CRITICAL CHAIN PROJECT MANAGEMENT
BY PHILIP MARRIS
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The speaker: Philip Marris

• Expert in boosting performance using the Theory Of Constraints and Lean, Philip has been successfully implementing the Theory Of Constraints combined with Lean for over 30 years in over 250 organizations worldwide. His principal skills are operational performance and project management.
• He is English, 59 years old and is based in Paris, France. Starting in 1986 he worked with Eliyahu Goldratt, the founder of the Theory Of Constraints (TOC) and the author of the international best-seller "The Goal" and many other books. Philip Marris is the author of a very successful book in French "Le management par les contraintes".
• He is the CEO of Marris Consulting, founded in 2005 and based in Paris, France. He has worked all over the world in over 30 countries. Among his clients are: Air France, ArcelorMittal, Autoliv, Bayer, Bosch, Embraer, GSK, Infineon, Ipsen, Jaeger LeCoultre, Louis Vuitton, McDonald’s, Novartis, Procter & Gamble, Nexter, Rolex, Safran, Sanden, Siemens, SKF, Thales, Valeo and Zodiac Aerospace.
• He has been implementing the Theory Of Constraints’ way of managing projects and portfolios of projects – Critical Chain Project Management or CCPM – for over 15 years in a great variety of industries: aeronautical, pharmaceutical, luxury goods, consumer goods, medical devices, M.R.O., automotive …
• He actively contributes to the awareness of the Theory Of Constraints and Critical Chain Project Management throughout the world: dozens of conferences every year, numerous articles, hundreds of videos …
PMI Luxembourg Chapter Coming Events & News

• Elections – please vote for the new Board of Directors of your Chapter
• 50 years PMI anniversary celebration: Friday, November 22 at Chambre de Commerce
• Campfire session at Infeurope, November 28
• General Assembly, January 7, 2020 at PWC

• Ongoing collaboration agreements with
  • PMI Luxembourg & Sportunity
  • PMI Luxembourg - Chambre de Commerce Luxembourg – ISEC: Master "Management de Projet"

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Critical Chain Project Management

Will you dare to finish all your projects on time!?

Project Management Institute - Luxembourg Chapter
Conference by Philip Marris

Luxembourg, 21st of October 2019
Version 1.1
Critical Chain Project Management claims it provides extraordinary results:

- To finish nearly all your projects on time (and within budget and full specifications)
- And simultaneously to do your projects twice as fast as before
- And at the same time doing twice as many projects per year with the same resources.
- We will see at the end of this presentation how many of you are convinced that this is possible.

Content

1. Introduction
2. Overview of the Theory Of Constraints (ToC)
3. Critical Chain planning and execution
4. Critical Chain Portfolio Management
5. Case studies
6. PMI PMBOK and Critical Chain complementarities and differences
7. Conclusion
Speaker: Philip Marris, CEO of Marris Consulting, Theory Of Constraints & Lean expert

- Consultant (warning!).
- Theory of Constraints specialist. 33 years of ToC experience. Started working with the founder Eliyahu Goldratt in 1986. 34-year experience of Lean (Manuf. & Engineering)
- >30 years of experience helping over 250 companies in all industries.
- Over 80 assignments in project environments especially New Product Development & MRO (Maintenance Repair & Overhaul).
- Author of the very boring but bestselling French textbook about ToC in manufacturing Le Management Par les Contraintes.
- Motto: Factories, People & Results.
On 5th of October 2019, the PMI awarded the best project of the year to Embraer who used the Critical Chain approach.

This was the culmination of a 10 year Critical Chain Project Management journey.
Over the past 20 years, Critical Chain has demonstrated its ability to greatly improve the performance of project planning and execution.

- Critical Chain Project Management (CCPM) enables organizations to finish their projects on time, without budget overruns nor loss of initial specifications.
- Furthermore CCPM can, simultaneously, significantly reduce project durations and increase the efficiency (productivity) of the resources involved.

### Results

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<th>Average</th>
<th>Worst case</th>
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<tr>
<td>Project durations</td>
<td>-39%</td>
<td>-13%</td>
<td>-78%</td>
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<td>Number of projects</td>
<td>+70%</td>
<td>+15%</td>
<td>+222%</td>
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<td>time</td>
<td></td>
<td></td>
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<tr>
<td>Throughput</td>
<td>+53%</td>
<td>+14%</td>
<td>+150%</td>
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Source: “Advanced Multi-Project Management Achieving Outstanding Speed and Results with Predictability” 2013 book by Gerald I. Kendall & Kathleen M. Austin, page 99. The analysis is based on public information available concerning 60 different organizations working in different industries that had applied CCPM.

See appendix for a list of cases.

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The Theory Of Constraints gained global recognition because of the success of the “business thriller” *The Goal* by Eliyahu Goldratt

- Over 7 million copies sold in over 30 languages. Mandatory reading in most universities/MBAs/…
- Written by Eliyahu Goldratt the founder of ToC with Jeff Cox.
- A novel to explain a new approach to management.
- Chosen as one of the 25 most influential business books by Time magazine in September 2011.
- Used by Jeff Bezos, Amazon.com CEO, to build their Supply Chain and redefine the company’s goal.

Focus on improving the system constraints that determines the overall performance and buffer the system against uncertainty and variability

*It is no longer possible to distribute work equitably: organizations are necessarily unbalanced*

- Companies (factories, engineering departments …) and other organizations inevitably have unbalanced capacities.
- As a result, there is always a constraint somewhere in the system.
- Annual budgets pretend to balance organizations but they don’t succeed.
- One hour lost on that constraint (the bottleneck) = one hour lost for the system = one hour of lost sales.
- One hour gained on a non-bottleneck is an illusion. A non-constraint must only work according to the constraint’s requirements.
- A dual view is mandatory: different rules for constraints and non-constraints.

*The sum of local optima is not equal to the global optimum*
The different components of the Theory Of Constraints (ToC)

**Theory Of Constraints (ToC)**

- Approach initiated by Eliyahu Goldratt
- A systemic view seeking the global optimum based on a dual view of constraints/bottlenecks & non-constraints

**Drum – Buffer - Rope**

Production Management

- The importance of constraints, DDBR & S-DBR,
- Focused approach, …
- (historical origin of approach)

**Critical Chain (CCPM)**

Project Management

- Project Buffer (not "local" tasks), Fever Chart, Critical Chain (not Path), Bad multitasking, Student syndrome, …

**Replenishment Distribution**

- High frequency periodic replenishment, stocks centralized not distributed
- [very similar to DDMRP]

**Marketing & Sales**

- Mafisa Offer or (UnRefusable Offer / URO)
- + Decisive Competitive Edge + Sales force constraints

**Throughput Accounting**

Financial decision making

- T.I.O.E.: Throughput, Inventory & Operating Expenses, TBIDM,
- Dollar x Days, Total Variable Cost, Product Mix

**Value Added Computing Information Systems**

- Data & Information Necessary but not sufficient
- The 6 questions
- [Philip Marris' personal opinion]

**Thinking Processes Problem resolution**

- Evaporating Cloud, Goal Tree, Strategic & Tactic Trees,
- Current/Future Reality Tree, Pre-requisite & Transition Trees

**Other new ideas!??**

- Standing on shoulders of giants,
- Behavior & Organizations, Viable Vision, Strategy,
- KM, + new TA, …?

