APM
Association for Project Management

Senior Managers' & Project Managers' Guide to Critical Chain

Making the case for adopting critical chain project scheduling and execution management

THEORY OF CONSTRAINTS
TOCICO
INTERNATIONAL CERTIFICATION ORGANIZATION

Because when projects succeed, society benefits

Senior Managers' and Project Managers' Guide to Critical Chain

Making the case for adopting critical chain project scheduling and execution management

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Theory of Constraints International Certification Organization (TOCICO)

The Theory of Constraints International Certification Organization (TOCICO) is pleased to endorse the *APM Senior Managers' and Project Managers' Guide to Critical Chain*. This comprehensive guide provides valuable insights and practical strategies for implementing critical chain project management, a methodology that aligns with theory of constraints (TOC) principles.

As an organisation committed to advancing the application of TOC principles worldwide, TOCICO recognises the significance of this guide in helping project managers and senior managers improve project performance, enhance resource utilisation, and achieve project objectives more effectively. We commend the authors for their dedication to promoting excellence in project management and their efforts to share valuable knowledge with the project management community.

TOCICO is confident that this guide will be a valuable resource for professionals seeking to enhance their project management practices.

TOCICO Board of Directors

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Preface

My late father, Dr Eliyahu Goldratt, authored *Critical Chain* (1997) following the successful application of his theory of constraints principles to a series of projects at Statoil in Norway, at their request.

Critical Chain challenges entrenched beliefs and practices, such as 'The earlier you start, the earlier you finish', and the notion that 'Ensuring each task's timely completion guarantees the project's on-time delivery'. As the years unfolded, the methodology evolved, incorporating comprehensive solutions which address common obstacles to flow during both the planning and execution stages.

In the twilight of his life, my father was resolutely dedicated to elevating his legacy work to mainstream prominence. As part of his devotion to making critical chain mainstream, my father ardently advocated for critical chain to be included in credible industry training and for it to be recognised in established bodies of knowledge. The incorporation of critical chain into the *Body of Knowledge* of the Association for Project Management (APM) marked a significant milestone, endorsing its legitimacy. In unison with APM, we acknowledge critical chain as a natural and credible evolution of critical path, especially in projects where resource contention and uncertainty are the predominant obstacles to timely delivery.

We commend APM and the esteemed authors of this guide for their advocacy of diverse methodologies. More than two decades after the publication of *Critical Chain*, empirical evidence unequivocally attests to its efficacy. However, its transition to mainstream acceptance is contingent upon an increasing number of managers daring to transcend the status quo and instigating transformative changes in project management paradigms.

We wholeheartedly endorse this enlightening *Senior Managers' and Project Managers' Guide to Critical Chain*. It serves not just as a source of valuable insights but a clear call to action.

Rami Goldratt
CEO
Goldratt Group

Executive summary

There is empirical evidence that extraordinary results can be achieved with critical chain. The approach has delivered significant improvements in performance in complex design and development, manufacturing and maintenance projects across various industries. This guide provides a compelling case for adopting critical chain using a phased business change approach and simple principles (rules of flow) to address uncertainty, resource contention and other root causes of poor project delivery.

Critical chain is an evolution of critical path to better manage the execution of projects. The benefits (such as improved delivery throughput, shorter project durations and reduced stress) become quickly evident when the behaviours are aligned to the coherent set of critical chain principles. Some are 'back to basics' project management principles, some are borrowed from lean, and some are new concepts developed by Dr Eliyahu Goldratt.

The guidance provides 10 simple rules of flow, as well as advice on how to manage the implementation of a new way of working in an existing project team or organisation. The key ingredients of successful deployment and sustainment are to ensure that the roles and responsibilities are clear, that people receive the right training, and that tools and metrics are changed to enable the new ways of working.

A number of valuable resources and the steps to get started are also recommended.

Introduction

Various studies have described significant challenges to project delivery performance, quoting high failure rates (e.g. Flyvbjerg, 2011; Flyvbjerg and Gardner, 2023). There are many root causes and ways to address them. A recurring theme is that complex projects, programmes or portfolios, by their very nature, must cope with a high level of uncertainty, variability and change. Dealing with uncertainty and the resulting resource contention are the predominant obstacles to on-time delivery. Critical chain is an approach with a track record of successfully dealing with these issues.

