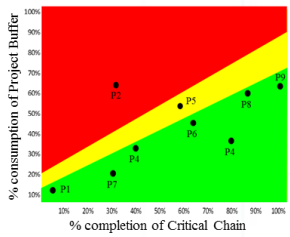

October 21, 2019

Luxembourg, Clausen

CRITICAL CHAIN PROJECT MANAGEMENT
BY PHILIP MARRIS
BROUGHT TO YOU BY PMI LUXEMBOURG CHAPTER

Project Management Institute (PMI) Founded in 1969 by Working Project Managers

LUXEMBOURG CHAPTER

Over 500,000 members, over 800,000 PMP certification holders and 10,000+ active volunteers in 182 countries and 25 territories, 285 chapters and 20 potential chapters.

CELEBRATING OUR 50 ANNIVERSARY PMI Project Management Institute

Luxembourg Chapter since 2010

- **Our Mission: Give Project Management professionals a platform for knowledge sharing and networking.**
- PMI Luxembourg offers a minimum of 16 hours of events/year, varying from knowledge sharing in the shape of presentations, workshops, research projects presented with panel discussions with local subject matter experts to networking opportunities.
- Join us to:
  - Meet your peers and grow your professional network
  - Share solutions and ideas, enhance your knowledge
  - Enjoy our events, in Luxembourg and abroad
  - Earn PDUs to keep your certification in good standing
  - Develop by learning and practicing new skills through volunteering with the chapter activities

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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PM Project Management Institute.

Critical Chain Project Management

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

Project Management Institute - Luxembourg Chapter

Conference by Philip Marris

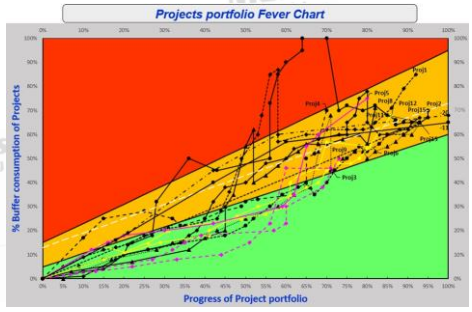
Marris Consulting

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.



Aerosud case
Portfolio of new product & process development
Aeronautical equipment supplier
after 2.5 years of CCPM
>98% finish on time

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Content

YouTube video on MarrisConsulting channel

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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*.
- Founder and CEO of Marris Consulting based in Paris, France. Founded in 2004.
  Motto: *Factories, People & Results.*

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We are honoured to have been able to help…

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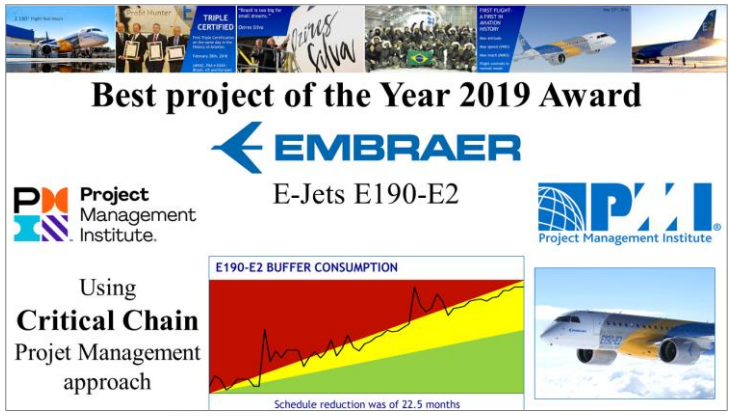
On 5th of October 2019, the PMI awarded the best project of the year to Embraer who used the Critical Chain approach



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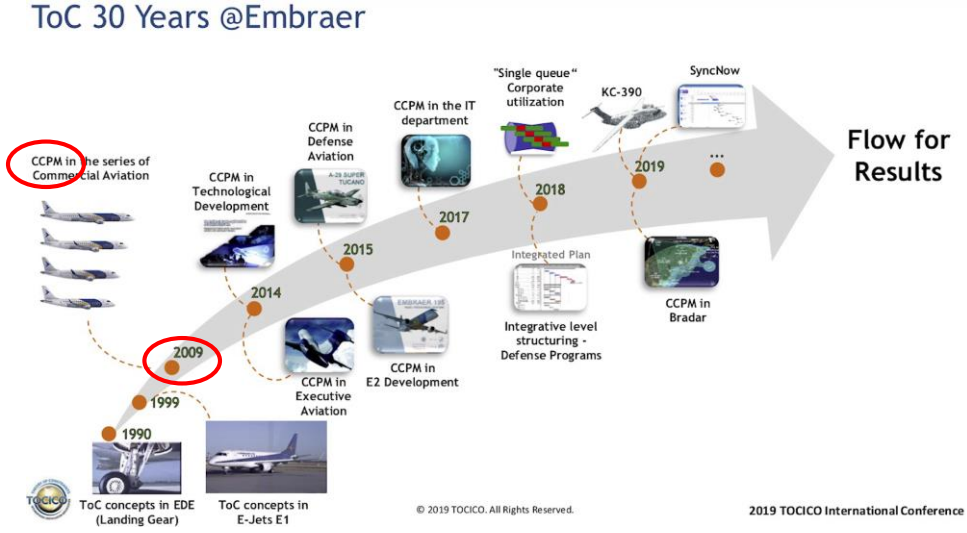
This was the culmination of a 10 year Critical Chain Project Management journey



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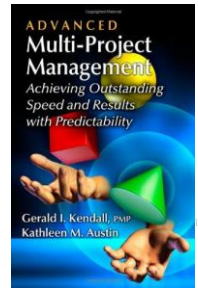
Over the past 20 years, Critical Chain has demonstrated its ability to greatly improve the performance of project planning and execution

- 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	Average	Worst case	Best case
Project durations	- 39%	- 13%	- 78 %
Number of projects completed in a given time	+ 70 %	+ 15%	+ 222%
Throughput	+53%	+ 14%	+ 150%



See appendix for a list of cases.

Source: "Advanced Multi-Project Management Achieving Outstanding Speed and Results with Predictability" 2013 book by Gerald I. Kendall & Kathleen M. Austin, page 95. The analysis is based on public information available concerning 60 different organizations working in different industries that had applied CCPM.

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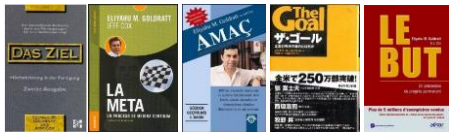
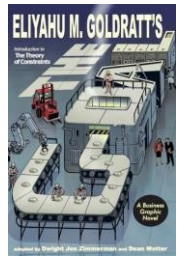
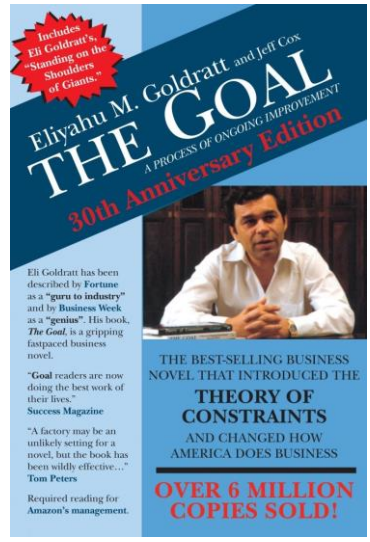
The Theory Of Constraints gained global recognition because of the success of the "business thriller" *The Goal* by Eliyahu Goldratt

- 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.
- New graphic edition in 2017.







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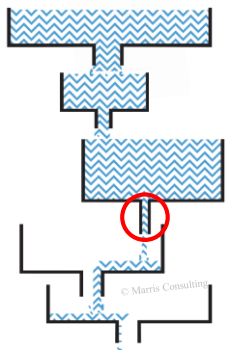
Focus on improving the system constraints that determines the overall performance and buffer the system against uncertainty and variability

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 optimums is not equal to the global optimum

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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, DBR & 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 Marketing & Sales** Mafia Offer or (UnRefusable Offer / URO) + Decisive Competitive Edge + Sales force constraints
Throughput Accounting Financial decision making T,I,O.E.: Throughput, Inventory & Operating Expenses, TBDM, 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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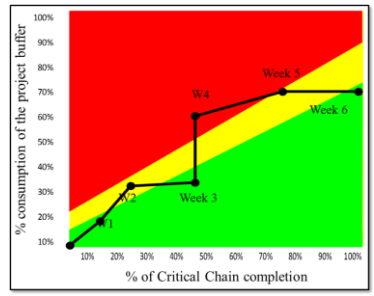

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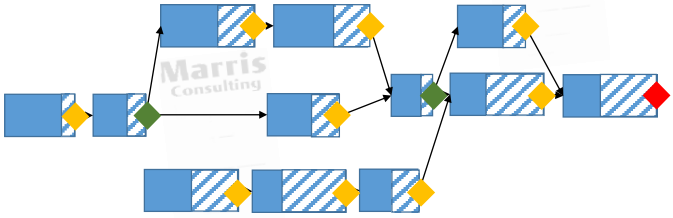
Project managers try to compensate for the uncertainties inherent in projects

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



Actual task duration

Added margin

- Main milestones
- Intermediate milestone
- Final milestone

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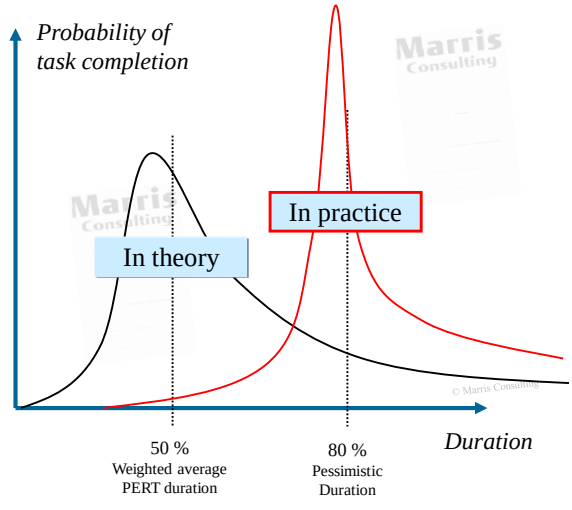
In practice, these local task margins and task completion date pressure make projects last longer and make project end dates less reliable

- Margins are wasted because of:
  - Student syndrome
  - Parkinson's law
  - Bad multi-tasking
  - Early finish waste



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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.

