Application of Fuzzy Multi-Criteria Decision Making in R&D Project Manager Selection

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ABSTRACT

Project managers perform better and lead projects to a successful end if their characteristics match with the requirements of the position. Manager of a research project should not only have a solid scientific background, but also possess attributes of a leader. Incompetent research and development (R&D) managers can cause grievances, complaints, employee turnover, and organizational disruptions. The process of selecting the best project manager among several candidates involves comparing both tangible and intangible attributes. Such a complex problem involves satisfying several objectives simultaneously. Hence the most suitable methods are multi-criteria decision making techniques. In this article, a fuzzy linguistic problem is addressed using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to identify the most suitable manager to lead an R&D project. A selection committee of five experts is formed to choose the best applicant on the basis of eight criteria. In the final analysis, leadership is found to be the most important criterion followed by scientific accomplishments.

Keywords: Fuzzy Numbers, Linguistic, Multi-Criteria, Research and Development (R&D), Scientific Accomplishments, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

INTRODUCTION

Projects have become the central activity in most organizations. They tend to consume and utilize large amounts of resources within the establishment. R&D projects face many challenges such as some fail to meet the time schedule, budget goals, and satisfy customers. Researchers had to spend time and efforts to identify the main factors that contribute to project success or failure. In this regard, several factors were identified such as planning, control, communication, top management support, and assigning proper manpower among others. It is of paramount importance for a project to be adequately managed. Effective project management is imperative for a successful organization.

A successful project manager has to be highly competent in the planning and executing the project, forming a coherent team, organizing the various tasks, monitoring the execution of the project, and evaluating the project’s outcomes. Moreover, he/she should ensure the timely deliverance of various tasks, completing the project within the budget, according to
specifications, and fulfill the client’s request. In addition, the project manager should have a combination of behavioral, temperamental, emotional, and mental attributes in order to deal with the project team adequately and handle proficiently the different risks that might be encountered during the execution of the project. Most scientists agree that poor interpersonal skills are one of the major causes of managerial failures.

The subject of managing projects has been researched extensively in the literature. Mikkelsen and Folmann (1983) discussed the importance of assigning a qualified and capable manager for running a project. They stressed that priority should be given to investing in the selection process. In this work, a quantitative tool was used in evaluating the skills and qualifications of the candidates. Kelemenis et al. (2011) examined the problem of assigning a project manager highlighting the complexity of the selection process. Since the problem incorporates many criteria at the same time, and each criterion assigned different important levels, it was decided that fuzzy logic and TOPSIS multi-criteria method to be most appropriate to handle the problem. Friedman et al. (1992) through a survey questionnaire attempted to recognize the major activities performed by R&D managers at different supervisory levels, and the cognitive and interpersonal ability requirements that underlie these activities. Three main activities were identified namely: project management, personnel supervision, and strategic planning. In his paper El-Sabaa (2001) compared the difference between project managers and functional managers with respect to skills, attributes, and experiences. The study was developed in three stages. In the first stage, project managers were asked to describe from experience the skills and qualities of good project managers. In the second stage, a questionnaire was designed and project managers were asked to provide scores to various skills needed by project managers. In the third stage, data were collected for the career path of both project and functional managers. All data were statistically analyzed. The analysis showed that for a good project manager, human skill is the most important trait followed by conceptual and organizational skills, and technical skills came last. When comparing profiles of project managers to that of functional managers, results indicated that the project managers are usually younger, have greater mobility across projects and less stability. Meredith et al. (1995) grouped the skills needed for a manager into six categories: leadership, team building, and communication, organizational, technical, and coping skills. Grant et al. (2006) studied the issue of risk and risk management in R&D projects. The specific objective is to provide empirical support to R&D project managers in order to estimate the probability and consequences in every task and activity in their project. Moreover, the study provided the relative likelihood and intensity of the various risks based on the analysis of hundreds of incidents on adverse schedule performance on major aerospace system development programs. In their study, Rudolph et al. (2008) found that the behavioral aspect of managing an R&D project played a significant role in the project success. The behavioral aspect included participation, communication, and identifying conflicts. Coccia and Rolfo (2009) analyzed the new organization of public research body in Italy. The analysis showed that project management should be properly designed and implemented within the body to be successful, otherwise it will become unmanageable. Not properly managing projects within the body will eventually lead to conflict, confusion, and miscommunication within the body. Farooquie and Farooquie (2009) used factor analysis technique in order to design a scheme for measuring the managerial implications of project planning and performance. It was found that conformance to requirements is the most important criterion for project success followed by sound planning.

Project manager’s leadership style is of utmost important in the success of an R&D project. It has been of paramount importance in industry, research, and academic fields as investigated by Kendra and Taplin (2004), Turner and Muller (2005). It has a significant positive impact on team member as detailed in Yang et
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