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A multiple criteria decision model for assigning priorities to activities in project management

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Abstract

This study presents a model for supporting project managers to focus on the main tasks of a project network using a multiple criteria decision aid (MCDA) approach. A MCDA structure is important for dealing with this kind of problem, in the context of the project manager, when he/she solving a decision problem, taking into account several, often contradictory, points of view. A case study on the construction of an electricity sub-station is used to demonstrate the model proposed. As a result, managers can increase their performance in controlling project activities, particularly in a dynamic and changing environment.

Keywords: Multi-objective activity priorities; Multi-criteria decision method; Task classification

1. Introduction

Construction project management is a difficult task, when one takes into account the complexity, uncertainties and large number of activities involved. The increasing complexity and uncertainty of construction projects have led to many significant losses for the construction industry. Problems related to the management of projects are addressed in many studies. Sambasivan and Wen Soon [1] present several causes for losses in construction project management, such as a contractor's faulty planning, inadequate contractor experience, problems with subcontractors, shortage of material, non-availability of and failures in equipment, lack of communication between parties and mistakes during the construction stage. Hameri [2] visualises other problems: lack of discipline in controlling design change, diverse views on what the objectives of the project are and poor reactivity to sudden changes in the project environment.

Some considerations on construction project management at the building site need to be emphasized such as the high degree of current uncertainty about the construction process, the predominance of excessively informal decision aid coming from the project manager and the exaggerated over-emphasis given by project managers to controlling time and costs [3]. According to Cooke-Davies [4] there have been several past studies on the success of projects and which factors lead to project success. Despite this, a project may still under-perform and an understanding of project success factors alone is not sufficient for the success of a project [5].

The role of the project manager and his/her leadership style have been addressed as important aspects for the success of a project [5], although most of the literature ignores this [6]. The project manager's monitoring of tasks and his/her relationship with subordinates seems to be direct related to the performance of the project.

Greek and Pullin [7] also assert that many construction project management teams do not focus on those critical issues of projects. Project management, according to these authors, is an activity characterised by failure and these failures happen for two basic reasons: technical uncertainty and misjudgement of a project's urgency.

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In the context of construction projects, the basic question to be considered is how the project manager can control and monitor the large number of tasks contained in the project schedule, since long term planning hardly ever occurs without any changes. In practice, project managers apply different managerial practices to each type of project task, as they cannot give the same attention to all tasks. Hua Chen and Tau Lee [8] assert that a project manager's performance is directly related to his/her managerial practices. In their study, a performance evaluation model for project managers was constructed considering leadership behaviours that lead to managerial practices which contain some essential factors that may affect them.

Thus, this paper presents a more structured model for supporting the project manager so as to focus his/her attention on the main tasks of the project network. The identification of these main tasks is attended to by using multiple criteria decision aid methods (MCDA), in order to evaluate simultaneously the several aspects related to the performance of projects such as: deadlines, costs, contractors' experience and so forth. A case study on the construction of an electricity sub-station was carried out to demonstrate the structured model proposed.

2. Characterization of problem

Projects need to be divided into parts that admit to being manageable. This means defining a set of activities or tasks that are very often inter-related. In construction projects, any given set of activities is usually very large and complex.

In general, different forms of management are applied subjectively to each set of activities (or tasks), without prior assessment of the activities or a study being made of the problem, such decisions being based only on the manager's experience. An analysis of this decision problem can help tackle each of these activities by using appropriate management methods, as a function of the specific instances of the activities and thus permitting better use of the manager's knowledge, acquired from his or her experience on previous projects.

Different classes of managerial practices should be defined and used when executing and controlling project activities. These practices are different because the possible associated consequences do require so, for instance:

- A group of activities may require a tighter form of managerial practice, for example, tasks involving subcontractors where the probability of delay is high. This could represent the possibility of a very undesirable consequence for the project. In such cases, the manager would perform the activities himself.
- On the other hand, another group of activities could require a standard form of managerial practice. They might be delegated to a subordinate, in order to keep the project operational as scheduled.
- The project manager could also delegate another group of activities to a subordinate, but in this instance with very close monitoring by him/her. This close monitoring could be necessary with regard to the possibility of a medium undesirable consequence.

Classifying tasks into types of managerial practice are dependent on the context of the problem and should be driven by the project's objectives. Therefore, several criteria are considered for this purpose.

3. Proposed model structure for assigning priorities to activities in project management

The structured model proposed aims to assign project tasks into three classes of managerial practice, based on their characteristics in relation to a set of criteria. The application of the model requires two procedures with the aim of obtaining a general view of the problem and to regularly reassess the model.

The initial procedure consist of five steps presented below, and analyses all project activities without considering their inter-relationship only as an important basis for thinking through the problem.

1. Building activity networks
2. Managerial classes: definition
3. Set of criteria: definition
4. Assessment of activities for each criterion
5. Applying a multiple criteria method in order to classify activities.

The activity networks are used as a way of producing information for the proposed model. The use of the program evaluation review technique (PERT) allows the network to be determined making use of probabilistic judgments about the duration of the project. Methods like PERT and CPM are widely advocated techniques [9–11]. However, others network models, such as critical path method (CPM) could be applied.

Using project information at hand, the manager should define the classes of managerial practices. This definition is context dependent. For instance, three classes of managerial practices can be considered such as those presented in the previous section. Fig. 1 shows this classification problem.

The structure of the problem also involves the requirements for defining each class of managerial practice. It is related to the set of criteria to be considered in the evaluation process and configures one of the most important parts of the analysis. This set of criteria will be related, in some way, to the project manager's view about the objectives of the project. For instance, one can consider criteria such as: task cost, resource mobilization (supply contractor), duration (length), slack, security, variability (measured by the deviation and used when a probabilistic time estimate is used), number of successor activities based on the inter-relation dependence.