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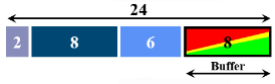
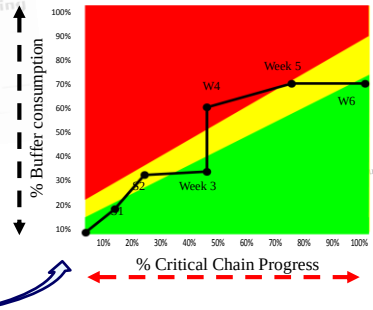
With traditional planning...

… each task has its own margin

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



Fever Chart



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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.

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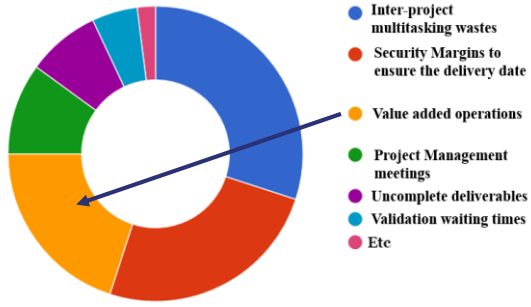
We find that it is easy to get everyone to accept very short focused task durations

- 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).



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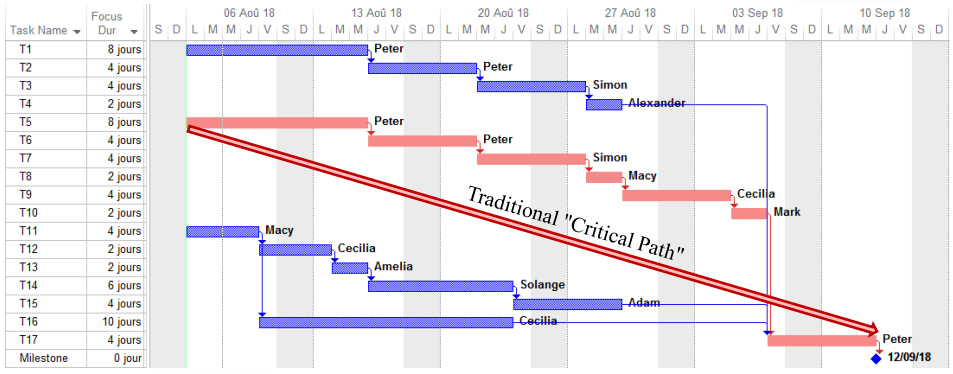
Unlike traditional approaches (such as Critical Path) Critical Chain planning is finite capacity planning

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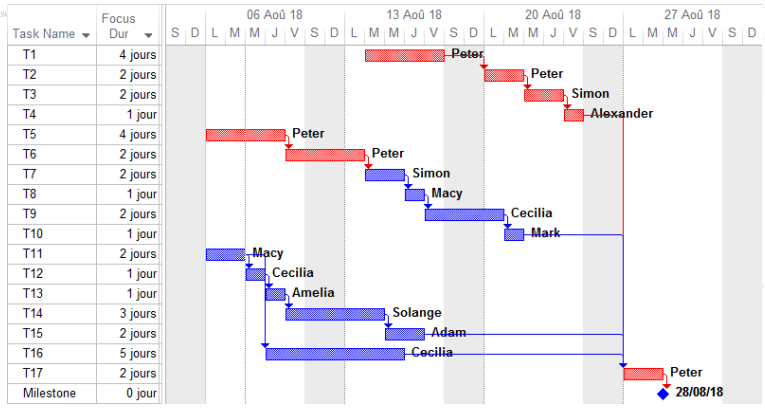
The Critical Chain is the levelled critical path (taking into account available resources)

- **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.



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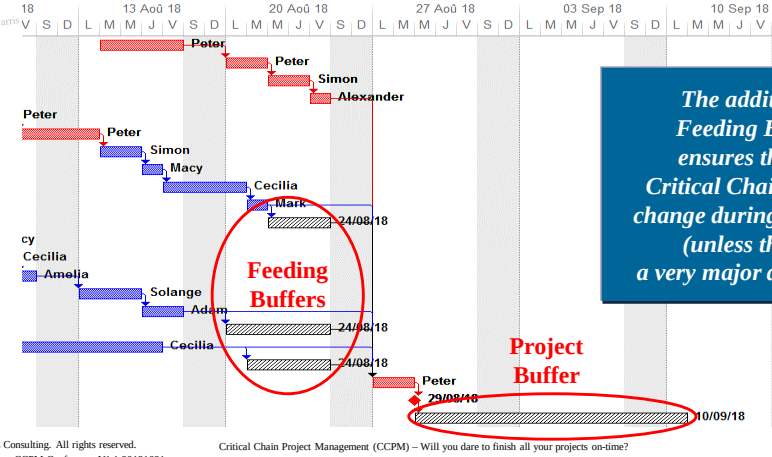
The total duration of the project is equal to the Critical Chain plus a shared "Project buffer"

- 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)

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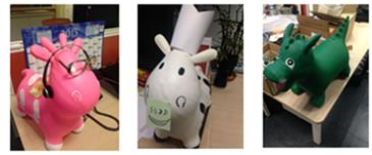
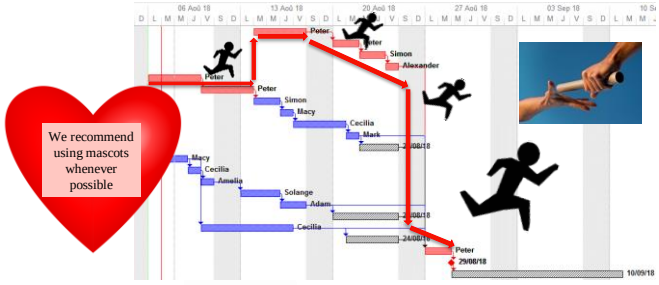
During project execution, we focus on the smooth and rapid execution of tasks on the Critical Chain

- 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

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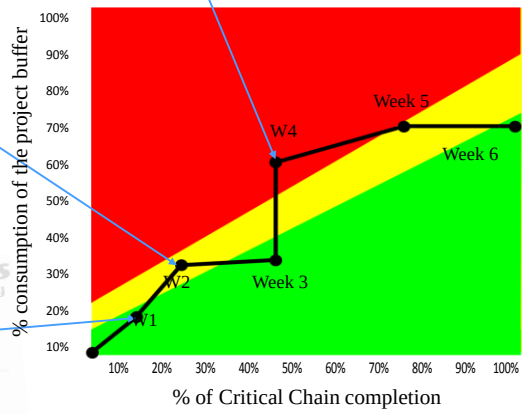
The project Key Performance Indicator (KPI) the size of a post card: Project monitoring is much easier thanks to the **Project Fever Chart**

Yellow zone= warning zone → identify main cause of delay and prepare action plan

Red zone = risky zone → start right now corrective actions



Green zone = comfort zone → no action needed

Green zone = this is just normal "noise"

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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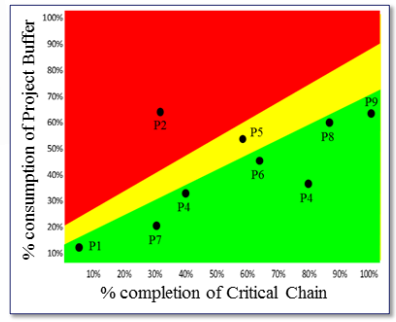

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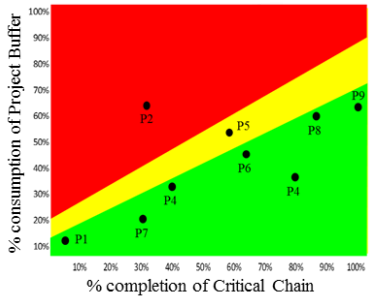
Managing a portfolio of projects is actually very easy

- 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: the portfolio management dream in postcard format

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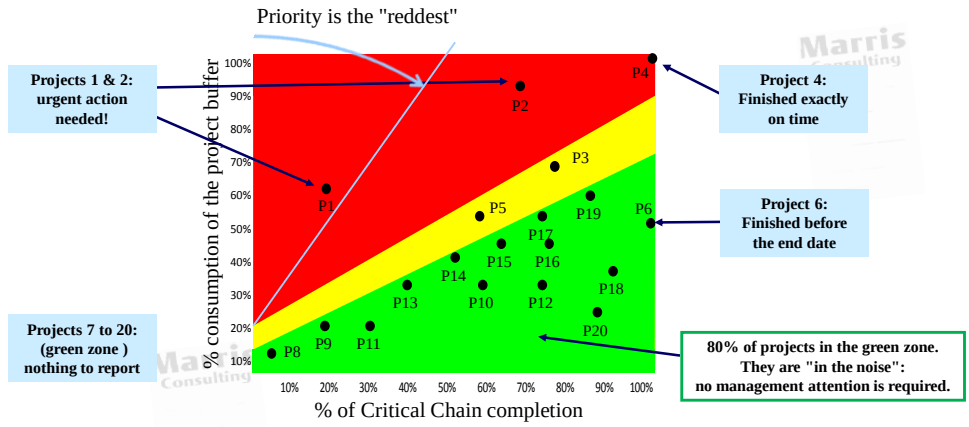
The **Portfolio Fever Chart** greatly facilitates dynamic arbitration between projects and portfolio management in general



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

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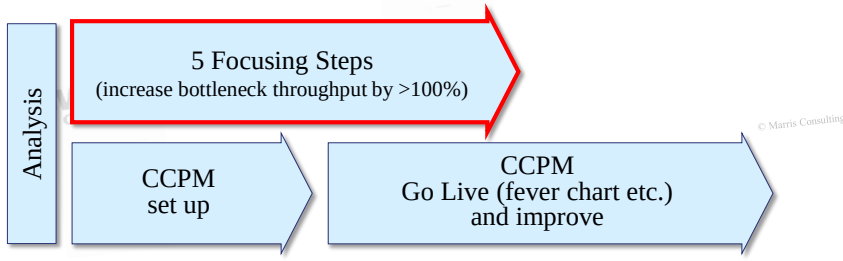
You can kick-start a portfolio implementation by significantly increasing the performance of the portfolio's capacity constraint

- 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.



