0 to 60
Intro to Project Management

TOCICO webinar

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Typical Project Results

Late

Over Budget

Compromise scope or content

QUALITY

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Typical complaints

- Our project lead times are too long.
- Project ROI and cash flow are frequently jeopardized.
- Due dates, budget, quality and/or scope are frequently compromised.
- There is a constant battle to reduce safety time.
- We sometimes miss dependencies in the project plan.
- Deliverables are not always clear.
- Critical resources are losing a lot of time moving from one task to another and having to report progress on all tasks.
Do projects fail because of uncertainty (in content, skills, processes, etc.)? Or is failure due to the common practices for managing projects?

Erroneous belief: In order to finish the project on time, we must finish each task on time.

Given the high level of uncertainty in projects, resources must provide estimates of how long it will take to complete the task – which then become commitments. How much safety is included?
Task time estimates

Which time will the resource provide?

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Conclusion: significant safety time is inserted

Do most tasks finish early?

Even if we finished a task early, could the next task begin early?
Impact of Integrations Points

When can B 15 task begin?
If the completion of each task relative to the planned start of B 15 is:
Y 7: 5 days late
B 10: 2 days early
G 15: 10 days late
R 5: on time
P 10: on time

We can not take advantage of early finishes.
Delays are always passed on at integration points.

What is the possibility of at least one task finishing late?
Student Syndrome

Level of effort

Task Start Date

Task Due Date

When will Murphy strike?

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Bad Multitasking

Occurs when resources stop work on a task to start another task even though they could still work on the first task.

The lead time increases significantly, even without considering additional setup time.
Other Resource Behaviors

- Work expands to fill the time due to lack of clear completion criteria (Parkinson’s Law).
- Work continues because it must take the full scheduled time to be of high quality (3-Minute Egg Rule).
- Resources do not typically report early finishes (lose negotiating ability for future task time estimates).
Conclusions regarding safety time in the project plan

- **Significant** safety is inserted into the project plan.

- Safety is **wasted** due to:
  - Impact of integration points
  - Student Syndrome
  - Bad Multitasking
  - Parkinson’s Law
  - 3-minute Egg Rule
  - Unreported Early Finishes
Another issue

- The additive rule is used to determine the project due date. Estimate each task time and find the sum of the times on the critical path.

- The due date is too early
  - if resource dependencies were not considered.
  - due to the impact of integration points.
Definitions

- **Critical Path**: longest sequence of task dependencies in terms of time. This is the traditional term and path that is NOT used in TOC.

- **Critical Chain**: longest sequence of task **and** resource dependencies in terms of time. In other words, it is the longest sequence of dependencies, with explicit consideration of resource availability.
The vicious cycle

Resources receive a poor evaluation for missed deadlines
Which causes resources to inflate estimates more
The end result:

• The project still does not complete on time, within budget and scope.
• Promised lead times for future projects are even longer (causing lost work?)
First, we identify the solution for individual projects.

Later, we will address the additional solution elements required for multi-project environments (where resources are shared across projects)
Dilemma regarding: *Our project lead times are too long*

**Background:** Our customers have been complaining that our project lead times are too long. Some customers have defected to our competitors as a result of our long lead times.

**Objective**

A. Satisfy customer and shareholder expectations (time, budget, scope)

B. *We must* Make reliable promises

C. *We must* Contribute to creating a competitive lead time advantage and not create opportunities for wasting time

**Requirement / Strategy**

**Prerequisite / Tactics**

D. *We Feel Pressure to* Add significant safety time to each task time estimate

D’. *(But) We Also feel Pressure to* Add the absolute minimum safety to task time estimates

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Dilemma regarding: **Critical resources are losing a lot of time moving from one task to another and having to report progress on all the tasks**

**Background:** Our resources have to spend a long time getting up to speed on a task that was set aside for a period of time. This time is non-productive time. A significant amount of set-up and set-down time is affecting resource productivity.

**Objective**

A

Satisfy customer and shareholder expectations (time, budget, scope)

**Requirement / Strategy**

B

*We must* Ensure that progress is made on all tasks

C

*We must* minimize time lost on “set-ups” and progress reporting

**Prerequisite / Tactics**

D

*We Feel Pressure to Frequently multitask*

D’

(But) *We Also feel Pressure to Limit the amount of multitasking*
Dilemma regarding: *Project ROI and cash flow are frequently jeopardized*

**Background:** We must pay our subcontractors when they start working for us and for materials when we start using them. However, we do not receive payments until progress is made on the project. Therefore, our cash outflows exceed our cash inflows during initial stages of projects.

