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Improved critical-chain Multi-project planning: Using more realistic assumptions

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Abstract— This paper addresses the problem of multi-project planning using critical chain concept, while considering more realistic assumptions, such as: precedence relations among projects, bottleneck resource transfer times, resource constraint considerations, and the condition that all projects may not need the bottleneck resource. Two algorithms with different assumptions are presented and the results of planning multi-project test problems, using the two different algorithms are presented.

Keywords—component; Multi-project planning; Critical chain; Uncertainty.

I. INTRODUCTION

Critical chain approach in project management was first presented by “Goldratt” in 1997 in a book named “Critical chain”. Critical chain is considered as one of the popular methods in dealing with projects uncertainty, as it eliminates the excessive safety times from activities and saves the omitted safety times in form of buffers which have two functions: (1) absorbing fluctuations in activities duration, (2) an alarm signal for assessing the progress of the project compared to the base-line plan. Critical chain also presents a stepwise method for planning the start and finish times of projects in a multi-project environment, based on a bottleneck resource capacity and idle time. For this aim, the critical chain considers some straightforward and not necessarily realistic assumptions, which are: (1) the bottleneck resource is needed by all projects (2) there is no precedence relation among projects, etc. While, in some cases, these two assumptions might not hold true. For example, consider the condition that we face planning some projects in a program phase, with precedence relations among some of them, or the condition that all projects may not need the bottleneck resource. Hence, we need to extend the solution presented by critical chain for planning multi-projects to be used for projects under more realistic conditions.

II. LITERATURE REVIEW

After critical chain concept was presented, many books, papers, websites, online groups, etc. scrutinized its characteristics and soon it became popular among project managers [1], [2]. Most of the papers on critical chain scope, discussed about assumptions, characteristics, and the steps critical chain presents in single project (e.g., [3], [4], [5], [6], [7], [8], [9]), and multi-project planning (e.g., [10], [11], [12]). While some others discussed about merits and pitfalls we may have to notice while using critical chain for project(s) planning (e.g., [1], [2], [13]).

As it was discussed earlier, just a few number of papers have addressed the problem of multi-project planning, while using the critical chain proposed framework. The main reason is that, the assumptions considered by critical chain for multi-project planning, are not necessarily accordant to what happens in reality. Moreover, the procedure presented by critical chain for planning multi-projects (staggering projects based on bottleneck resource capacity and workload) considers the not necessarily always true assumption that all projects need the bottleneck resource. Hence, in this paper, the problem of multi-project planning using critical chain concept while considering more realistic assumptions is addressed.

III. CRITICAL CHAIN PROCEDURE

The way critical chain accomplishes the projects planning, (both single and multi-projects), under two categories is discussed as follows:

A. Single project planning procedure

The main steps for single project planning are as follows [12]:

- I. Reduce activity durations by eliminating safety margins: Use 50% certainty for activity duration estimation.