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HOW TO IMPLEMENT CRITICAL CHAIN PROJECT MANAGEMENT

A FIELD GUIDE

01 Pursue "Time Efficiency" Not "Resource Efficiency"

While today's common practices for enterprise project management are driven by resource efficiency metrics, making efficient use of time is the key to success. Facilitating the flow of work in projects is important for both operational and business perspectives.

Operational Performance. When projects run late, you experience more than just project delays. There are cost overruns and, all too often, compromises in scope and quality. Consider the following:

- Even though managers attack cost overruns by making resources more efficient, it is well documented – and common sense – that the longer a project takes, the more resources it will consume.
- Once projects fall behind, additional expediting costs are also incurred.
- For capital-intensive projects, the longer the project takes, the higher the cost of the tied-up money.
- In multi project organizations, time also equals throughput. Simply put, the faster that a project gets completed, the faster resources become available for the next project.
- There is no argument that processes and discipline are needed to ensure that customer requirements are understood, and that work gets done with high quality; BUT these goals are easily compromised when projects face time pressures. Thus, having enough time is vital for high quality.

Business Performance. Whether you are developing new products, constructing infrastructure, overhauling aircraft or shutting down plants for maintenance, the faster the project gets done, the more value it delivers.

- As product life cycles shrink, faster time-to-market translates into higher pricing and larger market shares.
- The faster the infrastructure projects get finished, the faster their benefits start accruing.
- Faster turnaround in aircraft and ship MRO equates to higher fleet availability with a smaller fleet.
- Faster maintenance means longer availability of the plant and machinery for production.

Project-based businesses that feed into the above value chains can create a competitive advantage by guaranteeing on-time delivery of their sub-projects. And, if they are on the critical path of overall projects, they can even charge a premium!

It can be frustrating, that despite all the best efforts, projects rarely finish on time, stay within budgets and deliver the full scope. In such a situation, how can we even think about doing more projects faster, oftentimes, with fewer resources?

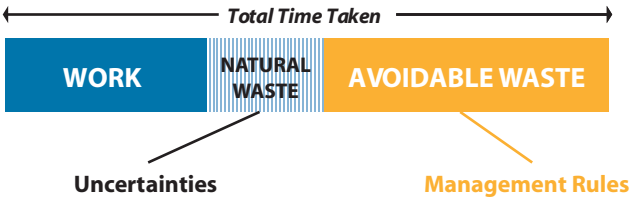
There is no doubt about it; more of the same is not working and a fresh approach is needed. We need to change how we manage project execution. The change begins with a major recognition. **Time is the most precious resource in projects.**

02 How Time Gets Wasted During Project Execution

Once we understand that managers must focus on time efficiency rather than resource efficiency, a natural question is, "how can we squeeze projects for time when it is difficult to meet even current timelines?"

After all, projects are full of uncertainties: work takes longer than planned; technical issues come up; vendors are late; approvals get held up; resources are not available as promised... no matter how painstakingly you plan, you will always get surprises in execution!

However a closer look reveals that rather than uncertainties themselves, the real problem is how we manage them.



Management Mistake 1: Starting projects ASAP. Project managers compete aggressively for shared resources. They start their project as soon as possible, hoping that it will maximize their chances of securing resources. In reality, the exact opposite happens – resources get spread thin, queues increase and projects take much longer than they should.

Management Mistake 2: Managers treat planning estimates as execution commitments. This means the estimates have to include safety time to account for all the uncertainties. Thus, project plans become longer.

Unfortunately in execution, while most tasks finish on time, almost none of the tasks finish early (a.k.a. Parkinson's Law: work expands to fill the time available). To compound, some tasks still take longer than planned, causing the entire project to still be late! Bottom line: local commitments only prolong the project without significantly improving on-time delivery.

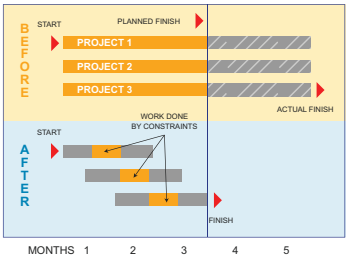
Management Mistake 3: The absence of good task level priorities in execution. Not knowing what to do and when, resources getting pulled in divergent directions; project managers compound this confusion by pressurizing resources to multitask (work on their tasks without completing other projects' tasks). Rather than helping, multitasking actually causes all projects to be stalled.

