Flow project management

Think up Critical Chain project management, AGILE & Lean Engineering methodologies.

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1. Introduction

This document sees itself to be a synthetic and non-exhaustive summary of the inherent notions of project management via critical chain. The principle of this electronic book is to offer the readers insight into this method and its implications, while allowing it to be shared with their teams or management.

Accordingly, you will see that each aspect of the critical chain is summed-up in one page (or two for a select few). The idea is to allow for the sharing of these elements to the greatest amount of people quickly, for free, while allowing a maximum amount of people to view it.

Up until a few years ago, I believed that project management was reserved for research and development or computer operation units. It took me few years to understand that the project environment concerns a much greater amount of functions than I had imagined. Indeed, the Supply Chain, Sales, factory management or even department store management can be organized via projects. We don't Imagine the quality, operations, or production control managing their functions with a handful of individuals; but rather, using their quality certification objectives, workshop implantations, computerized system implantations, etc. through the methodological prism of project management. In fact, there is nothing of the sort. We were able to observe that most of these projects are summed-up to at best a list of actions, updated daily or, at worst, "a project we launched a while back that requires an update". It is standard to see these projects rarely end on time, and that the projects' status is near impossible to determine even though all seem to work on the same projects.

This document hence aims to drive forward a behavioral and technical approach to project management. I hope that each chapter's title will be explicit enough to remember and apply in your daily life!

2. Share the dark side of the project

Most project managers or project function managers face recurring difficulties: the allocated time to complete the project along with the budgets and resources. In parallel, the demand for new projects is growing. Consequently, it is not rare to observe an increasing number of projects ending late, off-budget or with a scope review adjusted downwards. When these projects end, the team's feedback is at best disenchanted or stressed.

On the daily in project management, two worlds clash: those who believe that task durations are too high, and those who know that however long the duration of those tasks is, unforeseen events will make the project run late. When we ask these people why they believe their projects will not be completed on time, they answer:

- The clients or managers will change the project scope along the way;
- Resources are not always available when we need them;
- The limited visibility we have on projects doesn't always allow us to make the right decisions;
- Priorities seem to change regularly;
- When a task arrives at the desk, key elements required to complete it are sometimes missing.

However, when the planning portion of the project is finished, the project seems feasible! The tasks are known, the durations determined, the resources defined, etc. The issue is that multiple phenomena will disrupt this state:

- The fact the project's scope is often revised, or that priorities changes push some individuals to begin their tasks at the last moment. The problem with this strategy is that last minute events might come-up and compromise the completion of the task;
- At times, certain tasks are completed earlier than expected. Two phenomena appear to occur: the resource for the next task is not available, or the employee in charge of the task finetune his work. In both cases, the time gained is lost, either due to the wait for the resources, or by overdoing of the task. The second case is easily explained: the person having finished a task early knows that they could find themselves with a smaller timeframe next time.
- It is a true belief that the earlier a project is launched, the most likely the project will end on time or early. This approach, which consists of overloading the project portfolio, causes a loss in visibility of the ongoing tasks and projects. Everybody seem greatly busy, yet nothing gets truly finished. The other consequence is the emergence of the bad multitasking.
- Bad multitasking is the act of moving from one task to another without truly finishing a task. This behavior is flawed for multiple reasons: we push our teams to be flexible and evaluate them based on their capacity to finish each task within the timeframe. Take the example here below:

- 3 tasks (A,B,C) of 10 days duration. Let's see the differences between Multitasking and not !
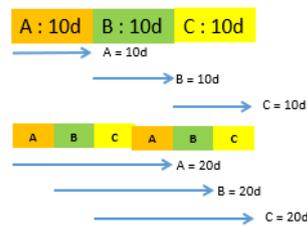
Status 10 days : A done, B&C 0%
Status 20 days : A&B done, C 0%
Status 30 days : ABC done