**Objective**

A. Satisfy customer and shareholder expectations (time, budget, scope)

**Requirement / Strategy**

B. *We must* Ensure that we have sufficient safety for each task

C. *We must* Postpone spending

**Prerequisite / Tactics**

D. *We Feel Pressure to* Start work as early as possible

D’. *(But) We Also feel Pressure to* Delay start of work as late as possible (especially on subcontractors)

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Systemic Core Conflict/Dilemma

A. Satisfy customer and shareholder expectations (time, budget, scope)

B. We must Complete the project based on the original promises

C. We must Finish projects in minimum time and cost

D. Feel Pressure to Take actions / use rules that will optimize task and resource performance (increase safety, multitasking; start as early as possible)

D’. (But Also) Feel Pressure to Take actions / use rules to improve overall project performance (reduce safety, multitasking; start as late as possible)
Direction of the Solution

- Do not turn estimates into commitments.
- Minimize the wasting of safety.
- Enable early and late finishes to compensate each other.
- Minimize bad multitasking.
Symptomatic Core Conflict/Dilemma

A
Manage projects well

B
We must Meet endangered original commitments

C
We must Not jeopardize other original commitments

D
Feel Pressure to Compensate for early mis-estimations / mis-considerations

D’
(But Also) Feel Pressure to Not compensate for early mis-estimations / mis-considerations
TOC’s Five Focusing Steps

1. Identify the system’s constraint(s)
2. Decide how to exploit the system’s constraint(s)
3. Subordinate everything else to the above decision
4. Elevate the system’s constraint(s)
5. If in the previous steps a constraint has been broken, go back to step 1. Warning: do not allow inertia to cause a system’s constraint.
Solution for each project

1. Identify the System’s Constraint(s)
   Identify the critical chain (the longest sequence of task and resource dependencies)

2. Decide how to exploit the System’s Constraint(s)
   Ensure that the critical chain time is minimized, but protected strategically with safety

   • We use an early warning mechanism (resource buffer) to ensure that resources working on the critical chain are prepared to start on time or start earlier than the scheduled start date if gains were achieved in upstream tasks on the critical chain
   • The project buffer (which is HALF of the safety removed from critical chain tasks) is used to ensure timely or early completion of the project overall.
   • Introduce and use measures that reinforce road runner and relay race behaviors.
Solution for each project

3. Subordinate everything else to the above decision

- Use feeding buffers (HALF of the safety removed) wherever non-critical paths/tasks feed into a critical chain task [to protect the constraint from delays].
- Schedule non-critical chain tasks to start as late as possible.
- Introduce and use measures to reinforce road runner and relay race behaviors [eliminates problematic behaviors].

4. Elevate the System’s Constraint(s)

Shorten project lead time by adding resources to break resource contention.
This is the original PERT/CPM network with safety inserted.
Remove safety time

Cut task times in half and push all tasks as late as possible while meeting task precedence relationships.
Resolve resource contention
Resolve resource contention
Resolve resource contention
Identify the critical chain
The project buffer is half the safety removed from the critical chain tasks (equal to half the sum of their times)
Insert the feeding buffers

The feeding buffer, which is half the safety removed from the non-critical chain tasks, is placed where a path feeds into the critical chain or end of the network.
Insert the resource buffers

Project lead time = 90
(25% less than 120)
PB is 1/3 of lead time
Task time distribution

- Original task time estimate cut in half
- 50% time estimate
- Original task time estimate (with significant safety inserted)

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Multi-project Environment

- In this environment, resources are shared across projects.
- The elements of the solution for individual projects are still applied.
- However, more solution elements are required.
Erroneous Belief:

The sooner one releases a project in a multi-project environment, the sooner the project will finish.
Typical Project Manager Complaints

- Often, resources are not available when needed (or even when promised).
- We have frequent conflicts with resources and resource managers.
- The due date, quality, scope and/or budget of projects are frequently compromised.
- Scope creep frequently occurs.
- It is time consuming to obtain detailed work breakdown structures from resources or resource managers.
Typical Resource Complaints

- Project priorities are constantly changing.
- Projects are undertaken without consideration of limited resources.
- We are stressed out.
- We have to compromise scope.
- There is too much rework.
We have frequent conflicts with project managers.