Our experience with over 300 organizations is that 30-50% of the time and capacity in projects are wasted due to traditional management practices. Fortunately, managers no longer need to feel bound by these traditions. The Critical Chain method provides a new set of rules for managing project execution.

03 New and Effective Rules for Managing Project Execution

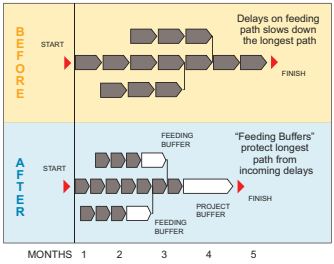
As we have seen, traditional management practices waste time. Fortunately, managers no longer need to be bound by those traditions. Critical Chain now provides a new set of rules to effectively manage project execution.

Rule 1: Reduce Multitasking and Pipeline – In order to reduce multitasking at the individual level we must institutionalize low WP at the organizational level. Limit the number of projects in execution based on the most limited resources. Since you can carry out only as many projects as you can get through the most limited resources, releasing more projects will only spread your resources thin. **Enforce this rule even if it means leaving other resources idle!** Build and follow a master schedule based on this reduced WIP in your constraint resource with aggressive cycle times calculated using Little's Law.



In order for these concentrated resources to be most effective, they must have what they need to do the work before starting. The concept of **Full Kitting** is an important supporting solution to reducing multitasking, as it forces us to proactively tackle the usual hold ups in execution. Capacity should be dedicated to ensure projects start with everything they need to complete the work without predictable interruptions.

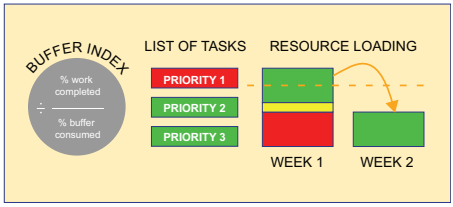
Rule 2: Buffering And Flexible Project Plans – In order to focus the organization around the flow of a project, we must build flexible plans (rather than fixed schedules) for execution. For a network to be flexible, the task owners must not be held accountable to each completion date, but rather the completion of the project. Each task in the network is then cut to remove any local safety and to create a buffer which can give us signals of where to focus management attention.



Rule 3: Buffer Management – Monitor the consumption of buffers to prioritize tasks and provide early warning signals. Give the highest priorities to tasks with the smallest buffers ahead of them. Initiate recovery actions if the remaining buffers fall below a certain threshold.

Buffer management must also be used for continuous improvement efforts. Activities and areas that consistently consume the most buffers should be targeted for root causes analysis and improvement.

Hundreds of organizations in a wide range of industries have proven that these rules allow you to do more projects faster with the same resources.



04 Attack Policies, Not Behaviors

So far we have discussed how Critical Chain provides a new set of rules to effectively manage project execution:

- **Reduce Multitasking** - Limit the number of projects in execution based on the most limited resources.
- **Buffering** – Build flexible schedules that allow tasks to be late and strip out safeties hidden inside task estimates.
- **Buffer Management** – Monitor the consumption of buffers to prioritize tasks and provide early warning signals.

Used successfully by private and public sector organizations around the world, Critical Chain is redefining performance standards for project-based operations. 20-40% improvements in throughput and lead times are typical. The ability to deliver projects on time and on target is even more icing on the cake.

It is however a myth that you need to change how people behave (procrastination, multitasking, unnecessary polishing of already finished work, etc.) in order to improve project performance. The reality is that the following policy changes will be much more productive:

1. Replace measurements that require individual tasks to finish on time with the ones that drive low work-in-process.
2. Mandate a minimum amount of protective time in each project, typically 50% of the sum of tasks, to assure uninterrupted flow of work.
3. Make project due-dates sacrosanct, to be changed only by senior management.

Yes, you might get some initial successes by focusing on behaviors, but they won't last. More important, changing behaviors in a large organization can take forever. Instead, institutionalizing these new Critical Chain based management policies will change behaviors on their own much faster. Behaviors will change gradually in response to these new management policies, which then will enhance the results even further.