Status 10 days : A 50%, B 50%, C 0%
Status 20 days : A done, B50%, C 50%
Status 30 days : ABC done

Illustration 1 : Multitasking effect

The person has 3 tasks with 3 different project managers. In the case above, without multitasking, the duration of the 3 tasks is done in 10 days, total 30 days. In the case of the multitasking, the person completes each task in 2 time increments: the good news, compared to the first scenario, is that every 10 days, each project seems to move forward, however; this method has a few ramifications:

- The duration of the tasks' execution goes from 10 to 20 days;
- The first task is wrapped up after 20 days instead of 10, the second after 25 days instead of 20;

The issue is that this method relies also on underlying assumptions:

- Moving from one task to another doesn't require a period of set up. However, we know that switching tasks requires refocusing.
- When the project manager reviews the project history to eventually determine the duration of each task, he will view a 10-day task as a 20-day task. If the practice of multitasking continues, the duration of tasks will continue to increase.

3. Assume the task estimation you will

- So, if we evaluate the teams based on their capacity of finishing each task on time,
- if certain tasks start at the last moment with the risk of disruptions,
- if certain tasks are completed early but that gain is not truly gained,
- if we launch projects at the earliest to keep everyone busy,
- and if multitasking elongates the duration of tasks

➔ Then what can be said about the duration of tasks of our projects?

As difficult as it might be to admit, most of the tasks' durations include security margins that aim to ensure their completion on time. These margins are even more reinforced than the practices cited previously are existent. An additional reason why we include these margin lies within Murphy's Law. It tells us that when we estimate most precisely the duration of a task,

we have a 50% of finishing it in time. This phenomenon, well known by project managers, is represented by the following diagram:
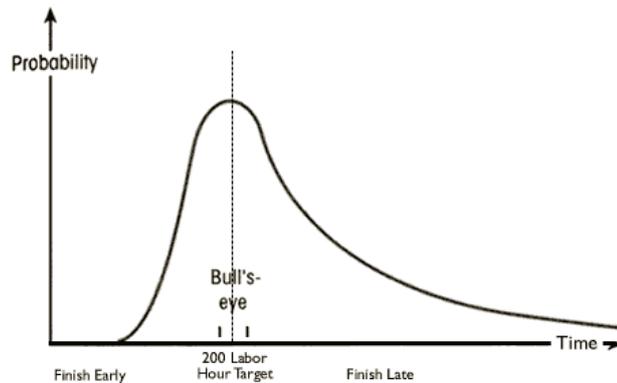
Illustration 2. – Project task estimations (lnk)

When we only take the necessary duration (200 hours), the area of the curve represents only 50% of the probability of completion. Taking into account that team members are evaluated based on their completion of each task, and that 50% reliability risks not being appreciated during the project review, project teams can only increase their task durations to increase their chances of finishing on time.

Adding this trend to the others mentioned anteriorly, you obtain, even with margins of time security and practices of early project launching, projects that don't always finish on time.

4. Live with uncertainty you will

Let's say that all these elements stem from a few beliefs:

- Protecting a project from internal/external incertitude is a must
- If all tasks are completed on time, then the project will finish on time.

We have just explained that the second belief is false, but the first is completely legitimate. All projects are subject to uncertainty, whether it be from the organization of summer vacation or the building of a factory.

Therefore to satisfy the objectives of a project office, we should:

- Transform our projects and tasks into a system of flow system;
- Find a system that protects us from uncertainty;
- Put into place an organization that controls and easily decides the actions necessary for a project or project portfolio;

- All while ending our projects on time, faster and within the indicated budgets…

The following chapters describe the points made above. These elements are issued from a concept that we call the critical chain, which comes from the Theory of Constraints (ToC). It would be, however; incorrect to say that only the critical chain resolves/ has attempted to resolve these problems. The Agile methods have inspired us in the elaboration of this document. Additionally, we do not disavow the content of the PMBOK (edited by the PMI) or tools such as the Gantt and PERT diagrams. On the contrary, you will see that we rely systematically on those concepts and their combinations to answer the actual objectives of project organizations.