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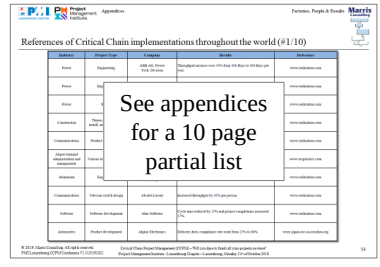
Since its appearance more than 20 years ago, Critical Chain has been implemented thousands of times

- More than 500 cases formally identified and documented (and about 300 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.



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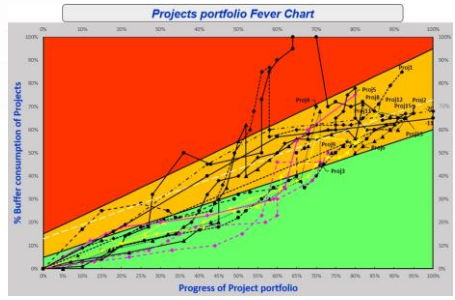
South African aeronautical equipment manufacturer
New Product Development + ERP implementation + …

- 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.



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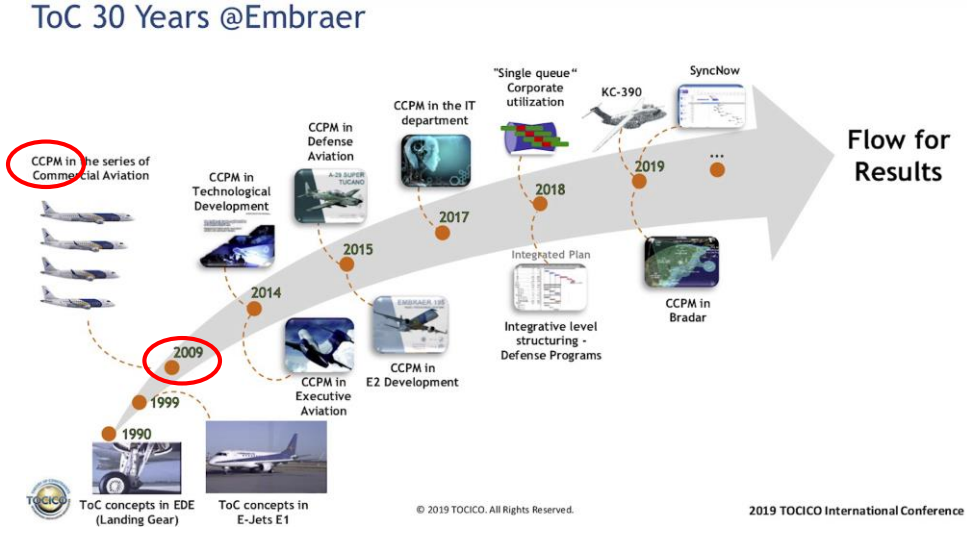
As we saw with Embraer's case, in large organizations it can take several years for Critical Chain to become the main way



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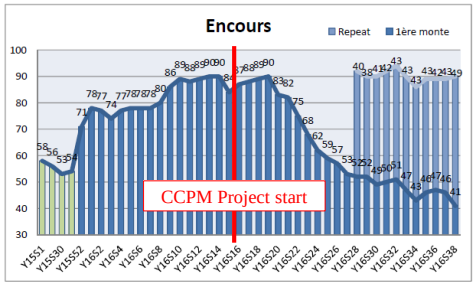
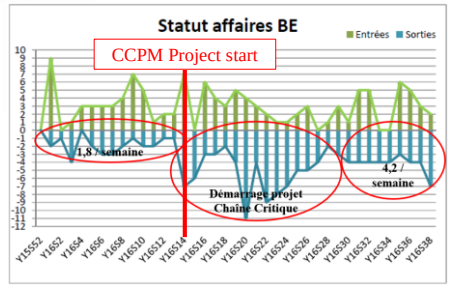
A Engineering To Order and Make To Order company
Lead-times divided by 5 and productivity more than doubled

- 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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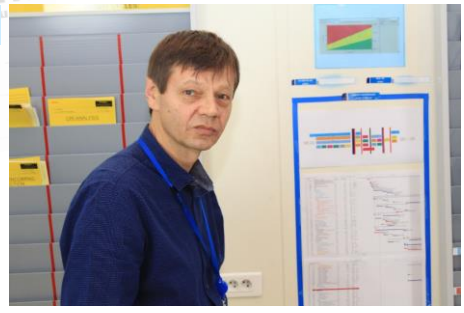

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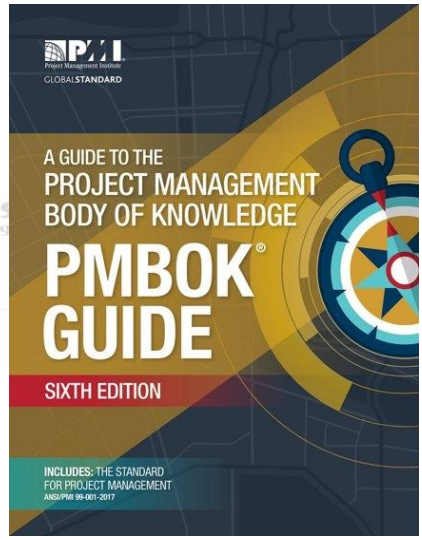
Critical Chain now has a proven track record but it is not yet integrated in to the PMBOK

- 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.



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Maybe this will change now that PMI's Best Project of the Year 2019 was obtained using the Critical Chain approach

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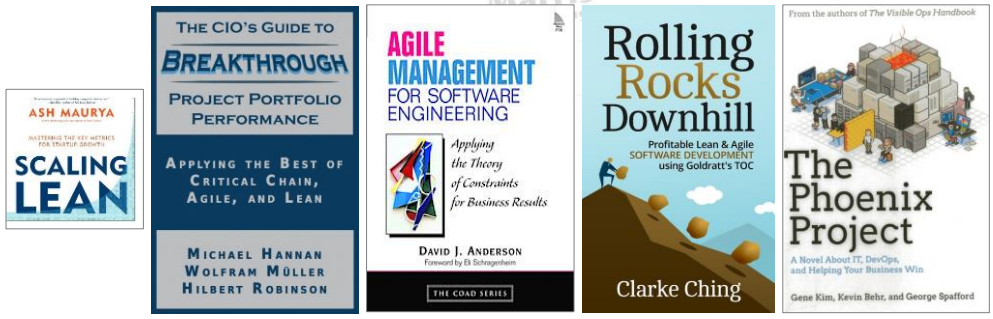
Critical Chain can be combined with Agile and/or DevOps

- 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.



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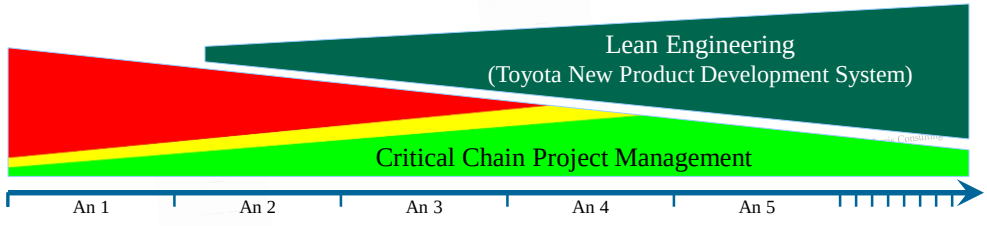
For new product development projects, the Critical Chain allows manufacturers to embark on a "Lean Engineering" journey

- 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.



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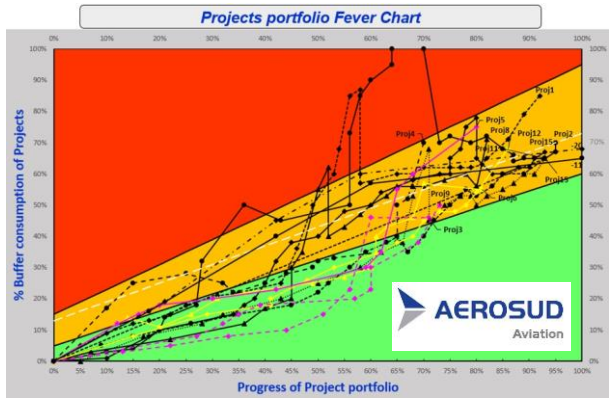
Dare to finish all your projects on time!
(title of this presentation)

- 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

Do you think this is possible in your organisation!?

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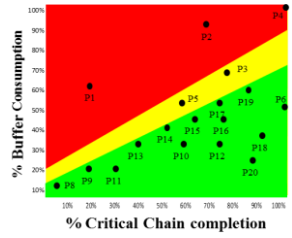
Summary of the Critical Chain way

- 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	Average
Project durations	- 39%
Number of projects completed in a given time	+ 70 %
Throughput	+ 53%



Critical Chain enables you to take control of your projects portfolio…
…do you dare to finish all your projects on time?

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Thank you for your time. Any questions?

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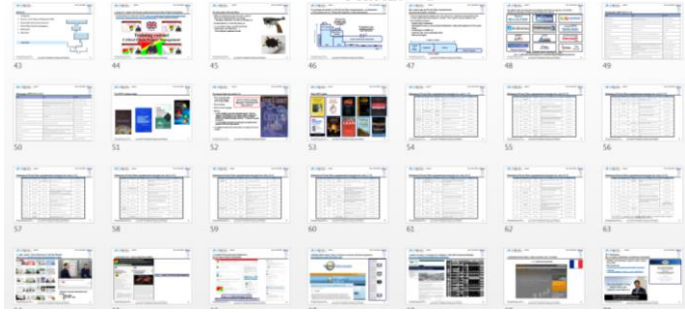
Note:
We recommend having a look at the (big) appendices to this presentation



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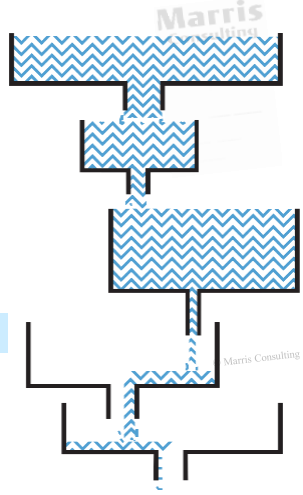
Sommaire

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. Conclusion

- Appendices



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

- On Marris Consulting website and YouTube: https://www.marris-consulting.com/en/critical-chain-project-management-videos/critical-chain-project-management-series (2 versions: English and French)

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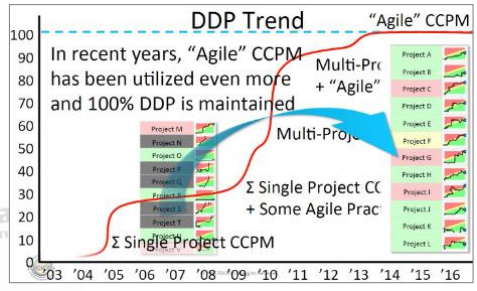
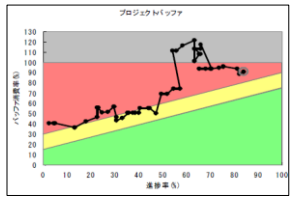
Mazda, car manufacturer
After a 10 year roll out the first complete cars "Made by ToC" are now available

- 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.