05 Putting the Rule 1 into Practice

In this part we outline how to apply the Reduce Multitasking and Pipeline Rule to multi-project environments. The Reduce Multitasking and Pipeline Rule is to concentrate resources on a few projects (or work streams). Its benefits are fewer shortages of resources, more attention from experts and managers to resolve problems and faster completion. It also allows you to do more projects with the same resources as work flows faster with fewer interruptions. This rule is typically put into practice in two steps:

STEP 1: Transition to Low WIP

- Temporarily freeze at least 25% of the projects (by workload), both in the overall pipeline and in the Constraint phase, for example a "system integration and testing" (SI&T) phase.
- Accelerate remaining projects using a simple priority process, e.g.: project due-dates. The project that is due first gets the first shot at resources; remaining resources are given to the project due next and so on.
- Deploy any remaining resources on "Full Kitting" (preparing for execution) the frozen projects. It is important to distinguish between "preparation" and "project execution". Typically customer approvals, sign off's, staging of drawings and materials etc. – activities that allow project tasks to be done without interruptions are included in Full Kit, whereas activities that directly progress the project should be excluded from the Full Kit list.
- As in-process projects are completed, unfreeze the full kitted frozen projects one by one.
- Avoid paralysis by analysis. The goal is to start getting results within 3 weeks.

STEP 2: Establish a Pipelining Process

- Set targets for cycle time by project type, this ensures that projects are planned with concentrated resources.
- Decide on the pacing resource. The pacing resource determines the rate at which projects can be completed (and started) in execution. Typically the overall throughput is determined by the rate of project completion in the SI&T phase, because of the considerable effort spent in synchronizing resources and resolving problems as they are found. It is possible, in very few cases, that an upstream resource or phase is a constraint and should be the pacing resource rather than SI&T.
- Establish a management meeting for setting project priorities and committing due-dates. Typically a dedicated "Master Scheduler" or "Pipeline Analyst" is required for providing analytical support.
- Close the loop with a resource planning process that ensures that enough of all the other resources are available. This may require creating additional resource flexibility in the organization to support the execution of the pipeline plan.

An excellent resource for understanding the details of pipelining is Session 1 of the Goldratt Webcast on Project Management. Please visit **www.toc-goldratt.com**.

06 Implementing Buffering Rule (Project Planning)

While it is obvious that project plans are needed to provide execution priorities and early warning signals, many organizations struggle with creating useful and manageable project plans. This section answers the frequently asked questions about project planning under the new rules:

What comprises an execution ready-project plan?

A complete project plan contains the following data:

- Tasks, Task Duration and Resource Type/ Resource Units needed for the task
- Checklist below the tasks to model additional detail (optional)
- Dependencies between tasks to model the flow of work
- Task Managers who make sure the tasks get done
- Buffers (feeding buffers; contractual milestone buffers and project buffers)
- Resource Types and the Maximum Units of a Resource Type available to the project
- Project-end and Contractual Milestone Dates

How much detail is required in the plans?

Too many tasks in a project plan induce multitasking, make analysis of plans and buffer consumption difficult and generally lead to loss of control. Not enough detail on the other hand encourages unnecessary safeties and Parkinson's Law and also leads to loss of control.

Based on our experience in a wide range of projects, more than 300 tasks in a complex network, or less than 10 tasks for a simple project are not recommended. If a task is less than 2% of the project cycle time it may be small enough to drive multitasking, and a task greater than about 5% may be too difficult for task managers to update. If this thumb rule yields tasks that are too long (and thus not useful for Task Managers), then you can use subprojects to zoom into detailed tasks rather than adding tasks to the main project.

What is the process of creating good plans?

- (In multi project situation) derive cycle time targets based on throughput goals.
- Communicate to all the managers that people will not be measured in execution against the task estimates used in planning.
- Assemble a team of project manager and representative task managers and conduct a workshop to get their buy-in into the rules of critical chain.
- Create basic project plans without buffers focusing on the flow of work in the project*.
- Convert basic project plans into buffered project plans (stagger tasks based on resource availability and insert buffers in the required places).
- Challenge and refine assumptions (data) whenever the calculated project cycle time does not match the expected/ desired result.
- Share the final project plan with all the task managers so that they understand their tasks as well as the overall plan.