The purpose of this guide is to make a compelling case for using critical chain, as an evolution of critical path, to manage the execution of projects. It will describe its benefits and provide explanations to use with stakeholders.

Critical chain project management has delivered significant improvements to performance in complex design and development, manufacturing and maintenance projects across various industries (e.g. aerospace, defence, pharmaceutical, construction, automotive, communications, consumer goods and energy). It has been used at all scales of project, from small projects to complex multi-year megaprojects. The approach can be used to manage individual small-to-medium-sized projects, but it is particularly beneficial for larger, complex programmes and portfolios.

> … there is empirical evidence that extraordinary results can be achieved with critical chain.
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> *APM Body of Knowledge 7th edition* (Association for Project Management, 2019, p.176)

Critical chain embeds many of the 'back to basics' principles known to experienced project managers. However, it deals differently with durations, schedule contingency and resource contentions during planning. In execution, it facilitates the timely and supportive leadership behaviours required for the early identification of, and rapid recovery from, issues to mitigate schedule risk.

The guide is intended for senior managers and project managers who are looking for a new way to increase the likelihood of project success.

This guide is not a comprehensive 'how to' manual, but will direct you to excellent, relevant resources.

What is critical chain?

Critical chain project management is a method of planning and executing projects which addresses resource conflicts to protect the schedule against uncertainty. Today's highly complex projects have to deal with a great amount of volatility, uncertainty, complexity and ambiguity (often described as VUCA). Critical chain builds on critical path and sound logical task networks (also known as 'precedence networks') to provide focus. It makes innovative use of a schedule buffer to drive the right behaviours to achieve on-time project delivery.

Critical chain uses optimistic task durations when scheduling the project, with the addition of a sizeable time buffer to protect the project's due date (the promise to the internal or external customer). The buffer is a shared project resource. An important consequence of this approach is that task estimates are not commitments made by the task manager but are simply a part of the method for calculating the estimated project duration and buffer size.

During execution, tasks that are underway and are forecast to take longer than their optimistic duration will consume some of the buffer. Those few tasks that are completed in less time than the optimistic estimate will add time back into the buffer. The rate of buffer consumption (relative to project progress) serves as a visible progress and performance indicator, and becomes an early-warning system.

A few key activities and behaviours are required to protect the schedule, for example:

- de-conflicting any major resource contention to avoid two tasks using key resources occurring at the same time, which would slow down execution
- relentlessly focusing on recovery actions to reduce or reverse excessive consumption of the buffer
- focusing on task preparation to ensure that people have everything required to finish the task, without having to stop to wait for inputs, materials or information

What is the role as a senior manager to deliver the benefits?

It is vital for senior managers to provide visible leadership when introducing critical chain. Their role requires:

1. making the case for change as change leaders (see part 2) and winning hearts and minds
2. setting up the environment needed for people to operate with a new set of rules, rewarding adherence to the new ways of working
3. allowing critical chain pilot projects to tailor their approach to meet the intent of existing policies and practices used for project management, reporting and governance
4. communicating early successes
5. demonstrating servant leadership by supporting the project team in 'recovery action' escalation when critical path or critical chain tasks are consuming buffer

The project manager who is implementing critical chain needs to discuss expectations with the senior manager for being a proactive sponsor of implementing critical chain.

What are the critical chain principles and rules?

Critical chain consists of a coherent set of principles. Some are 'back to basics' project management principles, some are borrowed from lean approaches, and some are new concepts developed by Dr Eliyahu Goldratt.

The 10 rules of flow aim to describe, in practical terms, the process and managerial prerequisites to being able to work in 'the critical chain way'. The 'Rules of Flow' title was inspired by the novel *Goldratt's Rules of Flow* by Efrat Goldratt-Ashlag (2022). The rules clearly demonstrate that it is not just about scheduling with a significant time buffer (Rule 7) or staggering the work so as not to overwhelm a critical constraint resource (Rule 8). For critical chain to accelerate the flow of work and achieve the other benefits, all 10 rules need to be implemented.

