Keywords: complexity of projects, project management, scheduling, construction projects

Recently, construction projects have been studied from the viewpoint of complexity and issues such as emergence, where the project as a whole shows characteristics that may not be deduced from its activities, have received attention. Complexity measures for project schedules can be a useful tool for assessing the intricacies involved in scheduling and managing projects and are calculated based on the number of activities in a schedule and the degree of interrelationships between them. Complexity measures can be one indicator in determining planning, coordination, and control requirements of the project and is usually a good indicator of the time spent during scheduling and planning. Therefore, a project schedule complexity measure can be an important criterion in the selection of an appropriate project organizational form as well as other managerial decisions. Several factors however contribute to the complexity of project schedules, including the number of activities, the level of detail, and the shape of the project network, size of the project as well as the type and sophistication of the equipment used.

This paper addresses the issue of how the complexity measures of the project schedule correlates to that of the morphology of the project schedule network. A number of actual projects were collected and various complexity measures where calculated for these projects. The trends and distributions of these measures were analyzed and presented in this paper.

We are mainly concerned with the morphological structure of activity-on-the-node (AoN) project scheduling networks. Therefore, we describe a network as a set of nodes (N) to represent the project activities and a set of arcs (A) to represent the precedence relations between activities with a minimal time-lag of zero. One measure of the project morphology, which relates to project complexity was given by (Nassar and Hegab 2003) is

$$C_n = \begin{cases} 
100 \times \left\{ \frac{4(a - n + 1)}{n^2 - 4n - 1} \right\} \% & \text{if } n \text{ is odd} \\
100 \times \left\{ \frac{4(a - n + 1)}{n^2 - 4n} \right\} \% & \text{if } n \text{ is even}
\end{cases}$$

(1) (Nassar and Hegab 2006)

Other morphological measures have been suggested by (Tavares et al. and Tavares et al). In this research a number of past project schedules were collected and extensively analyzed. Thirty previous schedules were collected at random representing a wide array of project types, sizes and durations. Exploratory data analysis was conducted to ensure that the schedules collected were representative and that the project type, size and durations were uniformly distributed. The project networks obviously had differing morphologies as shown in Figure 1. Therefore, certain measures about each schedule were then calculated.
This paper aims at studying the morphology of construction project networks. The limitations of the papers include the relatively small sample of schedules studies and as a result a direction for future research includes collecting a more comprehensive and varied sample of previous project networks. Nevertheless, the technique presented here can be useful to characterize construction project networks and as such could lead to more precise analysis of project schedules by developing more accurate simulations models for example. Also another direction of research is conducting a comprehensive statistical analysis of the correlation between the morphological indicators and the project characteristics as well as the project performance. We also plan to use the measure as predictors of future project performance e.g. the likelihood of delay.

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