* In repetitive environments, the basic project plans can be stored as templates for future reference.

Points to Remember

- A project plan is not a time reporting or effort tracking mechanism. The purpose of a project plan is to provide execution priorities and early warning signals.
- A project plan is not a technical manual or a reminder list. A task represents a chunk of work. It should not be broken down to several tasks just because it requires different resources for different durations of time. However it should be broken down for chosen key-resource-types; a task should be defined so that those key resource types are required for most of the task time.
- Don't model noise like "lead and lag" relationships between tasks or fractional resources. In the uncertain world of projects, reality will often override such sophistication.

07 Implementing Buffer Management (Prioritizing and Managing Tasks)

As we discussed before, absence of task level priorities is a major shortcoming in traditional project management. Now that we can issue clear, uniform and stable task priorities using Rule 3 (tasks consuming the most buffer get the highest priority), what is the management process around them?

1. Remaining Duration Reporting
During execution, Task Managers provide daily estimates of how much longer it will take to finish their tasks-in-progress. With this simple information, we can calculate the ratio of buffer consumed for a chain of tasks compared to the work completed in that chain. This ratio is then used to calculate task priorities and provide Task Managers a report of all current and upcoming tasks in order of priority.

(Tendencies to procrastinate and not report early finishes are also curbed. When the buffer consumption ratio is high and visible to everyone, it reminds Task Managers to make and report progress.)

2. Resource Assignment
Task Managers assign resources to current tasks in order of priority. If resources are not enough to handle even the red tasks (tasks that have crossed the threshold of acceptable buffer consumption), overtime and other such decisions are implemented.

3. Task Preparation
After taking care of current tasks on their plate, Task Managers turn their attention to upcoming tasks. They make sure that all necessary preparations like getting approvals, drawings, materials etc. are made so that tasks can be executed without interruption when they arrive.

4. Quick Issue Resolution
By interacting with resources for Remaining Duration updates, Task Managers discover unexpected problems quickly. They now have a chance to resolve them in a timely manner on an ongoing basis instead of fighting fires towards the end.

5. Reminder: Don't Pressurize Resources to Meet Planning Estimates
Otherwise you will soon be back to square one.

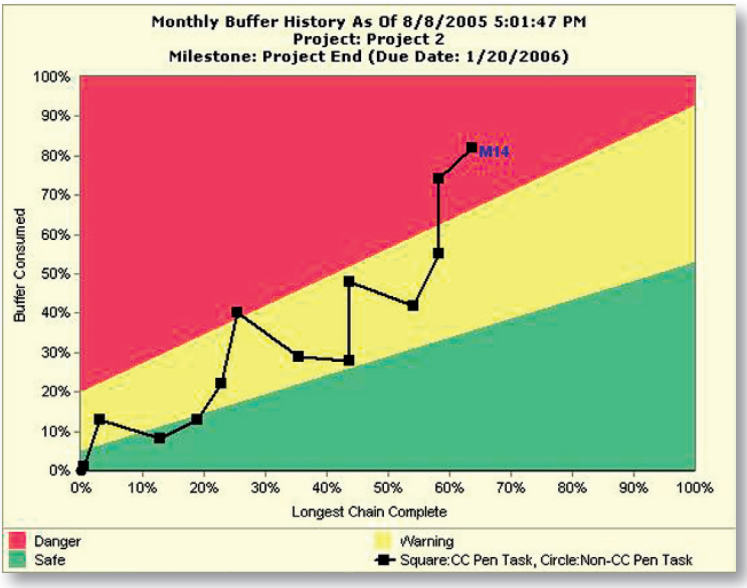
Implementing and reinforcing good Task Management is the key to sustained improvements in project performance!

08 Implementing Buffer Management (Management Controls)

In the uncertain world of projects, managing tasks is often not enough. Scope changes, technical glitches and other uncertainties that cannot be accommodated through Task Management happen in projects. This time we will discuss how Buffer Management can be used to manage such uncertainties.

Project Control

Comparing the rate of buffer consumption (% buffer consumed) against the rate of project progress (% work completed on the longest chain) is a reliable way to assess project health. If buffer is being consumed at a slower rate than the rate at which work is getting completed, it means that the project is on track and vice versa.