Project managers do not always have the ability and authority to change the scheduling and control methods from those they currently use to critical chain. Their wider organisation will have established norms and systems, and project managers are expected to comply with corporate policy and contractual requirements.

Critical chain also relies on the adoption of a different mindset to schedule risk, due dates, the release of work, different behaviours to the execution of work, and a different role for leaders.

For these reasons, introducing critical chain as a new way of working will need to be managed as a business change project.

Justifying the case for critical chain and sense of urgency

It is important to engage senior stakeholders and people at all levels to identify and socialise the case for change and sense of urgency.

The sense of urgency can stem from:

- a customer request to accelerate a project to meet operational demands (e.g. in defence during a period of conflict)
- the penalties for not meeting a regulatory deadline which a project aims to deliver (e.g. in financial services)
- the consequences of delaying the provision of the capability the project is providing (e.g. in health care)

A business change project team needs to develop and communicate a clear vision, drive momentum and remove obstacles. This is best done through an inclusive approach with workshops, training and two-way engagement sessions.

Creating a guiding coalition

Critical chain implementations which are purely focused on the schedulers/planners are bound to fail. The critical chain principles depend on different roles in a project organisation adhering to a new set of behaviours; for example, a procurement manager prioritising full kit materials for a critical chain task over other tasks, or an engineer understanding the clear handover requirements from one critical chain task to the next.

That is why it is important to cast a wide net when implementing critical chain. It is not just about scheduling and buffers; it is about improving teamwork in the cross-functional project team. Unless a systemic approach is taken to all the enablers for tasks on the critical chain, the buffer will be used too quickly and the project will still be late.

In addition to project managers, the stakeholders to involve are in functions such as:

- procurement
- engineering
- manufacturing
- logistics
- finance

An effective way to win 'hearts and minds' is to combine a training session on the principles of critical chain with a workshop to reveal the current challenges experienced by the project team. This provides an opportunity to map current pain points with the solutions that critical chain offers. In some cases, key basic project management foundations required for any project, as well as critical chain, are not in place. For example, there may be no sound logical network to identify the critical path/critical chain, or the work breakdown structure may be incomplete. These issues can be addressed as part of the critical chain implementation.

Planning the business change project

Implementing change is best done in small steps. This will reduce implementation risk, allow for learning and deliver quick wins. This, in turn, whets the appetite for more.

A deliberate pilot approach on a crucial part of the project organisation (rather than an insignificant area nobody is interested in) can be an effective phased implementation. However, it should be executed as a serious first phase of a further roll-out. Any indication that it is not a well-supported endeavour is guaranteed to lead to failure.

For the project team, it is important to follow a structured process when introducing critical chain, such as the five-step deployment strategy in Part 2 on page 16. The key ingredients of successful deployment and sustainment are to ensure the roles and responsibilities are clear, that people receive the right training, and that tools and measures are changed to enable the new ways of working.

Roles and responsibilities

A number of roles focusing on key critical chain activities need to be owned by specific people on the project. These do not necessarily need to be additional resources and often align with existing roles.

Table 3 Roles and responsibilities

Role	Responsibilities
Senior manager as the business change project sponsor	To advocate for new ways of working with stakeholders (both internal and external to the project). Point of escalation for recovery actions.
Project manager	To be the key advocate for implementing critical chain in the way the project is run and to live by the critical chain principles.
Business change implementation manager	To plan and manage the implementation of critical chain on the project. The key role is to deliver successful adoption of critical chain.
Full kit and release manager	To ensure the highest possible degree of full kit before work is released. To release work based on priorities set by the critical chain principles to optimise utilisation of resources and release non-full-kit work by exception only.
Trainer and coach	To provide the organisation with the internal capability to implement critical chain on a given project and future projects. To build internal capability to sustain the new way of working in the long term.
Critical chain implementation steering board	Cross-functional group of senior stakeholders who meet regularly (e.g. fortnightly or monthly) to discuss progress against a critical chain business case and implementation plan, resolve obstacles to implementation, and support the sponsor and implementation manager in achieving the benefits.