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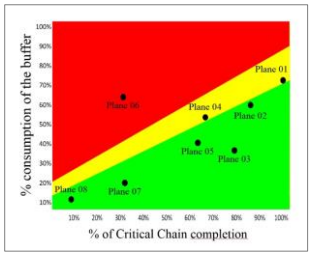
MRO – EMEA Maintenance Centre for Executive Jets
Executive Jet Turn Around Time reduction

- 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%.
- Reduction in the level of stress. Stability and clarity of the priorities set by management. Reduction in multitasking.
- Implementation of "pipelining" of aircraft. Development of a hangar portfolio Fever Chart.



(En) Embraer using Critical Chain PM for Executive Jets

See the YouTube video testimonies on the MarrisConsulting channel

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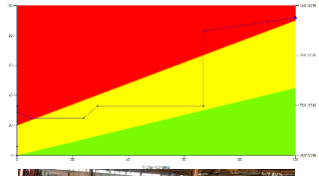
European leader for aeronautical equipment
Rapid factory plant layout transformation

- 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.



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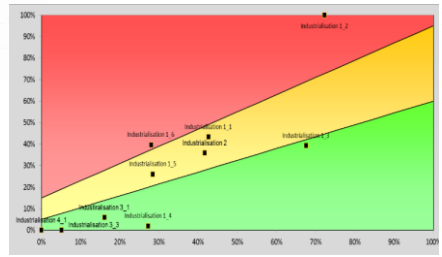
Equipment manufacturer for aeronautical industry
New product development and industrialisation portfolio

- 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.



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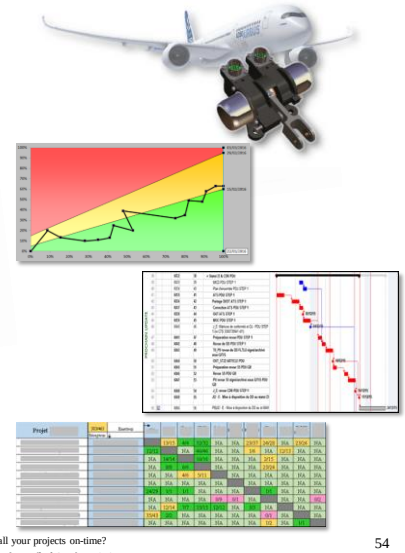
European leader in aeronautical equipment
Development of a complex avionics system

- 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).



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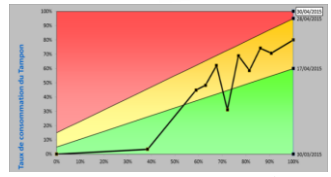
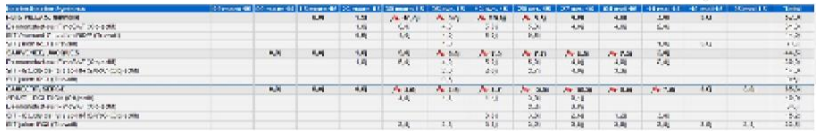
French terrestrial armament European leader
Critical Chain to manage several key projects

- 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.





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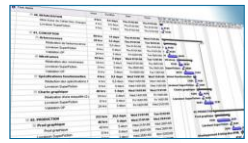
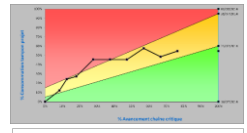
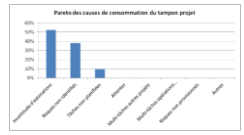
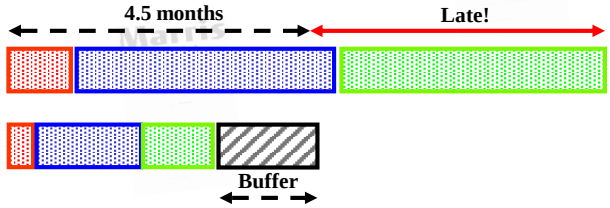
Space industry European leader. CCPM to save a crucial overdue project
Project duration reduced from >9 months to <4.5 months and delivered on time

- 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.









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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, …).

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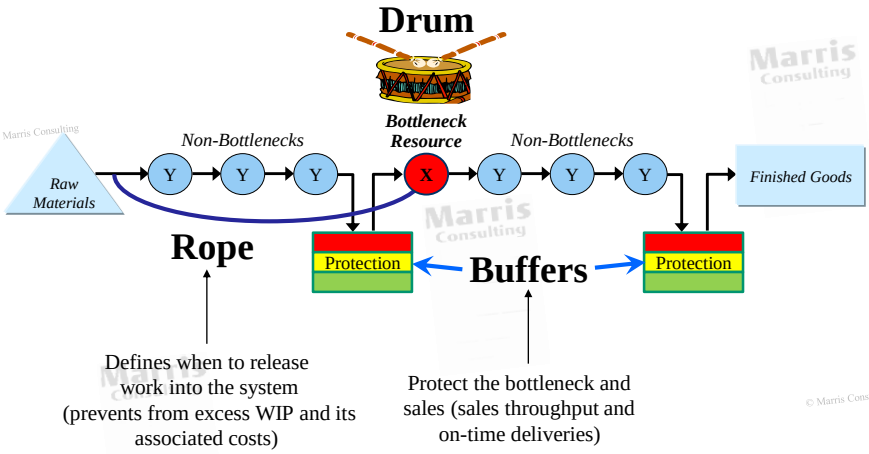
ToC controls production flow with the Drum Buffer Rope (DBR) mechanism



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.

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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.

Easy to do in production but not in projects

Without investments in $ or in time

The most difficult step

With investments in $ or in time

Or choose the "best" constraint of the system

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

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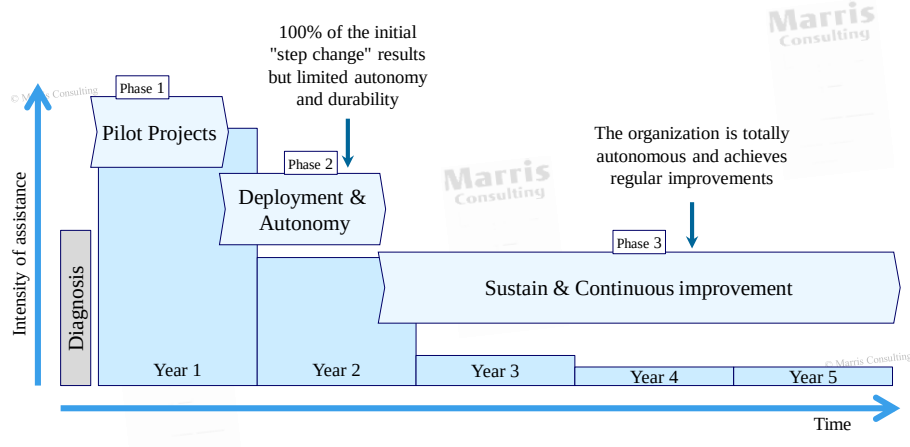
To guarantee the durability of the Critical Chain implementation, we recommend a 5-year process for New Product Development in large organizations



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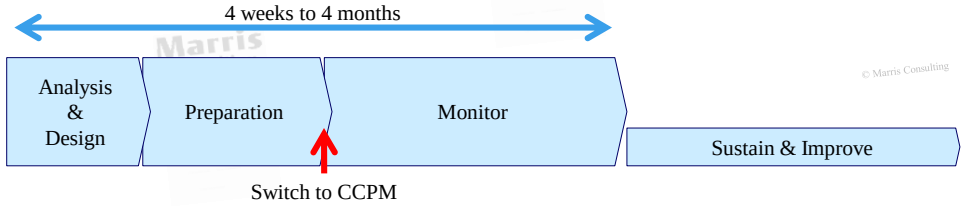
But in other cases the Critical Chain implementation, can and must be done "overnight"

- 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



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

Concerto REALIZATION℠ Dedicated to Improving Project Management.

ProChain SOLUTIONS INC.

EXEPRON COLLABORATIVE BUSINESS SOLUTION

BeingManagement 3 Critical Chain Project Management

Aurora-CCPM Stottler Henke Smarter Software Solutions

LYNX A-dato

CC-Pulse Gratuit en ligne!

Permanent benchmark available on Marris Consulting website:
http://www.marris-consulting.com/en/points-of-view/critical-chain-project-management-software-solution

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Appendices

Factories, People & Results

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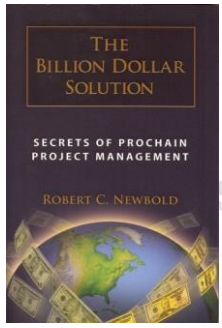
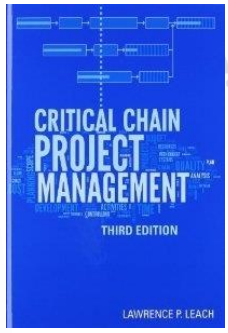
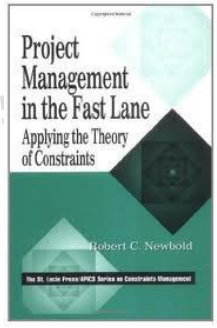
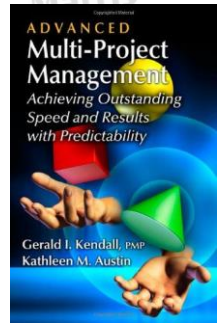
The CCPM reference books









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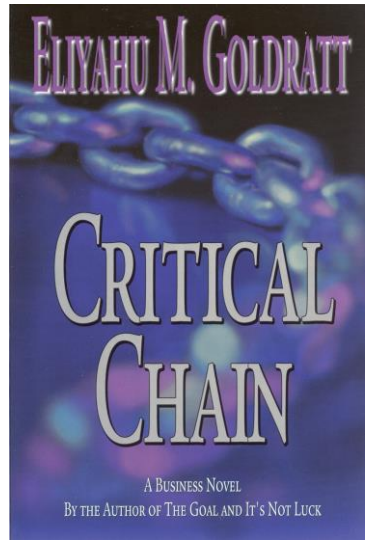
The original book that started it all

- 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.