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Project managers try to compensate for the uncertainties inherent in projects

- Commitment on every task completion date
- Local safety margins are added to each task duration
- Micro-management leads to increasingly detailed schedules

In practice, these local task margins and task completion date pressure make projects last longer and make project end dates less reliable

- Margins are wasted because of:
  - Student syndrome
  - Parkinson’s law
  - Bad multi-tasking
  - Early finish waste
The Critical Chain approach accepts the inherent uncertainty of projects and protects the whole project, not the individual tasks.

- All project tasks have significant security margins, but they are wasted.
- With the Critical Chain approach, these margins are reduced and mutualized in a buffer at the end of the project.

With traditional planning...

...each task has its own margin

With Critical Chain, margins are mutualized and cycle times are challenged

With the Critical Chain planning we reduce the expected duration of tasks by 50% on average!

- In Critical Chain planning, task durations are "focused durations".
- The "focused duration" is the working time necessary to complete the activity: in perfect working conditions (no other tasks and no multi-tasking); all the necessary information is available (full-kit) and there are no interruptions.
- The average (median) focused duration must be estimated. It's not a commitment. 50% probability of exceeding the expected duration. Safety margins are not added to the tasks.
We find that it is easy to get everyone to accept very short focused task durations

- **To reduce the duration of tasks by about 2:**
  - We formally advise against the approach too often recommended: a top down management decision.
  - We recommend to trust the seductive capacity of the Critical Chain reasoning: train all those who must predict the durations (one day of training) then ask them to re-estimate their “focused” durations.

- **We find that durations can be reduced by more than 50% on average. Note that some tasks will go from 2 weeks to 1 day, others will be incompressible (e.g. stability test of a drug or traditional sub-contracting).**

**Unlike traditional approaches (such as Critical Path)**

Critical Chain planning is finite capacity planning

- **Resources are rarely taken into account during planning, therefore:**
  - The same resource can have multiple scheduled tasks at the same time (no levelling),
  - The “Critical Path” (traditional approach) ignores resource constraints

Note that one can have a recalculated Critical Path that takes into account resource conflicts. In that case it is very similar to the “Critical Chain”.

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The Critical Chain is the levelled critical path (taking into account available resources)

- The Critical Chain is the longest path of dependencies, logical and resources, between tasks. It is obtained by levelling the tasks of the schedule so as not to plan any multitasking.

- The duration of the project is determined by its constraint: its Critical Chain.

The total duration of the project is equal to the Critical Chain plus a shared "Project buffer"

- The "Project Buffer" pools the safety margins of critical tasks, and represents about a third of the total project duration.

- The Critical Chain is protected from non-critical chains / tasks by "Feeding Buffers".

The addition of Feeding Buffers ensures that the Critical Chain will not change during execution (unless there is a very major disruption)
During project execution, we focus on the smooth and rapid execution of tasks on the Critical Chain

- The project is carried out according to the principle of the relay race throughout the Critical Chain.
- Having a mascot (a noticeable object) enables one to follow physically the successive offices and workstations the Critical Chain passes through.

By asking less than 1% of the resources to run at any one time, the whole company that goes faster

The project Key Performance Indicator (KPI) the size of a post card: Project monitoring is much easier thanks to the Project Fever Chart

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
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<tr>
<td>% of Critical Chain completion</td>
<td>% consumption of the project buffer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>60%</td>
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- **Red zone = risky zone** → start right now corrective actions
- **Green zone = comfort zone** → no action needed
- **Yellow zone = warning zone** → identify main cause of delay and prepare action plan

Finished project with project buffer not fully consumed

This means that the project finished before the end date

Note: This is how most people plan the "project" of catching a plane.
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Managing a portfolio of projects is actually very easy

- If each project in the portfolio is well planned taking into account the uncertainties, the available resources and practicing the "relay race" on the sequence of critical tasks – if each project has a good chance of finishing on time –, then managing a portfolio of healthy projects is relatively easy!
- All we need is to have a good system for identifying priorities allowing all actors to know their priority at all times by referring to a public and objective system.
The Portfolio Fever Chart greatly facilitates dynamic arbitration between projects and portfolio management in general.

Projects 1 & 2: urgent action needed!

Projects 7 to 20: (green zone) nothing to report

Project 4: Finished exactly on time

Project 6: Finished before the end date

80% of projects in the green zone. They are "in the noise": no management attention is required.

The Portfolio Fever Chart helps to quickly track all the projects in the portfolio with objectivity and transparency

You can kick-start a portfolio implementation by significantly increasing the performance of the portfolio's capacity constraint.

- Capacity constraints in project portfolios can be immediately exploited to produce 2 or 3 times more. This can be done even before you go live with CCPM.
- This is done by using a simplified version of the Theory Of Constraint's 5 Focusing steps:
  - **Identify** the bottleneck (the capacity constraint) by finding the largest queue of work.
  - **Exploit** it better (often by reducing bad multi-tasking and removing less important work).
  - This usually enables an increase of productivity of x2 or x3
  - So then you repeat the process by finding the next / new bottleneck.
Since its appearance more than 20 years ago, Critical Chain has been implemented thousands of times:

- More than 500 cases formally identified and documented (and about 500 others being validated)
- See the study by Gerald Kendall and Kathleen Austin: Advanced Multi-Project Management, J. Ross Publishing, 2013,
- List regularly updated on: www.chaine-critique.com
- The best known cases are:
  - Embraer (PMI project of the year 2019), Procter & Gamble, Boeing, Mazda (throughout product development), NASA, ABB, U.S. armed forces, Delta Airlines Maintenance.
- The cases in France today (2019):
  - Siemens, Louis Vuitton, Safran (several), Embraer (maintenance MRO), Forsee Power, Thales Alenia Space, Ipsen, Diehl Metering, Yves Rocher, Procter & Gamble, Teledyne e2v (since 2007)
  - Many small or medium sized companies.
South African aeronautical equipment manufacturer
New Product Development + ERP implementation + …

- 700 people facility. Very diversified product range. Suppliers of Boeing, Airbus, Spirit Aero, Safran, …
- Implementation of Critical Chain Project Management in only 2 weeks for all their projects:
  - Especially the development and industrialization of their new products and processes.
  - An ERP implementation project (a major change of software version).
  - Their large projects such as the complete warehouse restructuring.
- Over 98% on time finishing + reduction in project durations, more projects per month, visibility, what-if modelling, employee satisfaction …
- This company applies the Theory Of Constraints to all of its operations: projects, production, purchasing, strategy & tactics.

As we saw with Embraer's case, in large organizations it can take several years for Critical Chain to become the main way
A Engineering To Order and Make To Order company
Lead-times divided by 5 and productivity more than doubled

- Part of a large heavy industry manufacturer (>300,000 people).
- The capacity constraint / bottleneck was in the Design Office in the Engineering Department. It was flooded: 90 projects in progress, 50 weeks of lead time, 1.8 projects (designs) finished per week.
- The results: lead times divided by 5 and Throughput and productivity improved by 130%.

