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An incentive pay system for project management based on responsibility assignment matrix and fuzzy linguistic variables

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ABSTRACT

Project management is a discipline that is receiving continuous attention. Managing people effectively has significant impact on the outcome of a project. An effective incentive system helps the organization achieve its goals while meeting the personal needs of participants. The present study proposes a novel incentive pay system for project management based on responsibility assignment matrix (RAM) and fuzzy linguistic variables. It adopts the structure of RAM to model each team member's responsibility and performance, which are then evaluated by fuzzy linguistic variables. Four models are proposed for variant project management circumstances. When tested in a realistic application, the resultant feedback was supportive, with it beings perceived to be more fair and timely when compared to a conventional incentive pay system. Its implementation is efficient; and its results are effective.

1. Introduction

Project management is a discipline that receives continuous attention from the academic community as well as business practitioners. This trend can be derived from ever-increasing publications and size of the associated professional society (Cleland & Ireland, 2004; PMI, 2004).

In the past decade, there has been a steady increase in the number of modern enterprises adopting project management to secure competitive advantage. For many firms, projects have become the central way that work is accomplished. The consequence is a widespread commitment to improvement initiatives that include the establishment of an enterprise project management process, the development of a career path for project managers, the implementation of project management education and training programs, and investment in project management tools and information systems (Grant & Pennypacker, 2006).

With regard to achieving project success, historically, management of projects was as technical systems instead of behavioral structure. That is, there has been a tendency to use a mechanistic approach focusing on results, with the main objective of attaining target dates, achieving financial plans and controlling the quality of the final product (McCollum & Sherman, 1991).

Managing people effectively can have a significant impact on the results of a project since most major project failures are related to social issues. The more managers believe rewards like pay, promotion, and respect from others stem from good performance the more likely they are to be rated as good performers by their peers, superiors, and selves (Lawler & Porter, 1967). Thus, management actions should be supportive of the measurement system by providing rewards when the targets have been achieved. In addition, the achievement of the targets should support the organization's strategy and achievement of the company goals (Hanna, Burns, & Backhouse, 2000).

An effective *incentive pay system* helps the organization achieve its goals whilst meeting the personal needs of participants (Anthony, 1981). Incentive pay plans attempt to relate reward (or bonus) rapidly and directly for above-average performance. There are two basic requirements for an effective incentive plan. The *first* concerns the procedures and methods used to appraise employee performance. The *second* requirement is that the rewards must be based on performance (Byars & Rue, 2006).

According to PMBOK® (PMI, 2004), a project is a *temporary* endeavor undertaken to create a *unique* product, service, or to gain results. It is accomplished through the application and integration of the project management processes of *initiating*, *planning*, *executing*, *monitoring and controlling*, and *closing*. Different process groups may have different staff from the project team. A project is often executed using diverse and limited company resources.

A conventional incentive pay system may not be a viable mechanism for project management. *First*, the project team is a temporary organization and the product (or end-goal) is unique. The project team is formed at the start of the project and then is dismissed at the completion. For the instance of a matrix organization, the most commonly used organization; the team may include full-time or part-time staff from different functional

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departments. A conventional incentive system, invariably evaluated by fixed-time interval, such as annual or quarterly evaluation, cannot provide responsive incentives to motivate the project team.

Second, a project manger's role as a supervisor is temporary. For the majority of incentive systems, the departmental manger is the supervisor who evaluates an individual's performance. This procedure is not adequate, however, for a project-based organization.

Finally, the responsibilities and performances of project team members may vary greatly for the different project process groups and/or different assignments. An effective incentive system for a project, on the other hand, should be able to accommodate the differences in responsibilities and performances among the project team members.

In consideration of the deficiencies of a conventional incentive pay system for projects, the present study proposes a novel incentive pay system for project management. It considers both the responsibilities and performances as the criteria of reward. The responsibility assignment matrix (RAM) is adapted to identify the difference in responsibilities among project team members. An individual's performance, in this instance, requires evaluation using both *crisp values* and fuzzy linguistic variables. While there is a significant amount of literature devoted to the discussion of incentive systems, we are not aware of any particular literature that focuses on addressing incentive pay systems for project management.

Specifically, the proposed incentive pay system has the following characteristics.

