Critical Chain Project Management: An abductive view

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OR58 Portsmouth UK 6-8 September 2016
Critical chain project management

Assumption: Adding buffer at each task protects the project from inevitable uncertainty

- Project success
- Reduce risk
  - Reduce duration
  - Less buffer
    - More buffer
      - Assumption: Any buffer adds to planned duration and we can act according to the plan
Critical chain project management

We can **reduce** variability, but we cannot **eliminate** it, because it is **inherent** to the nature of a Project.

We must **manage** the **variability** that remains.
Critical chain project management

Task 1

Task 2

Task 3
Critical chain project management

Task 1

Task 2

Task 3
Critical chain project management
Assumption: Adding buffer at each task protects the project from inevitable uncertainty

Injection: Insert more buffers at the end of the project, and remove individual buffers at the end of each task

Assumption: Any buffer adds to planned duration and we can act according to the plan
# Global survey of project management practitioners

Q: How often does your organization use each of the following?

<table>
<thead>
<tr>
<th></th>
<th>Global Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project performance measures</td>
<td>29%</td>
</tr>
<tr>
<td>Risk management practices</td>
<td>28%</td>
</tr>
<tr>
<td>Change management practices</td>
<td>27%</td>
</tr>
<tr>
<td>Program management</td>
<td>25%</td>
</tr>
<tr>
<td>Resource management to estimate and allocate resources</td>
<td>25%</td>
</tr>
<tr>
<td>Internal/proprietary methodologies</td>
<td>24%</td>
</tr>
<tr>
<td>Project portfolio management</td>
<td>21%</td>
</tr>
<tr>
<td>Earned value management</td>
<td>12%</td>
</tr>
<tr>
<td>Waterfall project management practices</td>
<td>11%</td>
</tr>
<tr>
<td>Critical chain project management practices</td>
<td>9%</td>
</tr>
<tr>
<td>Agile/Incremental/Iterative project management practices</td>
<td>9%</td>
</tr>
<tr>
<td>Lean project management practices</td>
<td>7%</td>
</tr>
<tr>
<td>Scrum</td>
<td>7%</td>
</tr>
</tbody>
</table>

- **Always**
- **Often**
- **Sometimes**
- **Rarely**
- **Never**
Literature review

On the one hand, CCPM has received much praise:

- Direction for project management in the 21st century (Newbold, 1998)
- Simple and workable (Newbold, 1998; Steyn, 2002; Vrincut, 2009; Raz et al., 2003)
- Stable schedule (Herroelen, Leus, & Demeulemeester, 2002; PMI, 2008; Woeppel, 2005)
- Addresses duration uncertainty well (Elton, 1998; Herroelen et al., 2002; Herroelen & Leus, 2001; Raz, Barnes, & Dvir, 2003)
- Many published success stories of CCPM application (Bevilacqua, Ciarapica, & Giacchetta, 2009; Hwang, Chang, & Li, 2010; Leach, 1999; Newbold, 2008; Paseuth, 2003; Smith, 2012; Stratton, 1998; Umble & Umble, 2000; Viljoen, 1997)
- Hundreds more recorded successful applications (Realization Technologies, Inc, 2010)

On the other hand, CCPM has been criticized for:

- Oversimplification (Herroelen & Leus, 2001)
- Not innovative (Trietsch, 2005)
- Lack of mathematical analysis (Ashtiani, et al., 2007; Jian-Bing, et al., 2008; Kuo, et al., 2009)
- Rejects data in later stages of the project (Dietrich & Lehtonen, 2005; Cohen et al., 2004)
- Not applicable to a wide range of projects (Mckay & Morton, 1998; Raz et al., 2003)

How and why is CCPM so successful in some projects and why it is not used in many other projects?
The Abductive research process

- A comprehensive scholarly literature on CCPM
- Broader TOC literature
- Broader project management literature

Constraint classification for projects
Theorizing CCPM applicability

Where and why CCPM is applicable and how TOC concepts can improve projects beyond those boundaries

Preliminary Literature review:
- Theory of constraints
- Critical chain project management

• Past experience
• Secondary empirical data (Project success literature)
• Case study data

Reference: Kovacs & Spens, 2005
Parts of abductive research

**Empirical Data**

**Sources of Data:**
- Case selection: Purposeful sampling
  - Interviews of project actors, Project and project related documents, observation