You will see that the chapters that follow tackle projects in a technical and organizational way. Even though these approaches can be combined without a particular sequence, it is recommended, when possible, to begin implementing management practice changes instead of uniquely technical aspects.

5. Control your ongoing tasks and projects you will

As we have previously seen, there exists the belief that the earlier a project starts, the more likely it will end on time or early. Consequently, when we look at an organization's project portfolio, we observe the following flow:

There are a lot of on-going projects, of different scale and/or urgency. In this configuration, the teams are usually remarkably busy, and it is complicated to determine the status of a project or to guarantee that the priorities are correctly established.

In the next situation, we will conserve the actual resources but this time they will be concentrated onto a very reduced number of projects, in the aim to finish them faster. In sum, it is better to focus 30 people on 3 projects than 30 people on 30 missions!

Idea of projects — Projects achieved
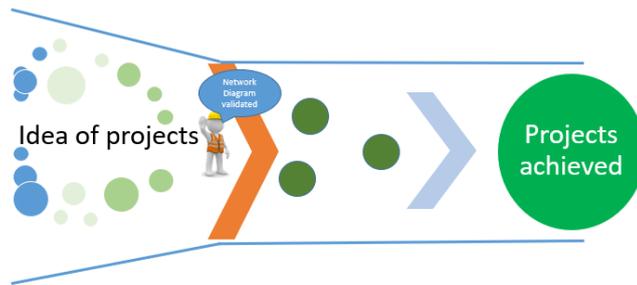
The question is based on the sorting of projects on which to focus. Our experience suggests that a certain number of projects are often ideas rather than real projects. Such projects are often called "the old chestnut" by teams. Then, it may be appropriate to freeze them at first. Next, since the objective is to speed-up the output, it is appropriate to pick the projects closest to the end. To do this, you can either take your current indicators to choose the project, or use the approach depicted in chapters 10 & 11 to make your decision.

In all cases, we strongly suggest that the projects that lack a network diagram be purely and simply frozen.

6. Write a network diagram you will

According to the PMBOK, 3rd edition, the project schedule network diagram is a "schematic representation of the logical links between the project's timetable of activities. It always is defined from left to right to reflect the chronological order of the project's work". This tool is often mixed with the work breakdown structure, which is used as well to breakdown the project's scope to improve the estimations, and better control the execution and reliability of the project realization. The subtle difference is that the first tool establishes logical links between the tasks, whereas the second categorizes these tasks in a large phase.

In order to clarify the comparison, the WBS is essentially the bill of material of a project whereas the network diagram is its routine . Yet, with the building method of this network diagram, it is possible to establish both the routine and the bill of material of the project. We will put forward a summary of the major steps, with the complete construction methods residing in chapter 16:

1) The preparation: in this step, the goal is to clarify the project's proponents and outcomes by defining the language on what is a deliverable, and what "do" means within the team. It is a question of recalling the diverse reasons and parameters of the project (what, why,

when etc.). Finally, we identify the main big steps of the project as well as the data entries and deliverables of each step.

2) Building the project network:

    a. We will trace the logical links between these milestones and verify their coherence: "If I have this data then I can accomplish this task that will be finished when I will have provided these deliverables". Helps to start the next task with all data, deliverables and other elements that clarify this macro view.

    b. Generating these deliverables and data entries allows to further detail the big steps. This way the latter task can be further divided all the while conserving the logic of adding these entrance and exit points at each step.

    c. We can then add the resources and the durations. Multiple tips should be considered:

- To avoid any debates, consider a duration based on the answer to the following question: how much time do you need to finish this task in the duration estimated for over 90% of all cases?
- When the total duration of the project is over you can verify the tasks that have a duration inferior to 3% and superior to 10% of the project's total duration. This means that those tasks were too detailed or not enough.

