A decision support tool for subcontractor multi-project resource allocation

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It is common for a typical construction project to utilize dozens of subcontractors, with 80-90% of the work of most building projects in the U.S. being performed by subcontractors (Hinze and Tracey 1994). The performance of the subcontractor is critical to project success (Gray and Flanagan 1989; Arditi and Chotibhongs 2005). Commonly, subcontractors have to perform work on multiple projects simultaneously (Sacks 2004), but with limited resources, each subcontractor strives to maximize its workload at any given time for optimum resource utilization (O'Brien and Fischer 2000; Matthews, Howell et al. 2003). Thus, subcontractors work activities are subject to individual resource constraints (Kim and Paulson 2003).

During construction, changes frequently occur and conflict with subcontractor’s capacity constraints, causing immediate reallocation of resources (O'Brien 1998). As a result, resource allocation due to frequent changes is a critical challenge for subcontractors. Because of frequent changes, subcontractors normally switch resources among projects, and they strive to understand the potential impacts after reallocating resources. Unfortunately, most existing tools provide limited support for resource reallocation across projects, especially for rapid what-if analysis scenarios for decision making. This leads to reliance on manual resource allocation methods.

In response, this paper presents a practical tool for multi-project resource allocation, including support for what-if scenario analysis. A test case with a variety of projects and task durations is presented to demonstrate the tool. The tool was developed using Visual Studio.Net (2005) environment and the Visual Basic.Net programming language. The tool allows users to input information through a Graphical User Interface (GUI) and uses XML as the internal data exchange format.

The key capability of the tool is to provide the what-if analysis scenario of resource reallocation. The following figure presents the screen shots of reallocating a resource. Figure (a) shows the current status of project and task, as well as the current resource utilization of the selected resource overtime. The upper left project status table shows the priority, current expense and status of each project. The lower left task status table shows the status of each task, including the original start and finish dates and actual start and finish dates. While selecting a resource, the lower right capacity utilization chart shows the current capacity utilization of that resource overtime. Based on the information provided, a manager can reallocate a resource to a desired project and task.

Figure (b) shows the potential impacts on overall schedule projects and tasks. The upper left project impact table shows the impacts of all projects on schedule and cost after reallocating the resource. The table below is the task impact table, which displays the impacts of all tasks on schedule and cost. The project cost impact chart, and the task duration impact chart locate beside the two tables and graphically present the differences before and after reallocating the resource. The lower part of
Figure (b) presents two capacity utilization charts. The left chart with blue bars shows the capacity utilization overtime of a selected resource before reallocating the resource, while the right chart with pink bars shows the capacity utilization overtime after reallocating the resource. The tool was validated with a robust test case and was accepted from the industry’s perspective.

Figure. What-if analysis of reallocating a resource

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References


