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Using fuzzy decision making for the evaluation of the project management internal efficiency

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Abstract

Specific applications of fuzzy logic in project management are relatively few in comparison to other application areas. The criteria of project cost, project time, and project quality may be considered as project management internal measures of efficiency. The objective of this research is to present an approach that employs fuzzy decision making (FDM) to combine these three measures into one measure namely the project management internal efficiency (PMIE) which should represent an overall estimate of how well the project was managed and executed. The proposed approach for the evaluation of PMIE is illustrated on a case study. A fuzzy decision making system is designed and implemented using the MATLAB software for the evaluation of the PMIE. The methodology and procedure proposed in this research may be easily implemented by project management organizations. The evaluation of PMIE can serve for project managers and for project organizations as an indicator for the level of achievement of the project management internal objectives. PMIE may help in the evaluation of the performance of project teams.

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1. Introduction

Effective management of projects is crucial for the development and survival of any economy because development is about growth and growth is about a series of successfully managed projects [4]. A project may be viewed as “the entire process required to produce a new product, new plant, new system, or other specific results” [1]. In this fiercely competitive world, project organizations are forced to look for

scientific tools that assist them in the evaluation of their projects. The project management team is responsible for producing the project output and hence the project management team must be constantly aware of the project goal, project purpose, and the project management internal measures of efficiency. Project effectiveness, which is a synonym of project success, is measured or assessed in terms of the degree of achievement of project objectives [2,3]. The concept of project success is a controversial concept. The Project Management Institute devoted its Annual Seminars and Symposium in 1986 to this topic. Many authors tried to study project success factors and attempted to mea-

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sure the project success [2,5,8,14,17,21–23]. Lin and Walker, [14], point out that the concept of project success remains ambiguously defined. Many studies considered that the factors of project time, project cost, and project quality are the essential factors for project success. Wideman, [23], emphasizes that customer satisfaction should be considered as a major factor of project success. Baccarini, [2], makes a fine distinction between the following three important concepts related to project success:

- *Project management success*: This deals with the project process from its start to its handover to the client. The focus here is on short-term criteria concentrating on meeting time, budget and quality objectives, and the satisfaction of the project process stakeholders who are in this case the client, and the project team.
- *Product success*: This deals with the effects of the project's final product at the post-project stage. However, the focus here is on the long-term criteria concentrating on meeting the project owner's strategic organizational objectives (profitability, market share, and technology advancement) and the satisfaction of the needs of the product-user, i.e., fitness for use. The stakeholders at this stage are the users of the product and the project owner.
- *Project success*: This is a combination of project management success and the product success. It should be pointed out here that some projects can meet the project management success criteria of cost, time, and quality and still they are product failures. Conversely, some projects don't meet the project management success criteria but they are product success.

Project management success can contribute positively toward product success but it doesn't guarantee it. In general it should be strived to achieve the project management success and the product success.

The criteria of project cost (PC), project time (PT), and project quality (PQ) are viewed by Shenhar et al. [21] and Baccarini [2] as project management internal measures of efficiency. It may be useful to combine these measures into one measure to get an overall judgement about how well the project was managed and executed. However, the problem is that the three measures are of different dimensions. This problem can

be overcome by measuring PC in terms of cost overrun/underrun as a percentage of the planned budget, measuring PT as a percentage of the planned duration, and measuring PQ as percentage conforming to functional and technical specifications. However, questions like the following may arise: When does a project have low, medium, or high cost overrun/underrun? When does a project have low, medium, or high schedule overrun/underrun? This is a vague problem, and we may adhere in this case to expert's subjective value judgement. Fuzzy logic is a problem solving technique that was introduced by Zadeh [28] to deal with vague or imprecise problems. Fuzzy decision making system (FDMS) in general uses a collection of fuzzy membership functions and decision rules that are solicited from experts in the field to reason about data.

The objective of this research is to present an approach that utilizes a fuzzy decision making system (FDMS) to quantify the Project Management Internal Efficiency (PMIE). The evaluation of PMIE can serve for project managers and for project organizations as an indicator for the level of achievement of the project management internal objectives. PMIE may help in the evaluation of the performance of project teams.

2. An overview of the proposed approach

As mentioned above, the objective of this research is to combine the measures of project cost (PC), project time (PT), and project quality (PQ) into a single measure that may be called the project management internal efficiency (PMIE). These three measures have different priorities with respect to the management of the project organization. Hence, for the evaluation of the PMIE we must take in consideration an additional set of variables, namely: Project cost weighting factor (PCWF), Project time weighting factor (PTWF), and Project quality weighting factor (PQWF), and we require that:

$$PCWF + PTWF + PQWF = 1 \quad (1)$$

Now it is reasonable to assume that the value of PMIE can be determined from the aggregation of the following three impacts:

- 1) The combined impact of PC and its weighting factor PCWF on PMIE.

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