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Critical Chain now has a proven track record but it is not yet integrated in to the PMBOK

- Critical Chain is not mentioned in the latest version of the PMBOK Guide.
- This is of course a source of preoccupation for PMI members interested in implementing Critical Chain.
- We hope this will change in the future.
- Especially as the Critical Chain approach creates a much more serene, less chaotic, less stressed working environment and therefore it enables (it gives people the time to) better implement the best practices of the PMBOK. In particular:
  - Risk management
  - Work Breakdown Structure building and optimisation
  - Scope management
  - Etc.

Maybe this will change now that PMI's Best Project of the Year 2019 was obtained using the Critical Chain approach
Critical Chain can be combined with Agile and/or DevOps

- Critical Chain can be combined with Agile (but this subject is not covered in today's conference).
  - The Sprints can be time boxed but we recommend content boxing
- DevOps states that one of its main sources of inspiration is the Theory Of Constraints. So there again the synergy exists.
- The "Lean Startup" approach also uses a lot of Theory Of Constraints.

For new product development projects, the Critical Chain allows manufacturers to embark on a "Lean Engineering" journey

- The main advantage of Toyota today is not in its production system but in its Toyota New Product Development System (see Allen Ward & al.)
- But this "Lean Engineering" is not accessible if the development activity is frenetic and barely under control ... we will never find enough time to "do Lean Engineering".
- We recommend using the Critical Chain first to bring product development under control and then test Toyota's bold product development system.
Dare to finish all your projects on time!

(title of this presentation)

- Finish almost all your projects on time
- Finish your projects twice as fast (and therefore often much cheaper)
- Do twice as many projects per year with the same resources.
- Without excessive stress
- With very little time wasted on "project management"
- With a win-win approach at all levels

**Aerosud case** - Portfolio of new product & process development
Aeronautical equipment supplier after 2.5 years of CCPM practice

**Summary of the Critical Chain way**

- The only important goal is to finish your projects on time, within budget and conform to specifications.
- Safety buffers are reduced and mutualized into project and feeding buffers.
- Monitoring of project execution with a Fever Chart: a simple and efficient visual management.
- Ensuring the proper and smooth execution of Critical Chain tasks (relay race and mascots) to execute projects faster.
- Projects are sequenced to limit the work in progress and devastating multitasking. We avoid launching projects too soon.
- Resource conflicts between projects can be easily, objectively and dynamically managed using the Fever Chart.
- Thanks to the focus on the capacity constraint the productivity of the whole business increases significantly.

**Results**

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<td>&gt; 39%</td>
<td></td>
<td></td>
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<tr>
<td>Number of projects completed in a given time</td>
<td>+ 70 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throughput</td>
<td>+ 53%</td>
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<td></td>
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**Critical Chain enables you to take control of your projects portfolio…**

...do you dare to finish all your projects on time?
Thank you for your time. Any questions?

Note:
We recommend having a look at the (big) appendices to this presentation

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- Appendices
A series of 4 videos of 20 minutes summarizing Critical Chain Project Management


**Training extract**

Critical Chain Project Management

Mazda, car manufacturer

After a 10 year roll out the first complete cars "Made by ToC" are now available

- Initially used to develop a new engine family, SKYACTIV.
- Project duration was divided by 2 and cars using that engine (CX5, Mazda 6, ...) won 73 rewards around the world in 2012 and 2013.
- Notable increase of New Product Development capacity & increase in productivity.
- CCPM then rolled-out to all the company’s development projects.
- Note: This is not a Marris Consulting reference.
MRO – EMEA Maintenance Centre for Executive Jets

Executive Jet Turn Around Time reduction

- Reduction in aircraft downtime duration of over 50% (from >10 to 5 weeks). Current target is to further reduce to 3.5 weeks.
- Increase of labour productivity of more than 70%.

European leader for aeronautical equipment

Rapid factory plant layout transformation

- To simplify and improve product flow in the factory a new layout for the mechanical parts machining workshop required the relocation of about 70% of the plant machinery (45 machines)
- Initially the "traditional" project was planned over 8 weeks. But the non-availability of the plant for such a long time was considered unacceptable.
- The project was therefore managed using the Critical Chain approach.
- Critical Chain allowed several hypotheses to be tested (necessary resources and equipment, project preparation phase, etc.) and validate the best scenario to relocate the machines in compliance with the time constraint.
- After several optimisation loops a CCPM project was constructed with a planned 8 day duration.
- Monitoring and project execution with Fever Chart and project buffer management was used.
- The project ended successfully 4 hours early even though 1.5 day were "lost" when they discovered that a machine could not be installed where they had planned.
Equipment manufacturer for aeronautical industry
New product development and industrialisation portfolio

- European leader in aeronautical equipment: flight control systems, aircraft engines, …

- The Critical Chain approach was applied to the entire New Products Development and Industrialisation portfolio of one of the factories in 4 months.

- Average project duration reduced by more than 50%.

- On time delivery improved spectacularly.

- Number of projects completed per year increased significantly.

- Recognized as a very powerful decision making tool:
  - Very easy arbitration of resources allocation between different projects.
  - Possibility to simulate the consequences of forcing a new project into the portfolio on the other projects.

- Etc.

European leader in aeronautical equipment
Development of a complex avionics system

- Deployment of Critical Chain on a complex pilot program (14 work batches, 10,000 tasks, 150 people on 4 different sites).

- Development of 14 schedules (1 planning per work batch) converted to the Critical Chain principles.

- Development of a scheduling synchronization system for the overall program planning.

- Management of multiple end/exit points and therefore of several simultaneous Critical Chains within the programme.

- Huge improvement in visibility and quality of project monitoring.

- Focus on Critical Chains and acceleration of project execution.

- Control of exchange of deliverables and linkage between the work batches (critical and spectacular).

- In view of the success of the pilot project summarized above the company is currently generalizing Critical Chain to the entire Business Unit (>1,000 engineers, 60 new product programs, 5 different facilities).
French terrestrial armament European leader
Critical Chain to manage several key projects

- Implemented Critical Chain combined with Agile / Scrum to manage the portfolio of projects.
- Solved numerous problems of key critical resources that were involved in several different projects simultaneously.
- Created a CCPM based system to reply to the large Call For Tenders with as a result a very significant increase in the speed and quality of the proposals. This involved managing conflicts between projects and Call For Tenders that were inserted into the portfolio with short response times.
- Implemented Fever Charts to follow all projects and dynamically arbitrate all resource conflicts.

Space industry European leader. CCPM to save a crucial overdue project
Project duration reduced from >9 months to <4.5 months and delivered on time

- One of the major actors in the design and production of satellites in the world. More than 7,000 employees.
- Just a few months before the Critical Chain implementation, management had no visibility on the odds of meeting the promised end date for the completion of a satellite. A quick audit showed that it would end at least 5 months late.
- More than 100 million € at stake if the satellite was late and political embarrassment with a foreign nation.
- Thanks to the Critical Chain approach, the project went back on track and local final testing was optimized until the last minute.
- Project in 2014.
The blind spots of Critical Chain

- CCPM is a scheduling and execution system. It does not ensure that the completed project was a success:
  - a bad product, a product that is very difficult to manufacture, etc.
- So needs combining with Lean Engineering etc.
- It is very difficult to apply to external contributors (subcontractors, other departments, …).