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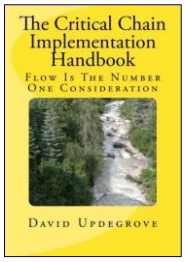
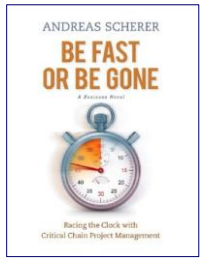
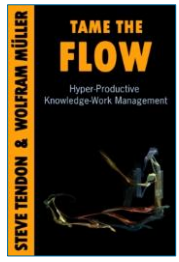
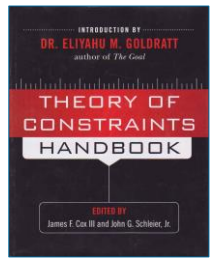
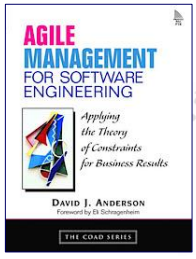
Other CCPM books

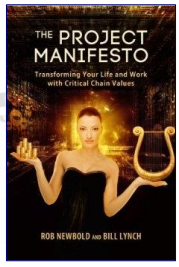


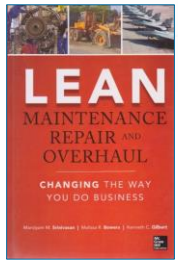


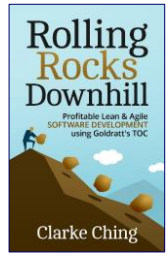


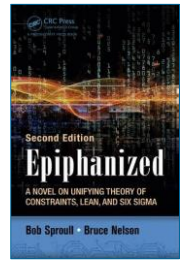












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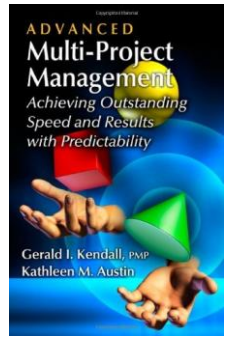
A list of >350 companies using Critical Chain

3M, ABB, "ABB AG, Power, Tech. Division", ABB Cordoba, ABB Halle, Abbott Labs, Accoat, "Action Park, Multiforme Grupo", Adirondack Oral & Maxillofacial Surgery, Advanced Energy Technology, Advasense Technologies, Aerojet Corporation, Agilent Technologie, AHIS-St. Vincent Health, Air Force Institute of Technology, "Airgo Networks, (Qualcomm)", Airshow Inc., "Alcan Alesa, Technologies", Alcatel, Alcatel-Lucent, Alfa Lava, Alna Software, AMCC, AMD, Amdocs, American Rubber Products, AMGEN, Andover Healthcare Inc., Applied Plasmonics, AREVA, Arterain Medical, Atomic Energy of Canada Ltd., Avaya, Avitronics, BAE Systems, Balfour Beatty, Barco, Baxter, Bell Canada, BHP Billiton, Bimba Manufacturing, Boeing (Military), Boeing Space & Intelligence Systems, "Boeing Wing, Assembly", Bosal, Bosch Rexroth Ltda., Boston Scientific, Bovis Pharmaceuticals, BP Oil, Brice Manufacturing, BT Radianz, BVR Technologies Company, C.F. Roark Welding & Engineering Co. Inc., C.N. Cotrentes, CAE USA, "Californie, Department of Corrections", Callaway Golf, Celite Corporation / World Minerals Columbia Industries, Celsa Group, Central Dupage Health, Central Nuclear Almaraz Trillo, Chrysler, Clopay, Coca-Cola, Colgate Palmolive, Computer Sciences Corp, Confluence UK, Conoco, Converge Medical Inc., Corning Cable Systems, Cray, Inc., Cueros Industrializados del Bajio S.A., Cytori Therapeutics, Inc., DaimlerChrysler UK, Danfoss, Danisco (Genencor), Del Monte Foods, Delta Air Unes, Inc., Delta Faucet Company, Detroit Diesel Reman-West, Dr. Reddy's Laboratories, DuPont, e2V Semiconductors, Eastman Kodak Company, ECI Telecom Ltd., Eclozion Informatique, Edwards Lifescience, eIRcom, eIRcom, Embraer, emcocables, Emesa, Erickson Air-Crane, Ericsson, Estonian Telephone, Ethicon, ExxonMobil Chemical, Fairchild Semiconductor, Fisher Controls, Fluid Brasil Sistemas E Tecnologia, Fluke Corporation, FMC Technologies, Fonterra, French Air Force, Fuel Cell Energy, Gambro Healthcare, GE Industrial Systems, General Dynamics, Gillette, GlaxoSmithKline, Graftech, Hach, Halliburton, "Hamilton Beach, Brands, Inc.", "Harris, Semiconductor", Hawker Beechcraft, Heineken, Heineken, Spain, Henkel, Hewlett Packard, Hitachi Computer Products, Honda, Honeywell, "HP Digital Camera, Group", IBM, IKEA Trading und Design, Ismeca Europe Semiconductor, "Ismeca, Semiconductor", ITT Canon, ITT Corporation, ITT Space Systems, Johnson & Johnson, Kawasaki Heavy Industries, Ltd., Kraft Foods, L-3 Communication Systems, "LeTourneau, Technologies Inc.", Lockheed Martin, Lord Corporation, LSI Logic, LSI Logic, Lucent Technologies, M&M Precision Systems, Marshall Industries, Marvell, McKee Foods, Medtronic, Medtronic, Medtronic, Europe, Medtronic, Inc., Merck Medco Managed Care, Merichem Chemicals & Refinery Services, Microsoft, Milwaukee Forge, Motorola, NASA, Nike, Northrop Grumman, Numonyx, Oregon Freeze Dry, Owens-Illinois, "Oxford-Radcliffe, Hospitals, UK", P&G Pharmaceuticals, Pharmacia, Philip Morris, Philips Semiconductors, Pioneer, Portsmouth Naval Shipyard, Puget Sound Naval Shipyard, Qualcomm, Railcare Wolverton, UK, Raychem, Raytheon, Rex Materials Group, Roche Diagnostics, Rolls Royce, RSA Security, SAAB Avionics, SanDisk, Sapient, Seagate Technology LLC, Shea Homes, Siemens, "Siemens Generator, Engineering", Skoda Power, Skye Group, Sony Ericsson Mobil Communications, Spectranetics, Spirent Communications, Spirit Aerosystems, Sprint, Sun Microsystems, Sylvania, Symbian, Tadiran Spectralink, Tata Steel, Tecnobit, Tektronix, Tellabs, Tenet Health Care, The Boeing Company, ThyssenKrupp, Timco, Tripod Data Systems, Inc., TRS Refrigeration, TT Technologies, Tundra Semiconductor, Tyco Electronics, Tyco Healthcare, U.S. Air Force (multiple bases), "U.S. Army Fleet, Support", "U.S. Army, Corpus, Christi", "U.S. Marine Corps, (Multiple bases)", Unilever, United Behavioral Health, UPC Technology, US Air Force, Valley Cabinet Works, Vascore Medical, Ventana, Volvo, Von Ardenne, Workscape, Xerox Corporation.



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

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

Industry	Project Type	Company	Results	Reference
Power	Engineering	ABB AG, Power Tech. Division	Throughput increase over 33% from 300 Bays to 430 Bays per year.	www.realization.com
Power	Engineering	ABB Cordoba	Engineering cycle time reduced from eight months to three months.	www.realization.com
Power	Repair	ABB Halle	Number of projects completed per year increased from 42 to 54, >25%.	www.realization.com
Construction	Theme park design, install, and commission	Action Park Multiforme Grupo	Increased number of projects completed from 121 to 153.	www.realization.com
Communications	Product development	Airgo Networks (Qualcomm)	Cycle time improved from 19 months to 8 months.	www.realization.com
Airpot terminal administration and management	Various building projects	Airplan (Colombia)	2 pilot projects : Control tower project & project of terminal extension finished on time	www.tocpractice.com
Aluminum	Engineering	Alcan Alesa Technologies	Number of projects completed increased over 30%.	www.realization.com
Communications	Telecom switch design	Alcatel-Lucent	Increased throughput by 45% per person.	www.realization.com
Software	Software development	Alna Software	Cycle time reduced by 25% and project completions increased 17%.	www.realization.com
Automotive	Product development	Alpine Electronics	Delivery dates compliance rate went from 22% to 88%	www.japan-toc-association.org

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References of Critical Chain implementations throughout the world (#2/10)

Industry	Project Type	Company	Results	Reference
Communications	Customized software development	Amdocs	14% increase in revenue/man-month; 20% reduced cycle time.	www.realization.com
IT	IT installation	Avrio (Hitachi Data System)	Remote site installation time reduced by 54%	www.exepron.com
Glass Manufacturing	Engineering (ETO + NPD)	Asahi Seisakusho	+23% throughput (number of projects completed per month), Overtime rate reduced by 35% , +50% increase in revenues with ¥50M in profits	www.realization.com
Manufacturing	Boiler installation	Babcock	Actual versus planned went from +200% to -20%. Between 20% and 55% reduction of manhours. 40% reduction of cycle time	www.tocpractice.com
Aerospace	Aircraft manufacturing	BAE/ RAAF	Reduction of TAT (TurnAround-Time) by 43%	www.exepron.com
Building	Civil Engineering	Balfour Beatty	Project delivered 9.5 weeks earlier than estimated, which was 45 weeks earlier than actually contracted (the contracted delivery date was the client's deadline) - in spite of increased scope of work	www.goldratt.co.uk
Resource	Engineering	BHP Billiton	25% reduction in hours needed to complete project and project finished three weeks early.	www.realization.com
Aerospace	Engineering	Boeing (Military)	Reduced required wing assembly time by 50%.	www.goldratt.com
Aerospace	Design and assembly	Boeing Space & Intelligence Systems	Doubled throughput and decreased cycle time by 28%.	www.realization.com
Aerospace	Engineering	Boeing Wing Assembly	On schedule, under budget. Reduced required wing assembly time by 50% (F-22).	www.goldratt.com