**Method of Analysis:**
- Case study and TOC thinking process tools

**Theoretical data**

**Sources of Data:**
- CCPM database 600 CCPM papers
- A project management database
- Other scholarly paper and books

**Methods of Analysis:**
- Qualitative Analysis: Analyzing and coding scholarly publications
- Content Analysis: Extracting trends with the aid of NVivo
- Text mining: Extracting trends with the aid of Leximencer
<table>
<thead>
<tr>
<th>Code Name</th>
<th>Type-Sector</th>
<th>Number of interviews</th>
<th>Role of interviewees and codes</th>
<th>Other sources of information</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Case 1’</td>
<td>Software- Commercial- TOC/CCPM user</td>
<td>5</td>
<td>Project manager (PM), Lead consultant (LC)</td>
<td>Observation (of the software used) The firm’s website</td>
</tr>
<tr>
<td>‘Case 2’</td>
<td>Software- Commercial</td>
<td>5</td>
<td>Project manager (PM (PM 2), Scrum master (SM))</td>
<td>The firm’s website</td>
</tr>
<tr>
<td>‘Case 3’</td>
<td>Software-service- Education</td>
<td>6</td>
<td>Scrum master (SM) Associate director (AD) Product Owners (PO1 and PO2)</td>
<td>Project documents, the firm’s website, observation of a full day planning session and one daily stand-up</td>
</tr>
<tr>
<td>‘Case 4’</td>
<td>Policy advisory- Government</td>
<td>3</td>
<td>Project manager (PM)</td>
<td>2 meetings with project consultant and project manager, 2 workshops conducted as part of the project, online material</td>
</tr>
<tr>
<td>‘Case 5’</td>
<td>Construction- Commercial</td>
<td>4</td>
<td>Project manager (PM), Site manager (SM)</td>
<td>The firm’s website, project documents</td>
</tr>
<tr>
<td>‘Case 6’</td>
<td>Service- Government</td>
<td>2</td>
<td>Project manager (PM)</td>
<td>3 organisation level meetings, with project manager and two of his upper-level managers prior to the official case study, the firm’s website</td>
</tr>
<tr>
<td>‘Case 7’</td>
<td>Improvement- Education</td>
<td>2</td>
<td>Project manager (PM)</td>
<td>1 organisation-level two upper managers prior to the official case study, the firm’s website, project documents</td>
</tr>
<tr>
<td>‘Case 8’</td>
<td>Construction- Commercial</td>
<td>1</td>
<td>General manager (GM)</td>
<td>Online material suggested by the interviewee</td>
</tr>
<tr>
<td>‘Case 9’</td>
<td>Service- Government</td>
<td>1</td>
<td>Project manager (PM)</td>
<td>The firm’s website</td>
</tr>
<tr>
<td>‘Case 10’</td>
<td>Documentary film Not-for-profit</td>
<td>2</td>
<td>Director and producer (DP),</td>
<td>Materials suggested and provided by the interviewee</td>
</tr>
</tbody>
</table>
Case Analysis

Projects characteristics were analysed using variables from following classification models:

Basic project information

End and Means (Pearson, 1990)

Software–Hardware / strategic goal of the project / technological uncertainty (Dvir et al., 1998)

Strategic goal of the project / Market uncertainty / Technological uncertainty / System scope / Pace (Shenhar, 2001; Shenhar et al., 2002)

TOC thinking process were used for analyzing the projects

In particular Goal tree* was used to analyze “What is the goal and how it is measured?”

* Dettmer 2011
Theoretical analyses of CCPM’s underpinning Model of reality
Text mining and content analysis
Evolution of the 2X2 Model

![2X2 Model Diagram]

- Quadrant 1: Non-dedicated, Fixed
  - 'Case 3'
  - 'Case 8'
  - 'Case 10'

- Quadrant 2: Dedicated, Fixed
  - 'Case 6'

- Quadrant 3: Non-dedicated, Variable
  - 'Case 5' A
  - 'Case 7'

- Quadrant 4: Dedicated, Variable
  - 'Case 1'
  - 'Case 4'
  - 'Case 5' B
  - 'Case 9'

Scope uncertainty

Value of the output

Team Type

Resource Flexibility
Empirical Data

We developed a goal tree for each project and observed:

Some project managers defined success factors in their projects in terms of ‘project management success’:
Time, cost, quality, customer satisfaction
Their goal unit was a fixed value that was set before the project started

Other project managers defined the success of their projects in terms of ‘project success’: the product itself
Project value was variable and was measured as the quality and quantity of its output
What is the goal and how is it measured?