ToC controls production flow with the Drum Buffer Rope (DBR) mechanism

One of the key ideas of ToC is to use buffers to protect the bottleneck against variability. There is a similar mechanism in ToC’s project management approach.
The 5 steps of ToC's continuous improvement process

1. **IDENTIFY** the system's constraint(s).
2. Decide how to **EXPLOIT** the system's constraint
3. **SUBORDINATE** everything else to the above decision.
4. **ELEVATE** the system's constraint
5. **WARNING!!!**
   If in the previous steps a constraint has been eliminated,
   go back to step 1,
   but do not allow **INERTIA** to become the system's constraint.

Note: Often called *The 5 Focusing Steps* or ToC's *Process Of On-Going Improvement* (POOGI).

To guarantee the durability of the Critical Chain implementation, we recommend a 5-year process for New Product Development in large organizations.
But in other cases the Critical Chain implementation, can and must be done "overnight"

- When the average duration of projects is only a few days or a few weeks then the entire portfolio is best switched to CCPM planning and execution "overnight". This is typically the case of MRO activities.
- The transformation process is:
  - Diagnosis, Design of transformation
  - Data preparation and clean up + Software choice and implementation. Variable duration depending on the initial situation
  - Training
  - Switch overnight to "the CCPM Way"
  - Monitor for at least twice the average project duration
  - Sustain and tune/improve

![Diagram showing the transformation process from Analysis & Design, Preparation, Monitor, to Switch to CCPM, Sustain & Improve over 4 weeks to 4 months.]

The CCPM software solutions are numerous and there are regularly newcomers (permanent benchmark available on Marris Consulting website)

- **Concerto**
- **REALIZATION**
- **ProChain Solutions Inc.**
- **EXEPRON**
- **Aurora-CCPM**
- **Stottler Henke**
- **LYNX**
- **BeingManagement**
- **A-dato**
- **Pulse**

### Bibliography CCPM 2016 (#1/2)

<table>
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<tr>
<th>Author</th>
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<tr>
<td></td>
<td>Constraints for Business Results</td>
<td>PTR (2001)</td>
</tr>
<tr>
<td>Athavale Rajeev,</td>
<td>Do-It-Yourself kit for projects</td>
<td>Leanpub (2012)</td>
</tr>
<tr>
<td>Grossard Joel</td>
<td></td>
<td></td>
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<tr>
<td>Bergland Eric</td>
<td>Get It Done On Time</td>
<td>Apress (2016)</td>
</tr>
<tr>
<td>Chin Chiu</td>
<td>Rolling Rocks Downhill - Accelerate AGILE with Goldratt’s TOC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2015)</td>
</tr>
<tr>
<td>Cox Jeff, Houlé Dale,</td>
<td>Managing Flow - Achieving Predictable Results in an Uncertain World</td>
<td>AOS (2014)</td>
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<tr>
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<td></td>
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<tr>
<td>Goldratt Eliyahu M.</td>
<td>Critical Chain</td>
<td>North River</td>
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<tr>
<td></td>
<td></td>
<td>Press (1997)</td>
</tr>
<tr>
<td>Hefinstead Ian,</td>
<td>The Executive Guide to Breakthrough Project Management - Capital and</td>
<td>Dartmouth</td>
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<td>Bolton Robert</td>
<td>construction projects on time in less time, on budget of lower cost</td>
<td>Publishing</td>
</tr>
<tr>
<td></td>
<td>without compromise</td>
<td>(2016)</td>
</tr>
<tr>
<td>Kondo II, A.</td>
<td>Advanced Multi-Project Management - Achieving Outstanding Speed</td>
<td>J. Ross</td>
</tr>
<tr>
<td>Austin Kathleen M.</td>
<td>and Results with Predictability</td>
<td>Publishing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2013)</td>
</tr>
<tr>
<td>Kim Gene, Hew Kevin,</td>
<td>The Phoenix Project - A Novel About IT, DevOps, and Helping Your</td>
<td>IT Revolution</td>
</tr>
<tr>
<td>Stafford George</td>
<td>Business Win</td>
<td>Press (2013)</td>
</tr>
<tr>
<td>Kishira Yogi</td>
<td>WA - Transformation Management By Harmony</td>
<td>North River</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Press (2009)</td>
</tr>
</tbody>
</table>

### Bibliography CCPM 2016 (#2/2)

<table>
<thead>
<tr>
<th>Author</th>
<th>Book</th>
<th>Publishing</th>
</tr>
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<tbody>
<tr>
<td>Leach Lawrence P.</td>
<td>Lean Project Management - Eight Principles for Success - Combining</td>
<td>Advanced</td>
</tr>
<tr>
<td></td>
<td>Critical Chain Project Management and Lean tools to accelerate</td>
<td>Projects, Inc.</td>
</tr>
<tr>
<td></td>
<td>project results</td>
<td>(2005)</td>
</tr>
<tr>
<td>Newbold Robert C.</td>
<td>Project Management in the Fast Lane - Applying Theory of Constraints</td>
<td>St Lucie</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Press (1998)</td>
</tr>
<tr>
<td>Newbold Robert C.</td>
<td>The Billion Dollar Solution - Secrets of ProChain Project Management</td>
<td>ProChain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Press (2008)</td>
</tr>
<tr>
<td>Newbold Robert, Lynch Bill</td>
<td>The Project Manifesto - Transforming Your Life and Work with</td>
<td>ProChain</td>
</tr>
<tr>
<td></td>
<td>Critical Chain Values</td>
<td>Press (2014)</td>
</tr>
<tr>
<td>Schon Andreas</td>
<td>Be Fast or Be Gone - Racing the Clock with Critical Chain Project</td>
<td>ProChain</td>
</tr>
<tr>
<td></td>
<td>Management</td>
<td>Press (2011)</td>
</tr>
<tr>
<td>Srinivasan Madhavam M.</td>
<td>Lean Maintenance Repair Overhaul</td>
<td>McGraw Hill</td>
</tr>
<tr>
<td>Gilbert Kenneth C.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tandon Steve</td>
<td>The Essence of TameFlow - Breakthrough Organizational Performance</td>
<td>TameFlow</td>
</tr>
<tr>
<td>Tandon Steve, Müller</td>
<td>Hyper-Productive Knowledge Work Performance - The TameFlow Approach</td>
<td>J. Ross</td>
</tr>
<tr>
<td>Wolffram</td>
<td>and its Application to Scrum and Kanban</td>
<td>Publishing</td>
</tr>
<tr>
<td>Updegrove David</td>
<td>The Critical Chain Implementation Handbook - Flow Is The Number of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dow Consideration</td>
<td>(2014)</td>
</tr>
<tr>
<td>Wizeppel Mark I</td>
<td>Projects in Less Time - A synopsis of Critical Chain</td>
<td>Pinnacle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strategies (2006)</td>
</tr>
</tbody>
</table>
The CCPM reference books

- The Billion Dollar Solution
- Critical Chain Project Management (3rd Edition)
- Critical Chain Project Management in the Fast Lane
- Project Management in the Fast Lane: Applying the Theory of Constraints
- Advanced Multi-Project Management: Achieving Outstanding Speed and Flexibility

The original book that started it all

- This is the original book written by Eli Goldratt who “invented” CCPM
- Eliyahu Goldratt
- Exists in several languages
- Scenario
  - An MBA professor gives a project management course in which they “discover” the Critical Chain way. He uses the “Socratic” technique. By addressing a class comprised of many different project environments (building, New Product Development, Software, …) it conveys how generic the solution is.
  - It is not Eli Goldratt’s best book. For instance part of the book covers the problems of MBAs and higher education.
  - It is mandatory reading for anyone seriously envisaging or involved in CCPM.