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References of Critical Chain implementations throughout the world (#3/10)

Industry	Project Type	Company	Results	Reference
Machine manufacturing	Packaging line development	Bosch Packaging Systems	100% on-time delivery. +27% turnover. 30% cycle time reduction for projects >2500 hours	www.japan-toc-association.org
Communications	IT Professional Services (eg: website)	Bowne & Co (Rapid Solution Group)	Due date performance improved by 30%, lead times reduced by 25%	www.realization.com
Energy	Cleanup	BP Oil	Saving of over $700 million with accelerated project and production required to meet project needs.	www.pinnacle-strategies.com
Power	Engineering	C.N. Cotrentes	Increased due date performance from 60% to 95%.	www.realization.com
Software	Flight simulation systems	CAE USA	Reduced cycle times by two to four months, with a $37 million increase in the number of profitable programs.	www.goldratt.com
IT	IT	Caesar	95% of projects on time.	www.tocico.org
Construction	New hospital facility	Californie Department of Corrections	Built and opened new mental hospital in 6 months that other approaches failed to do in 12 months.	www.vectorstrategies.com
Software	IT	Celsa Group	Increased completion of SAP projects from 15 to 20 per month.	www.realization.com
Power	Engineering	Central Nuclear Almaraz Trillo	Increased number of projects completed from 19 to 24-30 per month.	www.realization.com
Automotive	Product development	Chrysler	Cycle time for prototype builds reduced from 10 weeks to 8 weeks.	www.realization.com

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

Industry	Project Type	Company	Results	Reference
Iron ore mining	Truck overhauls	Cliffs Natural Resources Michigan Operations	Overhaul duration reduced by 67%	www.sinclairassociates.com
Financial services	Software development	Confluence UK	95% of projects on time.	www.criticalchain.co.uk
Building	Bank construction	Construtora Veloso	Triple revenues in 2 years. 98% on-time delivery	www.tocico.org
Building	SAP Implementation	Daiwa House	2011 Results after 1st implementation : 26% cycle time reduction for SAP module implementation 2015 Results after 4 years CCPM : +160% of completed projects per year - compared to 2011. >25% gain on project duration for 58%	www.realization.com
Biotechnology	Engineering	Danisco (Genencor)	Increased from 20% projects on time to 87%.	www.realization.com
Aerospace	Repair	Delta Air Lines, Inc.	23% increase in engines produced per year; 30% reduction in engine turnaround time.	www.realization.com
Pharmaceutical	Product development	Dr. Reddy's Laboratories	83% increase in projects completed in first 12 weeks; 75% increase in new product launches year over year.	www.realization.com
Energy	Installation	Duke Energy	Doubled thoughput in 3 months	www.realization.com
Semiconductor	Design and manufacturing	e2V Semiconductors	Cycle time reduced from 38 months to 23 months.	www.realization.com
Communications	Network design and installation	eIRcom	On-time delivery improved from 75% to 98%+. Average cycle time was reduced from 70 days to 30 days.	www.realization.com

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References of Critical Chain implementations throughout the world (#5/10)

Industry	Project Type	Company	Results	Reference
Communications	IT	eIRcom	From 40% to 90%+ of projects on time; lead time reduced from 150 days to 30 days.	www.toc-goldratt.com
Defense	Electronics	Elbit Systems	Within the Test Equipment department, 70% of on-time or <1-month delay delivery	www.tocpractice.com
Pharmaceutical	Development of Document Management Systems	Eli Lilly and Co	Projects schedule up to 12 months, reduced to 4 months	www.pmiwdc.org
Pharmaceutical	Product development	Eli Lilly and Co	On-time delivery of 100% with Critical Chain versus 60% with traditional project maganement	www.prochain.com
Aerospace	MRO	Embraer	Aircraft Turn Around Time cut by more than half (from >10 weeks to 5 weeks). Increase of mechanic's productivity by 70%	www.marris-consulting.com
Construction	Manufacturing plant	emcocables	Reduced 11 -month average project duration to 7 months. Increased revenue by 55%, received 4 months earlier.	www.realization.com
Construction	TGV station	Emesa	€ 5 million penalty avoided.	www.realization.com
Refrigerator Compressing Manufacturing	Product development	Embraco	+100% throughput in 4years (number of completed projects per year) & 11% lead time reduction	www.realization.com
Manufacturing	Product development	Emmerson	100% on-time delivery. 75% cycle time reduction	EM Strasbourg 2016 TOC conference
Aerospace	Helicopter manufacturing and maintenance	Erickson Air-Crane	Increased projects on time from 33% to 83%.	www.realization.com

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References of Critical Chain implementations throughout the world (#6/10)

Industry	Project Type	Company	Results	Reference
Measurement instrumentation	R&D	Endress + Hauser	+270% throughput, 60% higher reliability	www.a-dato.com
Energy	Engineering	FMC Technologies	50% reduction in test and final assembly time.	www.pinnacle-strategies.com
Military	Repair	French Air Force	Returned two out of five aircraft to Air Force (€ 300 million value).	www.realization.com
Public Institution	Efficiency improvement	Guarantee Fund Lithuania	95% reduction of pending applications. Application lead time reduced by 88%	www.tocico.org
Durable goods	Product development	Hamilton Beach Brands, Inc.	Increased from 34 to 52 new products in first year, 70+ in second year with no increase in head count.	www.realization.com
Semiconductor	Plant construction	Harris Semiconductor	Began full high-tech production in 13 months, instead of 54-month industry norm.	www.goldratt.com
Consumer goods	Product development	Heineken, Spain	20% farter time to market. Improved projects on time from 90% to 98%.	www.realization.com
Data Security and Lossless Compression IP cores	Software integration	Helion Technologies	40% increase in IT integration Throughput in 4 months. 97% of projects finished on time	www.exepron.com
Aerospace	MRO	Helisota	Went from 20 aircrafts/year to 40/year. Reduction of Turn Around Time by 52%	www.exepron.com
Consumer goods	Product development	HP Digital Camera Group	Improved new products from 6 in 2004 to 15 launched in 2005.	www.realization.com

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References of Critical Chain implementations throughout the world (#7/10)

Industry	Project Type	Company	Results	Reference
Semiconductor	Engineering	Ismeca Semiconductor	25% reduction in cycle time, from 84 days to 64 days.	www.realization.com
Manufacturing	Product development	Johnston Sweepers Ltd	90% on-time delivery	www.tocpractice.com
Building	Bridge building	Juntos	On Design Department : Due Date Performance increased by 65%, overtime reduced by 20%, subcontractor costs reduced by 40% and CT reduced by 50%	www.tocpractice.com
Building	Building construction	Kimly Construction Pte Ltd	30% reduction in confidence cycle, better alignment of departments & subcontractors involved in various project stages, ability to assess the impact of potential changes	GoldrattInstitute
Energy	Design and manufacturing	LeTourneau Technologies Inc.	Reduced design and engineering from 15 months to 9 months, production engineering from 9 months to 5 months.	www.realization.com
Building	27-floor building construction	Lithuanian building company	27-floor building construction, running late with due date several times postponed, came back under control according to schedule, delivered a month before planned.	www.exepron.com
Aerospace	Engineering and assembly	Lockheed Martin	Cut aircraft full finish time by 57% without reducing scope.	www.goldratt.com
Aerospace	IT	Lord Corporation	Found additional 60% capacity without hiring people.	www.vectorstrategies.com
Semiconductor	Design	LSI Logic	Went from major tool releases were always late to released on time for three years in a row.	www.realization.com
Aerospace	MRO	Lufthansa Technik Maintenance International	TAT decreased by 15-20%, mechanic's utilization rates increased by 45%	www.realization.com

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

Industry	Project Type	Company	Results	Reference
Medical	Transformation and compliance with new technology and legislation	Maasstad Ziekenhuis Hospital	Within 6 months, number of finished projects/month multiplied by 2, projects lead time cut by half and 95% of projects delivered on time, scope and budget	www.tocico.org
Medical	Product development	Medtronic	Improved software release intervals from 6 months to 9 months to every 2 months.	www.realization.com
Medical	Product development	Medtronic, Europe	Reduced project cycle time from 18 months to 9 months.	www.realization.com
Insurance	IT	Nationale Nederlanden - Groupe Life	Due Date Performance went from 52% to 82%	www.tocico.org
Textile	Capacity expansion	Nakoda	A scheduled 14-month project expected to be finished in May 2013, project finished in January 2013 (10-month duration)	www.realization.com
Supply Chain	Data Systems and S/W integration	NeoGrid	25% improvement in Time and Material Cost Recovery	www.exepron.com
Consumer goods	Sales	Oregon Freeze Dry	Increased number of sales projects completed per year from 72 to 171.	www.realization.com
Glass	Plant engineering	Owens-Illinois	Decreased cycle time from 6 months to 2.5 months.	www.realization.com
Health Care	Emergency room in hospital	Oxford-Radcliffe Hospitals, UK	Increased patients through emergency room from <70% within four hours to 100%, while patient load grew by more than 25%.	www.tocinternational.com
Pharmaceutical	Product development	P&G Pharmaceuticals	Increased projects completed per quarter from five to eight, and on-time rate from 55% to 90%.	www.realization.com

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References of Critical Chain implementations throughout the world (#9/10)