If the rate of buffer consumption is too high, then project managers find out which chains are in the "red" and develop and execute recovery plans for them. Recovery plans can consist of run of the mill items like scope adjustments and overtime as well as brilliant solutions for specific situations.

Pipeline Control

While project managers can keep the buffers within individual projects in control, it works when only some projects are "red". What to do when most projects are running behind schedule? Probably there is a more systemic or global issue at play that is affecting all projects in the pipeline. This is where senior managers step in and make global decisions like putting some projects temporarily on hold, renegotiating due-dates, reprioritizing projects or authorizing across the board overtime.

When managers consider their major job in execution as one of conserving buffers rather than firefighting, they quickly realize that while uncertainties cannot be eliminated, chaos does not have to be the *modus operandi*.

09 Ongoing Improvements

Having described how to put the three rules of execution management into practice, we can now go for the holy grail of project management – how to undertake and prioritize improvement efforts.

Buffer Analysis Guides Improvement Efforts

Buffer Management actually makes it quite simple: a historical analysis of buffer consumption is what we need. If we record "what help is needed" every time a task is stuck, and periodically rank these "help needed" items based on how much of the project buffer they ended up consuming, we can identify areas for improvement.

Understanding the root cause of the top ranked items will guide us to the solutions we need. Tightening of technical processes, improvement in task estimates, deployment of computer-aided engineering tools—all can be prioritized using this approach.

Using Buffer Analysis for Capacity Decisions

Buffer Analysis can also be used to make capacity decisions. What we need is a report that groups resources as follows:

Group 1 – Resources that increase the deepest penetration into the project buffers,

Group 2 – Resources that increase deep penetrations (any penetration which is 50% or more) into the project buffers,

Group 3 – Resources that reduce the deepest penetration into the project buffer, and

Group 4 – Resources that never contribute to the deepest penetration into the project buffer.

It is obvious that adding resources to Groups 1, 2 and 3 above will shorten project lead times and create room for additional projects.

(When resources are added based on buffer penetration as described above, the list of resources in the above categories may change. So it is best to add capacity in one resource type at a time; execute; and then reanalyze the buffer history.)

10 Ten Implementation Steps

The following ten simple steps keep everyone focused on results, while achieving buy-in's and establishing robust mechanics:

1. Create management consensus on business needs, making time efficiency the main goal
Do not pursue Critical Chain only for the sake of adopting a "best practice". Without driving business needs the concepts of CCPM can be very difficult to implement.

2. Qualify how time gets wasted
Managers have to be convinced about the waste before they will adopt new rules. A useful technique is to enumerate and quantify the losses caused by multitasking.

3. Get buy-in on the 3 rules and set ambitious targets
Managers must be truly bought in and not simply paying lip service to the concepts for the implementation to succeed. Ambitious improvement targets set by the managers and implementation core team ensure all buy-in questions will be raised, and the right level of focus will be paid to the required changes.

4. Reduce WIP and implement "full kitting"
Cut multitasking and realize immediate gains in performance as the organization focuses on fewer projects in execution. Full Kit projects that are "Frozen" or not yet started before they are released and implement a full kitting process that ensures we start projects with a full kit going forward.

5. Design your Management System
Execution cannot be perfect in the beginning, but a few items must be figured out up-front: roles of master scheduler, project managers and task managers; project templates; and policy-type changes. Everything else can be adjusted later on.

6. Create and validate pipeline plan
Check that the overall pipeline plan meets throughput targets. If it does not, re-evaluate the targets or cut cycle times across-the-board.

7. Establish Task Management
Task Management is the cornerstone of Buffer Management in multi-project environments. Task Management is monitoring remaining duration; and allowing tasks to be executed with minimal interruptions and in the right order of priority.

8. Establish surrounding processes
Put in place the pipeline, project and resource management processes.

9. Use Buffer Diagnostics to continue improving
Only ongoing improvement can guarantee sustainment. Use Buffer Diagnostics to guide local improvements, and the Five Focusing Steps to guide business-level improvements.

10. (If Applicable)
Use superior delivery as a competitive edge, to win more business.

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