Warning: this book is incomplete since it only covers single project management. It does not deal with project portfolios.
Will you dare to finish all your projects on 21st October 2019 — Luxembourg, Monday 21st October 2019.

A list of >350 companies using Critical Chain


- Source: “Advanced Multi-Project Management Achieving Outstanding Speed and Results with Predictability” 2013 book by Gerald 1 Kendall & Kathleen M Austin.

Appendix
### References of Critical Chain implementations throughout the world (#1/10)

<table>
<thead>
<tr>
<th>Industry</th>
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<th>Company</th>
<th>Results</th>
<th>Reference</th>
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<tr>
<td>Power</td>
<td>Engineering</td>
<td>ABB AG, Power Tech, Sironia</td>
<td>Thoroughly assess 10% from 305 days to 450 days per line.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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<tr>
<td>Power</td>
<td>Engineering</td>
<td>ABB Italia</td>
<td>Engineering cycle time reduced from eight months to three months.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Power</td>
<td>Engineering</td>
<td>ABB Italia</td>
<td>Number of projects completed per year increased from 45 to 54, 125%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Construction</td>
<td>Design, build,</td>
<td>Arcelor Mittal</td>
<td>Increased number of projects completed from 100 to 110.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Construction</td>
<td>Design, build,</td>
<td>Arcelor Mittal</td>
<td>Cycle time improved from 18 months to 9 months.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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<tr>
<td>Airports</td>
<td>Design, build,</td>
<td>Aeropartner</td>
<td>Cycle time reduced by 23% and project completion increased by 35%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Design, build,</td>
<td>Albatros Technologies</td>
<td>Cycle time reduced by 23% and project completion increased by 35%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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<tr>
<td>Software</td>
<td>Development</td>
<td>Alcatel-Lucent</td>
<td>Cycle time reduced by 23% and project completion increased by 35%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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<tr>
<td>Software</td>
<td>Development</td>
<td>Alcatel-Lucent</td>
<td>Cycle time reduced by 23% and project completion increased by 35%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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<tr>
<td>Aerospace</td>
<td>Design, build,</td>
<td>Airbus</td>
<td>Cycle time reduced by 23% and project completion increased by 35%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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<tr>
<td>Aerospace</td>
<td>Design, build,</td>
<td>Airbus</td>
<td>Cycle time reduced by 23% and project completion increased by 35%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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### References of Critical Chain implementations throughout the world (#2/10)

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<tr>
<td>IT</td>
<td>IT installation</td>
<td>ABB Italia</td>
<td>Breake even installation time reduced by 54%.</td>
<td><a href="http://www.eyepcon.com">www.eyepcon.com</a></td>
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<tr>
<td>Glass Manufacturing</td>
<td>Engineering (ITO + NPD)</td>
<td>Asahi Glass</td>
<td>Overall time reduced by 30% to 50% increase in revenue with 6% of profits.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Bikes' development</td>
<td>Biorack</td>
<td>Actual sales planned from 100% to 30%. Between 20% and 50% increase of sales. 40% reductions of cycle time.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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<td>Aerospace</td>
<td>Aircraft manufacturing</td>
<td>Zodiac</td>
<td>Reduction of TAT (Turnaround Time) by 40%.</td>
<td><a href="http://www.eyepcon.com">www.eyepcon.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Engineering</td>
<td>Boeing</td>
<td>Reduced rugged wmg assembly time by 50%.</td>
<td><a href="http://www.pikkit.com">www.pikkit.com</a></td>
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<tr>
<td>Aerospace</td>
<td>Design and assembly</td>
<td>Boeing Aerospace Systems</td>
<td>Reduced rugged wmg assembly time by 50%.</td>
<td><a href="http://www.pikkit.com">www.pikkit.com</a></td>
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<tr>
<td>Aerospace</td>
<td>Engineering</td>
<td>Boeing Aerospace Systems</td>
<td>Reduced rugged wmg assembly time by 50%.</td>
<td><a href="http://www.pikkit.com">www.pikkit.com</a></td>
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### References of Critical Chain implementations throughout the world (#3/10)

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<tr>
<td>Marine manufacturing</td>
<td>Packaging line development</td>
<td>Book Packaging Systems</td>
<td>10% on-time delivery, 91.7% invoice, 30% cycle time reductions for projects over 2,000 hours</td>
<td><a href="http://www.pgpa-ter-association.org">www.pgpa-ter-association.org</a></td>
</tr>
<tr>
<td>Communications</td>
<td>IT Professional Services (eg. website)</td>
<td>Booz &amp; Co (Kaplan/Strategy Group)</td>
<td>Data center performance improved by 10%, hours/minutes reduced by 7%</td>
<td><a href="http://www.booz.com">www.booz.com</a></td>
</tr>
<tr>
<td>Energy</td>
<td>Crump</td>
<td>INPHI</td>
<td>Savings of over $500,000 with accelerated project and project required to meet project needs</td>
<td><a href="http://www.inphi.com">www.inphi.com</a></td>
</tr>
<tr>
<td>PwC</td>
<td>Engineering</td>
<td>C.M. Colombo</td>
<td>Increased data center performance from 65% to 85%</td>
<td><a href="http://www.cmc-chambly.com">www.cmc-chambly.com</a></td>
</tr>
<tr>
<td>Software</td>
<td>Flight simulation systems</td>
<td>CATHA</td>
<td>Reduced cycle time by two to four months, with $37 million increase in the number of profitable programs</td>
<td><a href="http://www.cathay.com">www.cathay.com</a></td>
</tr>
<tr>
<td>IT</td>
<td>IT</td>
<td>Caesar</td>
<td>5% of projects on time</td>
<td><a href="http://www.caesar.com">www.caesar.com</a></td>
</tr>
<tr>
<td>Construction</td>
<td>New hospital facility</td>
<td>California Department of Corrections</td>
<td>Built and opened a new hospital in 12 months that other approaches failed to do in 12 months.</td>
<td><a href="http://www.ca.gov">www.ca.gov</a></td>
</tr>
<tr>
<td>Software</td>
<td>IT</td>
<td>Costar Group</td>
<td>Increased completion of SAP projects from 15 to 10 per month</td>
<td><a href="http://www.costar.com">www.costar.com</a></td>
</tr>
<tr>
<td>Newcastle</td>
<td>Engineering</td>
<td>West Gulf Adolf Trbovich</td>
<td>Increased number of projects completed from 15 to 30 per month</td>
<td><a href="http://www.newcastle.com">www.newcastle.com</a></td>
</tr>
<tr>
<td>Automotive</td>
<td>Project development</td>
<td>Chrysler</td>
<td>Cycle time for prototype builds reduced from 10 weeks to 5 weeks</td>
<td><a href="http://www.chrysler.com">www.chrysler.com</a></td>
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PMI Luxembourg CCPM Conference V1.1 (2019/10/21)

