consistent, learning and knowledge sharing, communication, and problem-solving. Kargar and Zihayat (2012) discussed requirements such as communication, cost, and skills for desired members. Several evidences showed important criteria for choosing appropriate members. These are cooperation, coordination, functional expertise, individual abilities, cost, and communication. Existing researches focus on main skills of candidates while to the best of our knowledge there is no study that notices subskills of candidates. Furthermore, there is no study which considers all the criteria simultaneously. In addition, utilizing quantitative methods for the formation of CFTs has been the topic of recent researches. Chen and Lin (2004) used chain wise AHP to evaluate sharing knowledge and selecting members who have high knowledge rating in each department. Following that, they have proposed the nonlinear quantitative model to select the appropriate candidates based on teamwork capabilities and working relationships for teams in industrial environments. The working relationships and teamwork capabilities respectively are calculated by using

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MBTI and AHP. Fitzpatrick and Askin (2005) formulated mathematical model based on Kolbe Conative Index (synergy, inertia, and stability) that measures interpersonal structure for multi-functional teams and then solves it by heuristic solution. Zhang and Zhang (2013) presented nonlinear multi-objective optimization for NPD and employed Multi-objective Particle Swarm Optimization to resolve it. They improved fuzzy AHP based on Fuzzy Lin PreRa. In addition, they used the model to evaluate capability and employed MBTI to measure interpersonal relationships among members of interior and exterior departments of the organization. Jiang et al (2010) offered a multi-objective 0–1 programming model for formation cross-functional teams and developed an improved non dominated sorting genetic algorithm II (INSGA-II) to solve it. However, most of the existing methods for the formation of CFTs are nonlinear and there is no simple model for developing CFTs. Therefore the multi-objective nonlinear 0–1 programming model is built based on all of the criteria. Then to solve it more easily, it is converted into a linear form by changing variables.

Materials and Methods: Five main measures are considered to form cross-functional teams: cooperation and coordination, functional expertise, individual abilities, cost, and communication. The Meyers-Briggs Type Indicator (MBTI) test is used to evaluate "cooperation and coordination". MBTI is a self-help assessment test which indicates different psychological preferences in how people perceive the world and how they make decisions. The professional interview is conducted to assess "functional expertise". In addition, the members answered self-report skill measures which rated in the Likert scale. In order to calculate "individual abilities" two methods are used: personal assessment (the participants are asked by questionnaire) and professional assessment (using the analytical hierarchy process (AHP) method). With the aim of realizing the "cost", the paychecks of candidates are considered. Sociometry test is used to asses "communication".

The collected data, based on the mentioned methods, are analyzed and the model is developed. The proposed model minimizes the cost and maximizes the other objective measures. Global Criteria method is used to convert the multi-objective proposed model to the one-objective model. Furthermore, this non-linear model is transformed to linear by using the Glover and Woolsey's method.

Results and Discussion: In order to examine the proposed method, the Census cross-functional team in the statistical center of Iran as the real case is considered. Four departments were selected for this test. 10 people were nominated from chosen departments (3, 3, 2, and 2 members from each department, respectively). The proposed model was applied and the results were compared to the chosen team by the head of the office. The members selected by the proposed model are 1, 2, 4, 5 and 9. However, 1, 2, 4, 5, and 7 members are chosen by the expert. In fact, these two results are 80% in common.

Conclusion: Forming cross-functional teams improves the performance of organizations. Selecting appropriate members for the team formation is a critical decision. Therefore, in this paper, significant features to form the CFT is found and a new model to solve the CFTs formation problem is developed. The findings show the vital criteria in CFTs are: cooperation and coordination, functional expertise, individual abilities, cost, and communication. We have developed simple, linear, multi-objective model which solve forming CFTs more easily and effectively. The outcome of the proposed model is better than the expert's decision in all goals except the "individual abilities", this exception may happen because of considering constraints.

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