These two control elements are fundamental to assure the right level of detail of the schedule you will then create. Indeed, we regularly saw that the tasks are often lacking in precision or too generic, making the visibility of the whole project very limited.

Therefore, it is imperative to repeat these three steps (a; b; c) until the following are achieved:

- A set of phrases that coherently tell a story;
- A set of tasks thin enough to be comprehensible for all.

We then have the following diagram, which includes both the resources and durations:
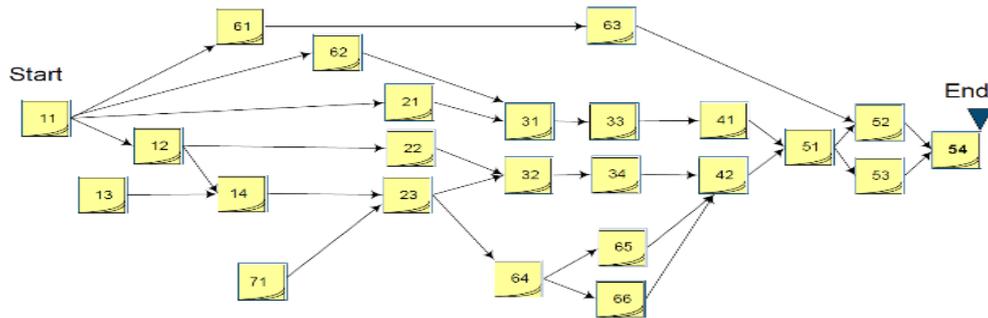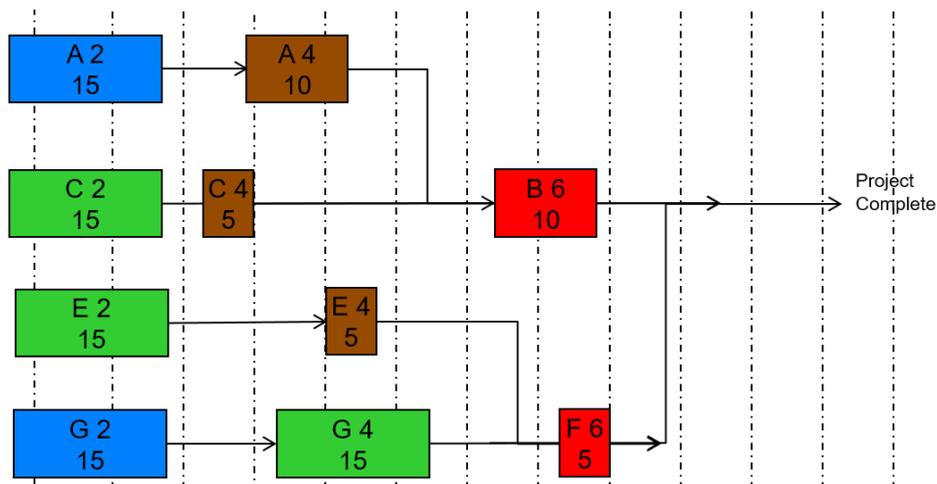
Illustration 5. – Synthetic Project Network Diagram

Now that we have the range, durations, and resources, it follows that we move onto the planning step.

7. Transform your critical path into the critical chain you will

If we look at the pattern below :

Illustration 6. – Example of network Diagram

In the above case, the color represents a resource, the number a duration, and the labeling is the name of the task.

If we refer to the definition of the critical chain, corresponding most often to the sequence of activities of the schedule that determines the duration of the project, the critical chain is the G2-G4-F6 sequence that lasts 35 days. Few implications are coming with this hypothesis:

- The blue resource is available but also needs to complete A2. Hence, A2 will finish late which might result in a project delay.
- The green resource does not appear to conflict with other tasks; however, we see that this resource needs to complete E2 and C2 which risks competing with G2.
- Additionally, the brown resource also clashes with other parts.