### References of Critical Chain implementations throughout the world (#4/10)

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<th>Results</th>
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<tbody>
<tr>
<td>Iron ore mining</td>
<td>Truck operations</td>
<td>CMI, Natural Resources</td>
<td>Marginal savings reduced by 2%</td>
<td><a href="http://www.cmi.com">www.cmi.com</a></td>
</tr>
<tr>
<td>Financial services</td>
<td>Software development</td>
<td>CoStar (UK)</td>
<td>95% of projects on time</td>
<td><a href="http://www.costar.com">www.costar.com</a></td>
</tr>
<tr>
<td>Building</td>
<td>Bank construction</td>
<td>Concentra Velico</td>
<td>Triple savings in 2 years, 90% on-time delivery</td>
<td><a href="http://www.concentra-velico.com">www.concentra-velico.com</a></td>
</tr>
<tr>
<td>Building</td>
<td>SAP Implementation</td>
<td>EuroHorse</td>
<td>Results after 1/2 implementation: 25% cycle time reduction, 30% pipeline improvement</td>
<td><a href="http://www.eurohorse.com">www.eurohorse.com</a></td>
</tr>
<tr>
<td>Biotechnology</td>
<td>Engineering</td>
<td>Danisco (Denmark)</td>
<td>Increased from 8% to 1% on-time delivery</td>
<td><a href="http://www.danisco.com">www.danisco.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Repair</td>
<td>Delta Air Lines, Inc.</td>
<td>21% increase in repair performed, 12% reduction in aircraft transmittal time</td>
<td><a href="http://www.deltaairlines.com">www.deltaairlines.com</a></td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>Product development</td>
<td>Dr. Reddy's Laboratories</td>
<td>Increased margins on 12 product launches</td>
<td><a href="http://www.drreddy.com">www.drreddy.com</a></td>
</tr>
<tr>
<td>Energy</td>
<td>Induction</td>
<td>Duke Energy</td>
<td>No benefit for DP3 purchase, 10% reduction in engagement transmittal time</td>
<td><a href="http://www.duke-energy.com">www.duke-energy.com</a></td>
</tr>
<tr>
<td>Semiconductor</td>
<td>Design and manufacturing</td>
<td>478 Semiconductors</td>
<td>Cycle time reduced from 51 weeks to 25 weeks</td>
<td><a href="http://www.478semiconductors.com">www.478semiconductors.com</a></td>
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<tr>
<td>Communications</td>
<td>Network design and development</td>
<td>Allianz</td>
<td>No change in delivery times of 9% to 10%</td>
<td><a href="http://www.allianz.com">www.allianz.com</a></td>
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PMI Luxembourg CCPM Conference V1.1 (2019/10/21)
### References of Critical Chain implementations throughout the world (#5/10)

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<tr>
<td>Communication</td>
<td>IT</td>
<td>eGlobal</td>
<td>From 60% to 90% of projects on time, lead time reduced from 154 days to 30 days.</td>
<td><a href="http://www.e-global.com">www.e-global.com</a></td>
</tr>
<tr>
<td>Defense</td>
<td>Electronics</td>
<td>Elbe System</td>
<td>Within the Eve European department, 70% of on time or &lt;3 month delivery.</td>
<td><a href="http://www.elbe-system.com">www.elbe-system.com</a></td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>Product development</td>
<td>Eli Lilly and Co</td>
<td>Projects schedule up to 12 months, reduced to 4 months.</td>
<td><a href="http://www.pattison.org">www.pattison.org</a></td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>Product development</td>
<td>Eli Lilly and Co</td>
<td>On time delivery of 100% with Critical Chain versus 60% with traditional project management.</td>
<td><a href="http://www.pattison.org">www.pattison.org</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>NRO</td>
<td>Defence</td>
<td>Aircraft Turns Annual Time by more than half (66%/13 months to 1 week); Increase of machinists’ productivity by 70%</td>
<td><a href="http://www.maris-consulting.com">www.maris-consulting.com</a></td>
</tr>
<tr>
<td>Construction</td>
<td>Manufacturing</td>
<td>Ericsson</td>
<td>Reduced 10% annual average project durations to 7 months; increased by 10%, received 4 months earlier.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Construction</td>
<td>Property</td>
<td>SIA</td>
<td>Reduces 6% building project durations to 7 months.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Refrigeration</td>
<td>Manufacturing</td>
<td>Boeing</td>
<td>&gt;60% throughput in terms of number of completed projects per month; 5% lead-time reduction.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Product development</td>
<td>EADS</td>
<td>10% on-time delivery; 70% cycle time reduction.</td>
<td>EADS Strasbourg 2016 TDC conference</td>
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<tr>
<td>Aerospace</td>
<td>Helicopters</td>
<td>Envision</td>
<td>Increased projects on time from 13% to 15%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
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### References of Critical Chain implementations throughout the world (#6/10)

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<tr>
<td>Measurement</td>
<td>R&amp;D</td>
<td>Edwards + Faurot</td>
<td>&gt;70% throughput; 60% higher reliability.</td>
<td><a href="http://www.a-data.com">www.a-data.com</a></td>
</tr>
<tr>
<td>Energy</td>
<td>Engineering</td>
<td>PwC Technologies</td>
<td>10 reports in two and final assembly time.</td>
<td><a href="http://www.pwc.com">www.pwc.com</a></td>
</tr>
<tr>
<td>Military</td>
<td>Repair</td>
<td>French Air Force</td>
<td>Returned two out of 66 aircraft to Air Force by 100 million threat.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Police</td>
<td>Efficiency improvement</td>
<td>United States</td>
<td>5% reduction of pending applications; Application lead time reduced by 60%.</td>
<td><a href="http://www.usps.com">www.usps.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Product development</td>
<td>Boeing Business</td>
<td>Increased from 14 to 15 days at first year, 30% in second year with no increase in lead cost.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>Product development</td>
<td>Boeing</td>
<td>Began 45% high tech production in 12 months, instead of 16- month industry norm.</td>
<td><a href="http://www.goldston.com">www.goldston.com</a></td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>Consumer</td>
<td>Boeing</td>
<td>30% lower cost to market; improved products on time from 90% to 90%.</td>
<td><a href="http://www.redston.com">www.redston.com</a></td>
</tr>
<tr>
<td>Data Security and</td>
<td>Software integration</td>
<td>Honeywell</td>
<td>10% increase in 8 integrations through 4 months; 60% of projects back on time.</td>
<td><a href="http://www.honeywell.com">www.honeywell.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Product development</td>
<td>Honeywell</td>
<td>Work from 20 months to 16-year; Reduces of 12- year by 50%.</td>
<td><a href="http://www.enginrx.com">www.enginrx.com</a></td>
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### References of Critical Chain implementations throughout the world (#7/10)