We feel pressured to increase staff to handle peak project loads.

There is too much rework.

It is difficult to know which projects to assign resources to.
Typical Executive Concerns

- Organization is too slow responding to important opportunities.
- Project lead times are too long.
- Some projects are abandoned.
- Project ROI and cash flow are frequently jeopardized.
- Too few projects are completed.
- The due date, quality, scope and/or budget of projects are frequently compromised.
Systemic Core Conflict/Dilemma in Multi-Project Environments

A
Successfully manage all projects in a multi-project environment

B
We must Demonstrate progress on all projects

C
We must Ensure the success of each project

D
Feel Pressure to Begin new projects without considering available capacity and work on all projects simultaneously

D’
(But Also) Feel Pressure to Not begin new projects without considering available capacity and not work on all projects simultaneously

Solution: Release and schedule projects based on global project priorities and available resource capacity.

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# Experiment

## Run 1

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<thead>
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<th>Project</th>
<th>Start Time</th>
<th>Finish Time</th>
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## Run 2

<table>
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<th>Start Time</th>
<th>Finish Time</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Identify the System’s Constraint(s)

Identify the company constraint resource (known as the drum or synchronizer). This could be a more loaded resource or a resource that is used across all (or most) projects if we do not have a heavily loaded resource. (The constraint is either a resource or the ability to complete projects that share resources.)

2. Decide how to Exploit the System’s Constraint(s)

Stagger release of projects based on the drum to finish each in less time.

- Prioritizing projects globally based on T, I and OE.
- Preparing the critical chain schedule for each project independently.
Additional Solution Elements

2. Decide how to Exploit the System’s Constraint(s)
   • Creating the drum schedule based on global project priorities.

3. Subordinate everything else to the above decision
   • Inserting capacity constraint buffers between projects to ensure that the project plan is achievable and to minimize resource contention across projects.
   • Inserting drum buffers to ensure that the drum is not starved for work.

4. Elevate the System’s Constraint(s)
   Increase the capacity of the drum resource.
Capacity Buffer

- Ensures that there is enough stagger between projects to minimize peak loads on all other resources.
- Used for the resource known as the drum.
- Includes ALL of the safety time removed from the drum tasks.
Project status

- Percentage of critical chain completion, thus causing us to focus on the constraint
- Percentage of project buffer completed relative to the percentage of the critical chain completed
- Rate of consumption of project buffer (In a given time period, is the rate more or less than 1/3 of the interval time?)
CCPM Results

- **Harris Corporation (now Fairchild Semiconductor):** An 8-inch wafer power fabrication facility was delivered in 13 months, compared to typical time frame of 54 months and the pre-planned time frame of 18 months. Production reached 90% of plan, 21 days after opening the plant, compared to industry norm of 18 months. By speeding time-to-market, payback is twice as fast as planned.

- **Shea Homes:** A reduction of cycle time for developing the land and building a home from 91 days to 56 days, resulting in millions of dollars saved in annual interest costs alone.

- **Pharmacia:** This pharmaceutical company implemented CCPM in clinical supplies, a vital link in the drug development process. On-time performance increased from 48% to over 90%, while lead times decreased from a range of 8 to 12 weeks to three weeks. The package rate increased from 20 to 50 per month.
About the presenter

Lisa A. Ferguson, PhD, is the founder and CEO of Illuminutopia, an organization that is focused on “Illuminating the way to utopia for individuals, organizations and society” (www.illuminutopia.com). Dr. Ferguson is the author of the chapter on Strategy and Tactic trees in the *Theory of Constraints Handbook*. Professor Ferguson has taught several programs on how to write S&T trees. She is currently working on completing her book on writing S&T trees, which will be published in 2013. Until June 2008, Dr. Ferguson spent a year working one-on-one with Dr. Eli Goldratt, the founder of the Theory of Constraints (TOC), while learning how to write. Professor Ferguson has trained TOC Experts and Supply Chain Logistics implementers in India, Japan and the U.S. as a faculty member of Goldratt Schools. Professor Ferguson has a PhD in Business (in Operations Management) and an MBA. Dr. Ferguson taught operations management full-time at a university for 10 years. Dr. Ferguson was a TOCICO board member from 2008 to 2011 and is TOCICO certified in Supply Chain Logistics, the Thinking Processes and Critical Chain Project Management.