Consequently, if one genuinely wants to master the critical chain, it is imperative to stop the resource conflicts before defining the critical chain. The definition of the critical chain is : "A technique of network analysis that consists of modifying the project schedule to take into account the resource limitations." PMBOK, 3rd edition.
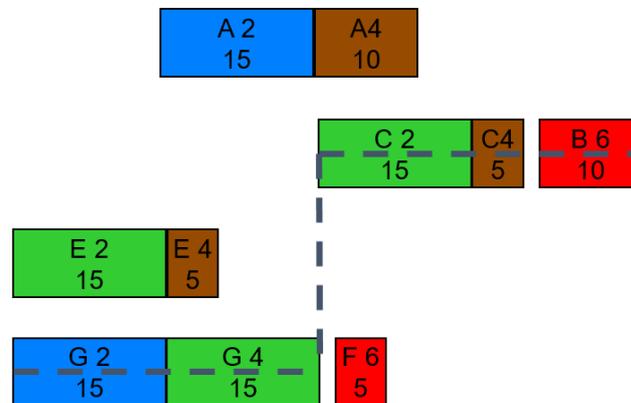
Illustration 7. – Example of Critical chain project Network Diagram

In this configuration, the longest sequence is entirely different from the last since it includes G2-G4-C2-C4-B6 for a duration total of 65 days. In the second diagram, the duration is almost doubled between the two schools of thought.

After having taken control of the portfolio, defined the project's tasks and identified the project's criticality, it is appropriate to move on to the planning stage.

8. Protect the project you will

In the previous chapters, we established that one of the project management practices consisted of protecting the duration of each task to ensure proper regard to each task's potential delay. This phenomenon is even more accentuated when the pressure of task execution is strong.

Yet, a project's objective is to finish on time while respecting the budget and requirement specifications. The critical chain proposition pushes to concentrate on a project as a whole rather than its separate tasks. The idea is to take a percentage of each task's duration (typically 50%) and move 50% of this value into a final project buffer.

In the previous case, the critical chain lasted 65 days. We take all the chain's tasks and divide by two: 33 days (32.5) and insert a 16-day buffer at the end of the critical chain. Hence instead of focusing on each step, the team and project manager concentrate on the tasks' execution based on the consumption of this buffer.

This concept also integrates the idea of an auxiliary buffer that aims to protect the parallel chains that join with the critical chain. In the previous case the E2-E4 chain is feeding. We add a duration of ten days with a feeding buffer of 5 days towards the critical chain. This protects the critical chain from frequent changes.

Finally, considering that the duration is divided by two, the team members only have a 50% chance of finishing their tasks on time (Fig.2). The buffer is there to absorb the positive and negative deviations. It hence becomes futile to track the progress of each task.

The criteria of 50% are variable and can be changed based on the level of trust in this approach. However, we generally observe that the teams cut the task duration but don't take these durations into a buffer at first. They keep those 100% and reduce them as the project moves along. At this stage we taken control of the project portfolio, established the range of the project, identified the leverage point of the project, and proposed a method that protects the project as a whole rather than individual tasks. The next step consists of understanding how to pursue the execution of the schedule: the following chapters integrate both follow-up indicators and changes in management practices.

9. Start task you can finish you will

The first change in behavior to implement within the teams is to keep them from starting tasks if all the data entries aren't available. This has the goal of considerably limiting multitasking. Hence a person missing certain elements will signal it to his project manager and the person responsible for delivering the data input: this is what we call, in the critical chain domain, the full kit. The idea is to have a full kit to begin a task.

What we observe in the mature cases of critical chain implementations is the emersion of a job dedicated to this task : the full kit manager This person is hence in charge of validating the beginning of the task and managing the gaps to fuel continued improvement programs or updating the network diagram, etc.

The full kit manager is at times in charge of validating the release or not of a new project when one is done. This role allows control over the progress of the tasks in the same way as the progress of the project (chapiter 5).