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<tr>
<td>Semi-conductor</td>
<td>Engineering</td>
<td>Innersource</td>
<td>75% reduction in cycle time, from 64 days to 4 days.</td>
<td><a href="http://www.innersource.com">www.innersource.com</a></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Product development</td>
<td>MHS Inc.</td>
<td>80% on-time delivery</td>
<td><a href="http://www.mhsinc.com">www.mhsinc.com</a></td>
</tr>
<tr>
<td>Building</td>
<td>Interior design</td>
<td>Janus</td>
<td>90% reduction in change order costs, from 9 months to 5 months.</td>
<td><a href="http://www.janus.com">www.janus.com</a></td>
</tr>
<tr>
<td>Building</td>
<td>Building construction</td>
<td>Handy Constructions Ltd</td>
<td>30% reduction in change order costs, from 9 months to 5 months.</td>
<td><a href="http://www.handyconstructions.com">www.handyconstructions.com</a></td>
</tr>
<tr>
<td>Energy</td>
<td>Design and manufacturing</td>
<td>Universal Technologies Inc.</td>
<td>Reduced design and engineering time, from 12 months to 9 months.</td>
<td><a href="http://www.universaltechnologies.com">www.universaltechnologies.com</a></td>
</tr>
<tr>
<td>Building</td>
<td>3D printing</td>
<td>Innovate building company</td>
<td>75% reduction in building time, from 3 months to 2 months.</td>
<td><a href="http://www.innovatebuildingcompany.com">www.innovatebuildingcompany.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Engineering and scientific</td>
<td>Lockheed Martin</td>
<td>Cut overall design costs by 15% without reducing scope.</td>
<td><a href="http://www.lockheedmartin.com">www.lockheedmartin.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>IT</td>
<td>IBM</td>
<td>Reduced IT costs, from 6 months to 3 months.</td>
<td><a href="http://www.ibm.com">www.ibm.com</a></td>
</tr>
<tr>
<td>Semiconductor</td>
<td>Design</td>
<td>Intel</td>
<td>Reduced IT costs, from 6 months to 3 months.</td>
<td><a href="http://www.intel.com">www.intel.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>MRO</td>
<td>Lehigh Technologies</td>
<td>T/L decreased by 15%-20%, schedule deviation reduced by 15%</td>
<td><a href="http://www.lehightechnologies.com">www.lehightechnologies.com</a></td>
</tr>
</tbody>
</table>

### References of Critical Chain implementations throughout the world (#8/10)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Project Type</th>
<th>Company</th>
<th>Results</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>Transformation and compliance with new technology and legislation</td>
<td>Memorial Sloan Kettering</td>
<td>Within 6 months, number of failed programs reduced by 75%</td>
<td><a href="http://www.mskcc.org">www.mskcc.org</a></td>
</tr>
<tr>
<td>Medical</td>
<td>Product development</td>
<td>Medtronic</td>
<td>Improved software release time, from 6 months to 3 months.</td>
<td><a href="http://www.medtronic.com">www.medtronic.com</a></td>
</tr>
<tr>
<td>Medical</td>
<td>Product development</td>
<td>Medtronic, Danone</td>
<td>Reduced project cycle time, from 18 months to 8 months.</td>
<td><a href="http://www.medtronic.com">www.medtronic.com</a></td>
</tr>
<tr>
<td>Insurance</td>
<td>IT</td>
<td>National Health Care Group</td>
<td>Due Date Performance was 25% to 35%</td>
<td><a href="http://www.nhcg.org">www.nhcg.org</a></td>
</tr>
<tr>
<td>Telecom</td>
<td>Capacity expansion</td>
<td>Nortel</td>
<td>A 50% reduction in project completion time, from 10 months to 5 months.</td>
<td><a href="http://www.nortel.com">www.nortel.com</a></td>
</tr>
<tr>
<td>Supply Chain</td>
<td>Data Systems and WMS integration</td>
<td>Novartis</td>
<td>25% improvement in fame and material cost recovery</td>
<td><a href="http://www.novartis.com">www.novartis.com</a></td>
</tr>
<tr>
<td>Consumer goods</td>
<td>Small</td>
<td>Oregon Food Co-op</td>
<td>Increased number of sales, from 7% to 12%</td>
<td><a href="http://www.oregonfoodcoop.com">www.oregonfoodcoop.com</a></td>
</tr>
<tr>
<td>Glass</td>
<td>Manuf. upgrading</td>
<td>Owens-Illinois</td>
<td>Increased cycle time, from 6 months to 2 months.</td>
<td><a href="http://www.owenis.com">www.owenis.com</a></td>
</tr>
<tr>
<td>Medical</td>
<td>Emergency room in hospital</td>
<td>OhioHealth</td>
<td>Increased patient throughput, from 10% to 5%.</td>
<td><a href="http://www.ohiohealth.com">www.ohiohealth.com</a></td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>Product development</td>
<td>R&amp;D Pharmaceuticals</td>
<td>Increased project completion rate from 25% to 40%</td>
<td><a href="http://www.rdp.com">www.rdp.com</a></td>
</tr>
</tbody>
</table>
### References of Critical Chain implementations throughout the world (#9/10)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Project Type</th>
<th>Company</th>
<th>Results</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoe</td>
<td>New Product Development</td>
<td>Puma</td>
<td>Close to desired delivery for new models with lead times up to 18 months.</td>
<td><a href="http://www.puma.com">www.puma.com</a></td>
</tr>
<tr>
<td>Rail</td>
<td>Repair</td>
<td>Railwave, Switzerland</td>
<td>Increased on-time delivery of service trains</td>
<td><a href="http://www.railwave.com">www.railwave.com</a></td>
</tr>
<tr>
<td>Defense</td>
<td>New Product Development</td>
<td>Northrop Grumman</td>
<td>Delivered on-time, on-budget</td>
<td><a href="http://www.northropgrumman.com">www.northropgrumman.com</a></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Product Development</td>
<td>Iron Mountain Group</td>
<td>Led time from 3 weeks to 10 days.</td>
<td><a href="http://www.ironmountain.com">www.ironmountain.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Product Development</td>
<td>Boeing</td>
<td>New development system (P6) delivered on-time without timeline on the initial design</td>
<td><a href="http://www.boeing.com">www.boeing.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Factory plant layout</td>
<td>Airbus</td>
<td>98% of total project development delivered on-time</td>
<td><a href="http://www.airbus.com">www.airbus.com</a></td>
</tr>
<tr>
<td>Aerospace</td>
<td>Product development</td>
<td>Lockheed Martin</td>
<td>On-time delivery of complex avionics systems</td>
<td><a href="http://www.lockheedmartin.com">www.lockheedmartin.com</a></td>
</tr>
<tr>
<td>IT</td>
<td>Product development</td>
<td>IBM</td>
<td>Cut new product development duration by half</td>
<td><a href="http://www.ibm.com">www.ibm.com</a></td>
</tr>
</tbody>
</table>

### References of Critical Chain implementations throughout the world (#10/10)

Please note that this list only represents a small part of Critical Chain implementations, many other companies manage their projects with this approach: Embraer, 3M, Abbott Labs, AMD, BELL, Coca-Cola, FEI, etc…
Factories, People & Results

Critical Chain Project Management (CCPM) – Will you dare to finish all your projects on time?

Project Management Institute – Luxembourg Chapter – Luxembourg, Monday 21st of October 2019

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PMI Luxembourg CCPM Conference V1.1 20191021

A video website with over 250 videos: Marris Consulting's YouTube Channel
https://www.youtube.com/user/marrisconsulting/videos

Appendices

To facilitate viewing and video selection use the playlists:
- English videos
- Critical Chain videos
- Etc.