Industry	Project Type	Company	Results	Reference
Shoe producer	New Product Development	Plasticaucho	On-time seasonal delivery for new models went from 37% to 78%	www.exepron.com
Rail	Repair	Railcare Wolverton, UK	100% on-time delivery. Increased from one project at a time to three.	www.realization.com
Defense	New Product Development	Raytheon	Ontime deliveries, cost avoidance, reduction in project duration, etc… example of Tracer Software : duration reduction, schedule went from 71 days to 24. $1,8M cost avoidance	www.raytheon.com
Manufacturing	Engineering and manufacturing	Rex Materials Group	Lead time down from six weeks to 10 days.	www.cmg-toc.com
Communications	Product development	Ricoh	New teleconference system (P3000) delivered on-time without any compromis on the initial design	www.beingmanagement.com
Aerospace	Product development	Safran Group / Sagem	Reduced the average product development lead time of the entire portfolio by 50%.	www.marris-consulting.com
Aerospace	Factory plant layout modification	Safran Group / Sagem	Total transformation of shopfloor layout. >80% of machines moved. Initial estimate 5 weeks, CCPM result 8 days with 4 hours of buffer unused.	www.marris-consulting.com
Aerospace	Product development	Safran Group / Sagem	Recovery plan for an overdue critical new product devlopment programme. 300 people, 6 facilities. Project deliverables promised to client recalculated and honoured.	www.marris-consulting.com
IT	Product Development	Seagate Technology	Cut New Product Development durations by half	www.stottlerhenke.com
Construction	Home building	Shea Homes	Reduced cycle time by 40% from 91 days to 56 days.	www.vectorstrategies.com

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

Industry	Project Type	Company	Results	Reference
Power	Engineering	Siemens Generator Engineering	Went from 110 to 128 projects completed, with 30% increase in throughput.	www.realization.com
Power	Engineering	Skoda Power	30% increase in casings per year. Went from60% to 90% on-time delivery, with 20%+ faster cycle time.	www.realization.com
Textile	Design	Skye Group	100% due date performance with 30% reduction in lead times.	www.realization.com
Aerospace	Engineering	Spirit Aerosystems	Reduced cycle time from 12+ months to 7 months.	www.realization.com
Building	Infrastructure building	Sub-contractor for Wroclaw city	Building roads, tram route, tram/bus station and Wroclaw stadium in order to host the UEFA 2012, all delivered on-time	www.tocpractice.com
Plastic	Mold Manufacturing	Takagi	Overall CT decreased by average 20%, production CT decreased by average 30%, throughput increased by 30% (number of projects completed per month)	www.tocpractice.com
MRO	Aircraft Maintenance	TAM MRO	7% reduction in TAT, ontime performance and quality increased	UNITED STATES SECURITIES AND EXCHANGE COMMISSION - LATAM Airlines
MRO	Aircraft Maintenance	TAP Maintenance & Engineering	21 % reduction in TAT, avoidance of subcontracting expenses	www.mromarketing.aviationweek.com
Steel	Plant maintenance	Tata Steel	68% faster project time, went from 11 -day planned shutdown to 5 days.	www.realization.com

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.…

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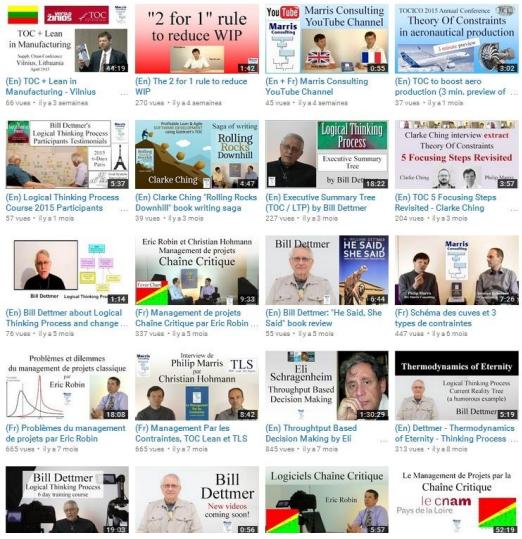

To facilitate viewing and video selection use the playlists:

- English videos
- Critical Chain videos
- Etc.

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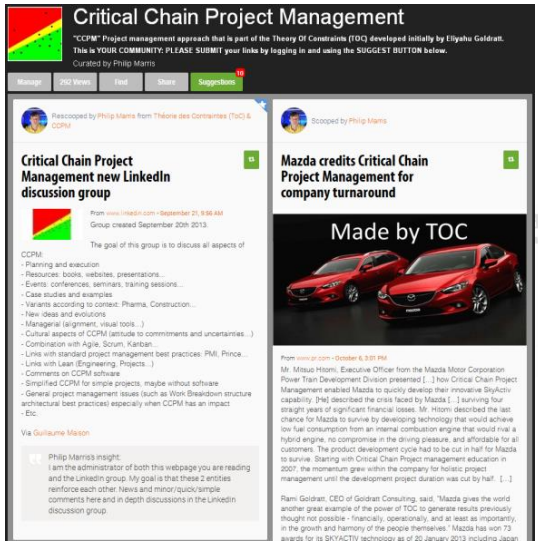
A permanent news website dedicated to CCPM



http://www.scoop.it/t/critical-chain-project-management

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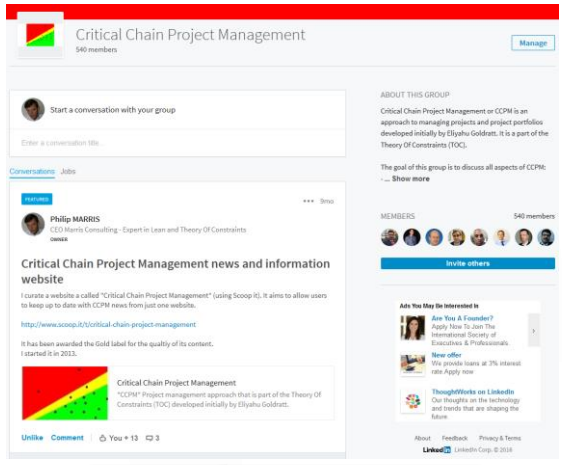
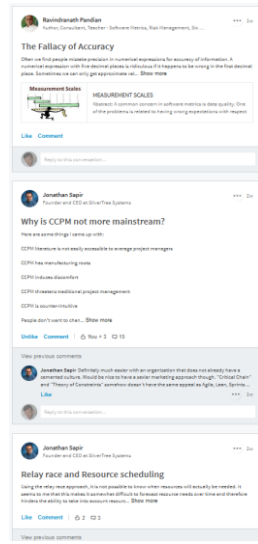
A LinkedIn Discussion group dedicated to Critical Chain Project Management



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

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



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TOCICO CCPM Portal (Theory Of Constraints International Certification Organization)

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

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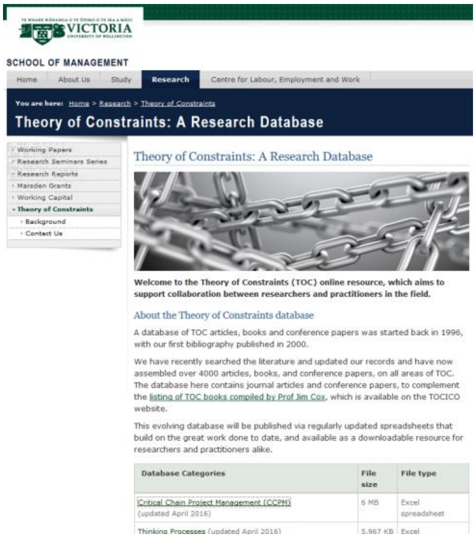
Victoria University Wellington New Zealand – ToC CCPM Research Database