This practice is probably the hardest to change amongst your team. Concretely, the visual management associated with the Agile method can be an excellent way of taking control of the kits that need completing and the tasks to launch.

Another aspect of the change needed is detailed in the following technique. Since the service rate isn't a viable criterion (since they only have a 50% chance of being finished on time), it follows to change the approach on this subject as well.

## 10.   Limit your indicators you will… but make decisions you will

In view of the actual paradigms of project management, the performance measurement of a project or the indicators of implementation monitoring are the subject of many jobs and books.

Indeed, a number of companies have created more or less official analytic functions to assume this task. Hence management charts hold an ocean of information that encompass the average duration of tasks, depth of delay, service rate, standard deviations, late reason codes, etc.

The critical chain, on a purely scheduling aspect, will take a contrasting approach to these aspects. Indeed, this method retains 3 performance indicators:

- Protection fever chart
- Project portfolio fever chart, which functions on the same basis as the previous one
- Buffer burner rate; used in multi-project mode.

The project fever chart is represented in the following way:
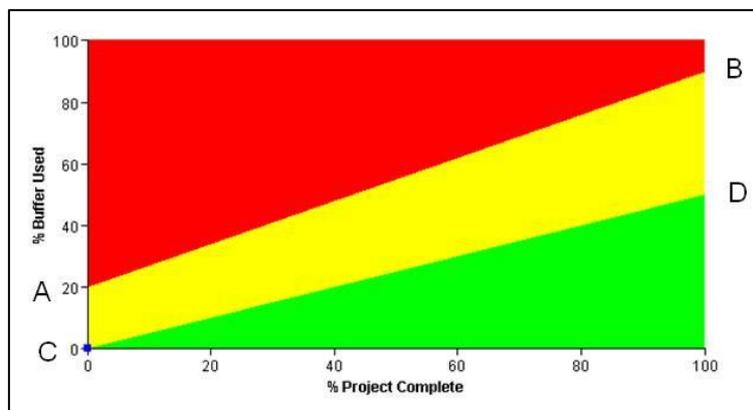
Illustration 8. – Example of buffer protection index

Based on the percentage of the critical chain's progress, in abscissa, we look at the number of days in which the buffer was consumed. For example, if we have a 20 days critical chain and a 10-day buffer: at the end of 10 days, 30% of the tasks have been completed, and this has consumed 7 days of buffer. In the above diagram, we are hence in the red zone. This means that we consumed the protection faster than expected. In this configuration, the project is late solely when over 100% of the buffer is consumed.

It is a very visual tool and is easily implemented. It can easily be applied to a particular project as well as a multiple-project portfolio where we indicate the project status with respect to the protection consumption.
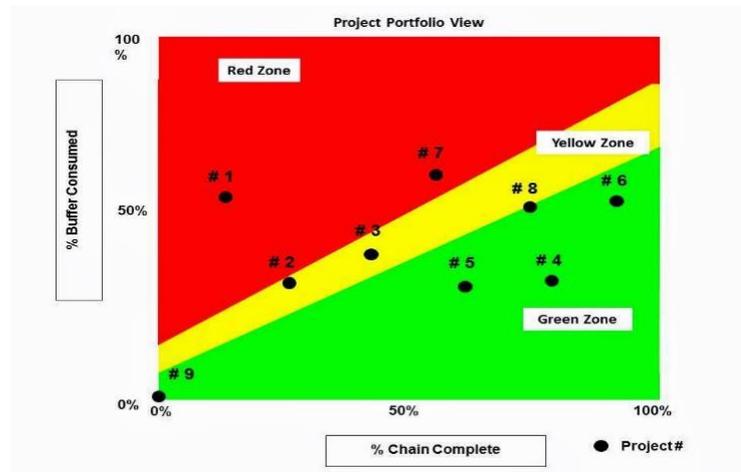

Illustration 9. –Example of protection project portfolio index

In the above example, we see that the 1^{rst} and 7th projects overconsume the protection while projects 4 & 5 appear to be going faster than expected.