‘Theoretical data’: from published papers

CCPM attempts to prevent scope creep, because more of the scope is not seen to be good!

Assumption: Scope and its value are defined prior to execution

However, we found in some projects:
Scope and its value emerge during execution, and an increase in goal units in these projects is considered desirable.
How do we produce the goal?

Empirical Data

Human resources acquisition and team size
Some projects required a specific person.
Other projects exhibit more flexibility in human resource acquisition.

Project workflow and team structure
Some projects used a non-dedicated team and adopted network scheduling.
  • Each task was performed by individuals or groups that specialised in performing that particular task
  • These individuals or groups were engaged in multiple projects and attended to the particular project temporarily at the specific time

Other projects used dedicated teams:
It was observed that in these projects, a dedicated team carries the baton together throughout the project
## How do we produce the goal?

‘Theoretical data’: from published papers

<table>
<thead>
<tr>
<th>CCPM assumption</th>
<th>Broader project environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects have a workflow similar to a network</td>
<td>Project processes are diverse</td>
</tr>
<tr>
<td>‘Relay race’ reduces project duration</td>
<td>Projects may be executed by a dedicated cross functional team</td>
</tr>
<tr>
<td>Schedule and buffer management meetings as means of</td>
<td>Schedules cannot coordinate non sequential processes</td>
</tr>
<tr>
<td>coordination</td>
<td></td>
</tr>
</tbody>
</table>
Diversity in Project Process
The CCPM solution

CCPM accepts variability and uncertainty as facts of life and use Buffer management to account for it and uses relay race to prevent project being delayed at handover times.

Because it is assumed that projects are always done using a non-dedicated team.

But is variability really a fact of life?
The impact of team type on schedule variability: (non-dedicated teams)

- Required human resources varies in action from what is planned
- There is variability in performing individual tasks
- Schedule is used to coordinate people and tasks
- Increased variability in project schedule
- The team members work on other projects before and after their turn in the project
- It is expensive to keep team members waiting idle for their turn in the project
- Team members are not continuously needed on the project
- There is variability in other projects
- Project uses a Non-dedicated team
- Tasks are designed to be carried out sequentially
The impact of team type on schedule variability: (dedicated teams)

- Reduced variability in the project schedule
- Project uses a Dedicated team
- There is variability in performing individual tasks
- Schedule maybe used to coordinate tasks
- It is expensive to keep team members waiting idle for their turn in the project
- Project is isolated from variability of other projects
- The team members take up tasks outside their assigned tasks when they are free
- Team members continuously work on one project
- If a task is not completed by the assigned member, their coworkers will help to complete it
## Summary of CCPM assumptions

<table>
<thead>
<tr>
<th>POOGI</th>
<th>CCPM assumptions highlighted in this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite 1. Define the system and its goal</td>
<td>Project is one system and there is <strong>unity of purpose</strong>. Human behaviour follows cause-and-effect logic. If a system is well-designed, complexity due to human behaviour can be managed.</td>
</tr>
<tr>
<td>Prerequisite 2. Define the measurements that align the system to that purpose</td>
<td>Project delivers a minimum viable product that generates a <strong>fixed throughput</strong>. This product is defined using necessity-based logic, prior to project execution. Project throughput is zero until completion. Therefore, projects are <strong>urgent</strong> and <strong>duration</strong> is their core measure.</td>
</tr>
<tr>
<td>1. IDENTIFY the system's constraint(s).</td>
<td>Project is a unidirectional <strong>sequence</strong> of events or tasks with no loops, where the longest chain defines its duration.</td>
</tr>
<tr>
<td>2. Decide how to EXPLOIT the system's constraint(s).</td>
<td>The only way to reduce duration is to shorten the Critical Chain by fast tracking, shared padding, and eliminating schedule conflicts of resources.</td>
</tr>
<tr>
<td>3. SUBORDINATE everything to the above decision</td>
<td>Variability and uncertainty cannot be reduced, therefore buffer management is the only way to coordinate a <strong>non-dedicated team</strong> leaving and returning to the project.</td>
</tr>
</tbody>
</table>