A permanent news website dedicated to CCPM

http://www.scoop.it/t/critical-chain-project-management
A LinkedIn Discussion group dedicated to Critical Chain Project Management

https://www.linkedin.com/groups/5183858

Beware there are several with similar names. This one is named: Critical Chain Project Management

TOCICO CCPM Portal (Theory Of Constraints International Certification Organization)

https://tocico.site-ym.com/?page=project_portal
People & Results

Luxembourg, Monday 21

Mitigating Behavioral Outcomes in A Multi-Project
Ellis, George
Productivity of product design and engineering
Critical chain and theory of constraints applied to
Improving performance in project-based management:
European Journal of
Zhang, Junguang; Song, Xiwei; Díaz, Estrella

COMFRC Addresses Legacy Hornet Readiness
According to PMA-265, 114 aircraft have completed inspections and are
of October 2019

Appendices

A dedicated Critical Chain website (currently only in French)

www.chaine-critique.com
2015 Conference:
How to identify bottlenecks in production and projects

- TOCICO Annual Conference in Cape Town South Africa by Philip Marris.
- Video here: https://youtu.be/ulXqO86OfpU?list=PLuB3wmjgtuAXQ3Y93Yd3Y

A dual view:
Different rules apply for constraints and non-constraints

**Rules for constraints**
- Increase productivity by:
  - reducing multitasking,
  - ensure full kitting before they start a task,
  - special favours in work environment,
  - improvement actions focussed here,
  - or investments.
- Understand in detail what the constraint really is. In a multi-project environment it is often a part of a department, rarely the whole department.
- Protect these resources so that they never stop and/or are never unnecessarily disturbed.

**Rules for non-constraints**
- Subordinate: decide new project or new task launches according to the overall schedule and never feed them just to keep them busy.
- Do not flood the upstream activities. This will only increase multitasking and will make it easy for them to look busy.
- Improvement actions should focus:
  - on the root causes of why they consumed their buffers and
  - on reducing non-quality issues.

This is the project management version of ToC’s dual view
Marris Consulting hosts over 50 public or internal training sessions every year

What we do

- Marris Consulting has a reputation for its capacity to be pertinent in nearly all kinds of industry. We have worked in over 250 companies helping in designing, making, selling and distributing:
  - cars, hamburgers, aeroplanes, perfume, trains, rockets, industrial equipment, pharmaceuticals, home delivery services, computer chips, chips (food), maintenance / repair / overhaul (MRO) of planes and trains, luxury handbags, corrugated cardboard production, the defence industry, Swiss watches, steel manufacturing, plastics, bank notes, satellites, gold mines …

- We are committed, viscerally, to producing results. Results that are well beyond our clients’ expectations. And results that last. Better still we incessantly seek to strengthen the process of on-going improvement; we want to see our ex-clients getting better and better many years after we intervened.
How we do it

- We understand that the hardest part of what we do is to change "people". Apart from the pertinent ideas that we must have we must directly and indirectly change individual and collective behaviour.

- We work simultaneously at all levels of the company from the front line operators to the board room.

- We are recognized experts in many different fields: "Lean" (manufacturing/engineering/management/…), the Theory Of Constraints, Six Sigma, Industry 4.0, DDMRP …

- One of our key strengths is that we analyse each of our new client's business & culture and then we mix up the right cocktail of solutions. We never impose a so called industry best practise.

- We like simple solutions. Simple is beautiful.

Theory of Constraints marketing & awareness activities

- 5 Permanent news websites (www.Scoopit.com)
  - Theory Of Constraints (English & French)
  - Critical Chain in (English & French)
  - TLS: ToC + Lean + Six Sigma

- >250 free videos (YouTube Channel)

- Discussion Groups (LinkedIn)
  - Critical Chain
  - TLS: ToC, Lean and Six Sigma

- 2 dedicated websites in French
  - ToC in Production
  - ToC in Projects

- Others:
  - Twitter, Facebook, Etc.
We are honoured to have been able to help...

Philip Marris, Founder and CEO of Marris Consulting
Business transformation, Theory Of Constraints and Lean expert
Bilingual & bicultural English/French

33 years of experience, 59 years old, Manufacturing & Supply Chain expert

<table>
<thead>
<tr>
<th>SECTORS / CLIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Over 250 engagements in industry</td>
</tr>
<tr>
<td>- Aeronautical (several), Pharmaceuticals (several)</td>
</tr>
<tr>
<td>- Automotive industry: car makers and suppliers, buses ... (several)</td>
</tr>
<tr>
<td>- Process industry: steel, glass, cardboard, edible plastic</td>
</tr>
<tr>
<td>- World leader in luxury goods, World leader in full bearings</td>
</tr>
<tr>
<td>- Packaging: cardboard, steel, plastic</td>
</tr>
<tr>
<td>- World leader in fast food</td>
</tr>
<tr>
<td>- World leader in electrical power system, Furnitures manufacturer, Satellites, Marine engines, Armoured vehicles, Luxury watches, Printed circuit boards, rockets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MISSIONS / RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- B&amp;D &amp; Industrialisation / Engineering / New Product Development (sample):</td>
</tr>
<tr>
<td>- Aeronautical OEM. 700 p., project duration: 40%, On Time: &gt;97%</td>
</tr>
<tr>
<td>- Luxury Goods designer and manufacturer. Durations: 65%, Throughtput and productivity: &gt;+150%</td>
</tr>
<tr>
<td>- Medical Devices: 2 successful CCPM implementations</td>
</tr>
<tr>
<td>- Electric bus battery pack NPD / CCPM</td>
</tr>
<tr>
<td>- Aeronautical product industrialisation portfolio: reduced durations and projects think on time</td>
</tr>
<tr>
<td>- CCPM in an industrial equipment manufacturer. Lead times reduced by 30%. Throughtput and Productivity over +150%. Projects completed on time went from less than 25% to over 80%.</td>
</tr>
<tr>
<td>- Several aeronatical product development and industrialisation projects involving up to 500 people per project in up to 8 different simultaneous facilities with budgets up to 20MM each</td>
</tr>
<tr>
<td>- New product development and product relooking: reduction of over 45% of average project duration, increase in number of projects completed each year of over 30%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FORMER POSITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cap Gemini Ernst &amp; Young / Boisard Consultant, In charge of Manufacturing Operations for Pronto &amp; Europe (+200 consultants)</td>
</tr>
<tr>
<td>- Cap Sevol Industrie</td>
</tr>
<tr>
<td>- Creative Output: collaborated with E. Goldratt author of The Goal</td>
</tr>
<tr>
<td>- Valiance, Shopfloor Engineer, Methods Engineer</td>
</tr>
<tr>
<td>- Professor at IRC Management School (Supply Chain &amp; Manufacturing)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPETENCIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Transformation programs in industry</td>
</tr>
<tr>
<td>- Industrial Excellence Expert, manufacturing and product development</td>
</tr>
<tr>
<td>- Recognition of project leader, Six Sigma and Theory Of Constraints. Other competencies:</td>
</tr>
</tbody>
</table>
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