This is also an advantage of this formalization; the decision points are easily identifiable. In the green, we do nothing. In the yellow, we see if a problem risks emerging. In the red, we act.

The rate of buffer consumption is used to support the project portfolio indicator. Indeed, when we look at this indicator weekly, it is complicated to remember the state of the 9 projects over all the previous weeks. This rate is hence the ratio between the used buffer portfolio and progress percentage. For each project and at each period of calculation, the rule is the following: once we are above 1, this means that we overconsume a buffer within a project.

This way in 3 indicators, it is possible to have a clear status of your project, your portfolio, and the need, or not, to make decisions. At this stage, it is time to see how to improve or speed-up the execution of certain tasks (or the project) since, like the critical path, any gain on the critical chain is a gain for the project.

11.   Improve yourself with lean and agile you will

In our mind, the critical chain is primarily a management and planning method. If you go over the previous chapters, there are only 3 chapters that are truly technical and connected to the

fundamentals of the critical chain. The others are elements of method and behavior linked to this discipline. The goal of this chapter is to show that this method isn't exclusive, as well as putting forth complimentary tools to the method! In no case this is an exhaustive list. As in all continuous processes of improvement, the following choices are based on our experience in specific environments.

The other current trend in project management is Agile, with its notions of iteration and of visual management. As you might have guessed, Agile integrates well with the notions of the critical chain management. Indeed, one of the limitations of the critical chain is that it establishes a macro planning without going into a precise level of detail. Some projects require this level of detail. This means that Agile's visual management suggestions are complimentary and pertinent. Additionally, this iteration phenomenon is a great tool to work and secure a project's critical chain. The only comment we might add is that the iteration process is most efficient when a buffer finishes it. This allows to secure this step of the project in a precise way. We will refer to it as the "Scrum Buffer".

From the point of view of Lean Engineering, we recommend applying/ using these elements mainly for the delineation of the project network and critical chain diagram. Using the principles of this method on all the project's tasks is meant to turn a local improvement into a larger, global improvement. As with Agile, the visual tools and/or communications of Lean Engineering (such as Obeya, or the logic of Value Added-No Value Added) and very much applicable.

The experience tends to show that an analysis with Lean Engineering of the project network diagrams is a fountain of opportunities for the project manager.

12.   Change your management approach you will

Throughout the previous chapters, we shared the practical problems of project management, and then the method of project diagram construction to move through the execution of the critical chain and the way of monitoring a project. With these points in mind, it follows to recall a few inherent principles with the new behaviors and adopt these for a project. The following are not exhaustive, but represent most of what we see in general:

- **_Project Protection index :_** The only decision-making tool on the planning aspects of a project. As we have seen, based on the color of this indicator, we decide whether to act or not. The principal idea is that the green zone does not require action, the yellow requires a look into the situation without necessarily acting. The red, though, implies the need to apply the options studied during the passage through the yellow zone. Be paranoid but not hysteric!

- ***Moving from due-date management to duration management***: this is probably the most complex aspect of project management with the critical chain. Since we have a buffer and we have cut back on the durations by 50%, respecting the original due dates is futile. It then follows to ask: "how much time is needed to finish?" instead of "will this be done for this date?".
- ***Concentrating on the critical chain:*** Any gain in the critical chain is a gain for the project. It follows to make several decisions around that:
  - Making the execution of the critical chain visible: in general, it follows to clearly show when someone works on the critical chain. A visual indicator is generally a good way of doing this. It is customized to excuse the person working on this task from meetings or allowing an electronic message of absence, over the phone, etc. Some companies have put into place a *Critical Chain Room* to offer a place dedicated to those having a task on the critical chain. The idea is to assume one's role and keep a focus on the chain.