(i) It can account for participations from the five project process groups.
(ii) It can consider the different weighting (or impacts to project success) for the five project process groups.
(iii) For each process group, it can evaluate the differences in responsibilities among project team members.
(iv) For each process group, it can evaluate individual's performance for his/her assigned task using either crisp or fuzzy numbers.

The present study presents four models. The first model (*Model 1* hereafter) only considers the responsibility evaluation as criterion of the rewards, and uses crisp numbers for the evaluation. The second model (*Model 2* hereafter) uses fuzzy numbers in *lieu* of crisp numbers in contrast to Model 1. Model 2 also evaluates an individual's responsibilities for the five project process groups. The weights of the five process groups are assumed to be the same. The third model (*Model 3* hereafter) adds the performance evaluation to each individual for his/her assigned task. Based on Model 3, the last model (*Model 4* hereafter) considers the different weights among the five process groups. The differences among these models are summarized in Table 1.

The remainder of this paper is organized as follows. Section 2 presents a review of pertinent literature. Section 3 provides a detailed discussion on the proposed methodology. Empirical results are shown as Section 4. Conclusions and future research opportunities are contained in Section 5.

2. Literature review

Responsibility assignment matrix (RAM) is a matrix-based chart for human resource planning in project management. It is used to illustrate the connections between work that needs to be done and project team members. Table 2, adopted from PMBOK (PMI, 2004), is a sample RAM using RACI (responsibility, accountable, consultant, and inform) format. The sample chart shows the work to be done (in the left column) as activities. The people can be shown as persons or groups.

RAM is widely adopted in project management for human resource planning. Since the project team is temporary, RAM is used for the assignment of responsibilities to project team members. Thus, a RAM is an ideal basis for an incentive system in project management. The present study adapts the RAM structure to differentiate the differences in responsibilities among project team members.

There is a significant amount of literature dedicated to the discussion of performance measures and incentives. Banker, Lee, and Potter (1996) presented a study of the impact of a performance-based incentives, and presented a field test of the multi-period incentive effects of a performance-based compensation plans on the sales of a retail establishment. An investigation by Baker, Jensen, and Murphy (1988) gave insights to different incentives and compensation systems. Several issues were raised from the paper including the absence of pay-for-performance compensation, promotion-based performance system, profit-sharing plan, biased and inaccurate performance evaluation, incentive contracts for top-level managers, *etc*. Baker (2000) examined the characteristics of performance measures to understand how firms use incentive contracting, and to predict the use of incentives on practice. Lazear (2000) discussed the power of incentives in terms of mathematical forms. Gibbons (1998) discussed the incentives in organizations. However, much of the existing literature is applied to general management and does not fully consider the unique characteristics of project management.

The fuzzy decision making has been an active research area in recent years in light of its qualitative modeling capability (Ribeiro, 1996). It has been adopted to solve a variety of practical applications such as the military battle tank evaluation problem by Cheng and Lin (2002), the dynamic operator allocation problem by Yang, Chen, and Hung (2007); the Six-Sigma project selection problem by Yang and Hsieh (2009), the data warehouse system selection problem by Lin, Hsu, and Sheen (2007), *etc*.

Dweiri and Kablan (2006) presented an approach that employs fuzzy decision making to combine three measures: project cost, project time, and project quality into one measure, namely the project management internal efficiency. This should represent an overall estimate of how well the project was managed and executed.

Pillai, Joshi, and Rao (2002) propose a framework to identify the key factors in each phase of the project lifecycle and integrate them through a formula to derive an integrated performance index that can be based to measure project performance. These studies were

Table 1
The differences of the proposed models.

Model no.	Evaluation numbers		Evaluation fields		Weights of the process groups	
	Crisp	Fuzzy	Responsibility	Performance	Equal	Non-equal
1	√	–	√	–	–	–
2	–	√	√	–	√	–
3	–	√	√	√	√	–
4	–	√	√	√	–	√

Table 2
A sample RAM using RACI format.

RACI Chart	Person				
Activity	Ann	Ben	Carlos	Dina	Ed
Define	A	R	I	I	I
Design	I	A	R	C	C
Develop	I	A	R	C	C
Test	A	I	I	R	I

R = Responsible; A = Accountable; C = Consult; I = Inform.