http://www.victoria.ac.nz/som/research/theory-of-constraints



Reference Type	Year	Title	Author	Publication	Abstract	URL
A+ Journal	2016	Zhang, Junguang; Song, Xiwei; Díaz, Estrella	European Journal of Operational Research	Project buffer sizing of a critical chain based on comprehensive resource tightness	A buffer sizing method based on comprehensive resource tightness is proposed in order to better reflect the relationships between activities and improve the accuracy of project buffer determination. Physical resource	http://www.sciencedirect.
Book Section	2016	Critical Chain Project Management (CCPM)	Ellis, George	Project Management in Product Development	This chapter presents critical chain project management (CCPM). The chapter starts with an overview of the method and then relates it to the Theory of Constraints, the foundation of the technique. A step-by-step	http://dx.doi.org/10.1016/b
A+ Journal	2015	Quantitative Analysis of Rate-Driven and Due Date–Driven Construction: Production Efficiency, Supervision, and Controllability in Residential Projects	Arashpour, Mehrdad; Wakefield, Ron; Blismas, Nick; Abbasi,	Journal of Construction Engineering and Management	Concerns about production efficiency, quality, and affordability in the residential construction indicate there may be benefits in adopting alternative production control strategies to those traditionally used. Reducing adverse	http://ascelibrary.org/doi/a
A Journal	2015	Optimisation of critical chain sequencing based on activities' information flow interactions	Zhang, Junguang; Song, Xiwei; Chen, Hongyu; Shi, Ruixia	International Journal of Production Research	One critique for the classic critical chain sequencing methods is that only resource constraints and logical relationships between activities are considered, while interactions of information flows are ignored. However,	http://www.tandfonline.co
Other Journals	2015	Productivity of product design and engineering processes	Hinckeldeyn, Johannes; Dekkers, Rob; Kreutzfeldt, Jochen	International Journal of Operation and Production Management	Purpose – Maintaining and improving productivity of product design and engineering processes has been a paramount challenge for design-driven companies, which are characterised a high degree of development of	http://dx.doi.org/10.1108/ij
C Journal	2015	Inclusion of strategic management theories to project management	Parker, David W.; Parsons, Nicholas; Isharyanto, Fitri	International Journal of Managing Projects in Business	Purpose - The purpose of this paper is to explore the benefits of integrating the theory of constraints (TOC), resources-based theory (RBT), resource advantage theory (RAT), with a structured project-based methodology e.g.,	http://www.emeraldinsigh
Other Journals	2015	A Model for Continuous Improvement at a South African Minerals Beneficiation Plant	Ras, E.; Visser, Jk	South African Journal Of Industrial Engineering	South Africa has a variety of mineral resources, and several minerals beneficiation plants are currently in operation. These plants must be operated effectively to ensure that the end-users of its products remain internationally	http://www.scielo.org.za/s
A Journal	2015	Dynamic monitoring and control of software project effort based on an effort buffer	Zhang, Junguang; Shi, Ruixia; Diaz, Estrella	Journal of the Operational Research Society	The improvement to the monitoring and control efficiency of software project effort is a challenge for project management research. We propose to overcome this challenge through the use of a model for the buffer	http://www.palgrave-journ
A Journal	2015	Project management for uncertainty with multiple objectives optimisation of time, cost and reliability	Jeang, Angus	International Journal of Production Research	This research adopts an approach that uses computer simulation and statistical analysis of uncertain activity time, activity cost, due date and project budget to address quality and the learning process with regard to	http://dx.doi.org/10.1080/0
B Journal	2015	Improving performance in project-based management: synthesizing strategic theories	Karessa, Cullen; David, W. Parker	International Journal of Productivity and Performance Management		http://dx.doi.org/10.1108/I
Other Journals	2014	A decomposition heuristics based on multi-bottleneck machines for large-scale job shop scheduling problems	Zhai, Yingni; Liu, Changjun; Chu, Wei; Guo, Ruifeng; Liu,	Journal of Industrial Engineering and Management	A decomposition heuristics based on multi-bottleneck machines for large-scale job shop scheduling problems (JSP) is proposed. In the algorithm, a number of sub-problems are constructed by iteratively decomposing the large-	http://www.jiem.org/index
Other Journals	2014	COMFRC Addresses Legacy Hornet Readiness	Walters, Andrea	Naval Aviation News	According to PMA-265, 114 aircraft have completed inspections and are designated for service life extensions beyond 8,000 flight hours, with an additional 102 aircraft undergoing high-flight-hour inspections at Fleet	http://web.b.ebscohost.co
Other Journals	2014	Software Project Management: Theory of Constraints, Risk Management, and Performance Evaluation	Asseman, Antoine; Aloraidi, Nada Ashqar; Salim, Mariam; Rezk,	The Journal of Modern Project Management	Constraints and risks are two critical factors that affect software project performance more attention needs to be paid to constraints and risks in order to improve performance. In this paper, investigation will take place to	http://www.journalmodern
Book Section	2014	Critical Chain Project Management		A Handbook for Construction Planning and Scheduling	Critical Chain Project Management™ (CCPM) is frequently presented as a revolutionary new project management concept, an important breakthrough in the history of project management. CCPM focuses on the uncertainty in	http://dx.doi.org/10.1002/9
Other Journals	2014	Critical Chain Method in Traditional Project and Portfolio Management Situations	Anantatmula, Vittal S.; Webb, James B.	International Journal of Information Technology Project Management (IJITPM)	Critical Path (CP) method has been under scrutiny in recent years as the next evolution of project schedule development, the Critical Chain (CC) project management is gaining attention. Advocates of the Critical Chain	http://www.igi-global.com
Other Journals	2014	Theory of Constraints and Its Application in a Specific Company	Linhart, Jakub; Skorkovský, Jaromír; Others,	Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis	This article analyses the possibilities of the practical utilization of Critical Chain Project Management methodology. Our study analyzed key processes related to the implementation and utilization of such a tool in a concrete	http://acta.mendelu.cz/62/
Conference Proceedings	2014	Multi-objective optimization model for multi-project scheduling on critical chain	Wang, Wei-xin; Wang, Xu; Ge, Xian-long; Deng, Lei	Advances in Engineering Software	In this paper, a multi-project scheduling in critical chain problem is addressed. This problem considers the influence of uncertainty factors and different objectives to achieve completion rate on time of the whole projects. This	http://www.sciencedirect.
C Journal	2014	Mitigating behavioral outcomes in a multiproject environment: a modified CCPM model	Agarwal, Atul; Larson, David	Academy of Information and Management Sciences Journal	Organizations continue to struggle in managing projects that lead to successful conclusions. While tools such as PERT and CPM have helped the project management process, they have not produced the level of success as	http://search.proquest.com
C Journal	2014	Mitigating Behavioral Outcomes in A Multi-Project Environment: A Modified CCPM Model	Agarwal, Atul; Larson, David	Academy of Information and Management Sciences Journal	Organizations continue to struggle in managing projects that lead to successful conclusions. While tools such as PERT and CPM have helped the project management process, they have not produced the level of success as	http://search.proquest.com
C Journal	2014	Critical chain and theory of constraints applied to yachting shipbuilding: a case study	Bevilacqua, Maurizio; Ciarapica, Filippo Emanuele; Mazzuto,	International Journal of Project Organisation and Management	Product development projects, like many other types of projects, often can exceed their planned schedule by 50% to 100%. Often this is attributed to uncertainty or the unforeseen. To compensate for this age-old dilemma,	http://www.inderscienceo
Conference	2014	The iTLS (TM) model-Integration of Theory of [illegible]	Navarro, Carlos I. M.; [illegible]	Proceedings of the 2014 [illegible]	Recently the three most applied approaches into the Operations Continuous [illegible]	http://search.proquest.com

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A dedicated Critical Chain website (currently only in French)

www.chaine-critique.com

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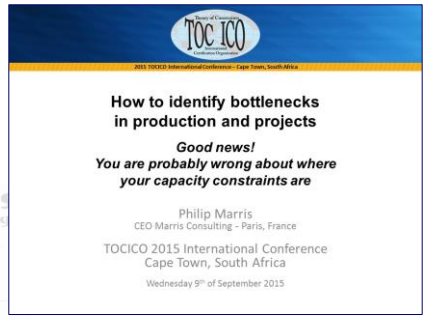
2015 Conference:
How to identify bottlenecks in production and projects

- TOCICO Annual Conference in Cape Town South Africa by Philip Marris.
- PDF available here:
  http://www.marris-consulting.com/medias/fichiers/tocico_2015_toc_bottlenecks.pdf
- Video here:
  https://youtu.be/ulXqO86OfpU?list=PLuB3wmjsgiunMLT_rrMFfHfQ33X3yft4S



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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.

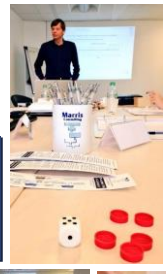
Rules for non-constraints

- 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


Logical Thinking Process

Lean Management
Theory of Constraints
Critical Chain Project Management

Lean Engineering

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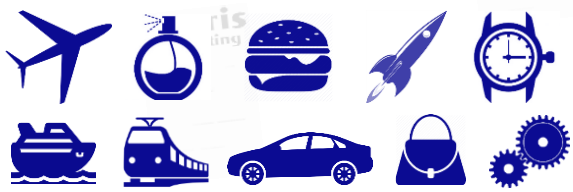
What we do

- 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.



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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.

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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.

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We are honoured to have been able to help…

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Philip Marris, Founder and CEO of Marris Consulting
Business transformation, Theory Of Constraints and Lean expert

33 years of experience, 59 years old, Manufacturing & Supply Chain expert
Bilingual & bicultural English/French

COMPETENCIES

- **Transformation programs in industry**
- **Industrial Excellence Expert (manufacturing and product development).** Recognized expert in Lean, Six Sigma and Theory Of Constraints. Often combines these ("TLS").
- **Project Management.** Critical Chain Project Management & Lean Engineering.
- **Author** of an industrial management bestseller in France: *Le Management Par les Contraintes en gestion industrielle*, Editions d'Organisation.

FORMER POSITIONS

- Cap Gemini Ernst & Young / Bossard Consultant: In charge of Manufacturing Operations for France & Europe (>200 consultants)
- Cap Sogeti Industrie
- Creative Output: collaborated with E. Goldratt author of *The Goal*
- Vallourec: Shop floor foreman, Methods Engineer
- Professor at HEC Management School (Supply Chain & Manufacturing).

SECTORS / CLIENTS

- Over 250 engagements in industry
- Aeronautical (several). Pharmaceuticals (several)
- Automotive industry: car makers and suppliers, buses … (several)
- MRO rail aeronautical and trains (several)
- Process industry: steel, glass, cardboard, extruded plastic
- World leader in luxury goods. World leader in ball bearings
- Packaging: cardboard, steel, plastic
- World leader in fast food
- World leader in electrical power systems, Furniture manufacturer, Satellites, Marine engines, Armoured vehicles, Luxury watches, Printed circuit boards, rockets …

MISSIONS / RESULTS

- **R&D & Industrialisation / Engineering / New Product Development (sample):**
  - Aeronautical OEM, 700 p., project durations -60%, On Time >97%.
  - Luxury Goods designer and manufacturer. Durations – 65%, Throughput and productivity >+150%
  - Medical Devices: 2 successful CCPM implementations
  - Electric bus battery pack NPD / CCPM
  - Aeronautical product industrialisation portfolio: reduced durations and projects finish on time
  - CCPM in an industrial equipment manufacturer. Lead times reduced by 45%, Throughput and Productivity over +150%. Projects completed on time went from less than 25% to over 85%.
  - Several aeronautical product development and industrialisation projects involving up to 500 people per project in up to 6 different simultaneous facilities with budgets up to 20M€ each.
  - New product development and product relooking: reduction of over 45% of average project duration, increase in number of projects completed each year of over 50%.
- **Production, Operations & Supply Chain (sample):**
  - Worldwide automotive OEM tier 1 supplier: increase in Throughput of 17% in 15 minutes. Savings >$400M per year. saved relationship with largest customer.
  - Large MRO (Maintenance, Renewal & Overhaul) Major European railway operator (France, 200 000 p.): in one of the main factories (940 p.) reduction of the production lead-times for the renovation of high speed trains from 126 days to 38 days . 8 assignments in 8 factories with similar results.
  - Labour productivity: furniture manufacturer +35% in 6 weeks, M.R.O: 80% in 2 months, manufacturing equipment (assembly) +70%, ...
  - Automotive Supplier (France, 350p.): Increase in the O.E.E. of the bottleneck, change from 5x8 shifts to 2x8 while providing the same output.
  - Complete reengineering of the Supply Chain of a steel manufacturer: Long term strategic planning, Sales & Operations Planning, Scheduling. Implementation of TOC/MPC. Increase in 40 points in due date performance
  - Manufacturer of large machines for cardboard packaging: reduction in the delivery lead-time by over 50% and a reduction in the number of hours of labour per machine of over 30%.
  - Aircraft MRO: reduced durations by over 50% and increased productivity by over 80% in 2 months.

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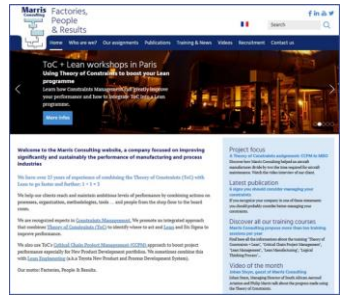

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