Hand over: during the work on the critical chain, a good practice is to inform the resource that a task on the critical chain is about to begin in x days. Hence the person has the time to put the current tasks in order and begin the launch of the task on the critical chain. This practice also allows to keep the organization's focus on the critical chain.

13.   Be prepared for success you will

In the next chapter a book is referenced that encompasses a large chunk of the successes of the critical chain and its combinations with other methods. In general, we observe a service rate on the rise (+20%), an increase in design flow rate (25-30%), as well as a reduction in project duration (20-50%). Considering the strong impact of these consequences, we can observe:

1) **The systemic problem shifts.**

When the results of a project increase in such way, it is usual to notice that the pressure once placed on the project teams quickly moves to other functions. The issue is that these other functions aren't ready to manage this change. One such example is a company we worked with that moved from a flow of 12 new products to over 70! The commercial function was not able to take into account this change and found itself submerged even though it had thought "everything would be fine". In general, these related functions are quite skeptical, or in a state of denial, regarding the duration gains, and it's generating an inertia that is difficult to get it back when facing new project function deliverables rates.

2) **Opening of a new project management sales approach**

If your business' projects are under such great pressure, there must be reasons behind them. If projects end early or on time, what is the added value for the client? What are the consequences

when a project is late for this same client? The logic to this approach is to identify the added value for the client and write-up a project management offer that would be linked to this added value.

- How much would the client be ready to pay to see their project end 10 to 20% faster than expected?
- What is the impact on the treasury when a project ends early for your clients?
- Based on the relevance of your projects, would including tardy-based penalties in your offer be a standout element when facing competitors?

14.   Learn deeper in the methodology you will

You can find below the bibliographic references to go deeper on Critical Chain project Management:
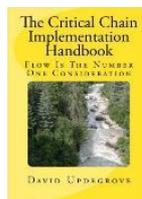
1) Books

Critical Chain , Eliyahu M. Goldratt (Author)

Critical Chain Project Management, Third Edition Kindle, Lawrence P. Leach (Author)

The Critical Chain Implementation Handbook , 2014 , David Updegrove (Author)

Advanced Multi-Project Management: Achieving Outstanding Speed and Results With Predictability , 2012 , Gerald Kendall (Author), Kathleen M. Austin (Author)

2) Scoop it ! & website

Project's management breakthrough with Critical Chain Management and Agile Approach

3) Videos

[Program Critical Chain Goldratt part 1](#)

[Program Critical Chain Goldratt part 2](#)

4) Training

Flow projet management training : formation théorique et pratique en 3 jours

15.   Keeping in touch you will

About the writer, Anthony FOUQUE

I am an engineer in Logistic of ISEL (Institute Superior of Logistic Studies) and have a Master in Entrepreneurship obtained at Management School of Normandie. It is during this master that I first encounter Theory of Constraints.

For ten years, I have been certified Theory of Constraints Fundamentals, Instructor CDDP & CDDL of the Demand Driven Institute, Logical Thinking Process.

In parallel to these certifications, I had the privilege of being trained by Carol Ptak at the DDMRP, Dettmer at Thinking Processes, Eli Schragenheim at Throughput Accounting & Decision support according to TOC and Skip Reedy au Critical Chain Project Management. For ten years, I have occupied management posts in Supply Chain careers in complex environment such as aeronautics, the Oil and Gas sector, and am now an instructor/consultant on these aspects with the AGILEA group.

I am also a synergologist- a non-verbal communication discipline developed by Philippe Turchet.

I have also written other documents similar to this one:

- The nonverbal dynamic in the guiding change,
- The introduction of the Thinking Processes in the guiding change,
- What if it wasn't the suppliers' fault? The application of DDMRP in an Engineering to Order environment,
- The management practices of the Theory of Constraints in project management,

Based on the downloading results of this document, I will put these documents online in a similar fashion.

Connect with Anthony on [Linkdin](#)