Project Management National Conference, India
Project Management - *Powering India's Global Leadership*
15-17 September, 2017, Chennai

The role of Process Innovation in achieving Project management leadership

Project Management Leadership in a rapidly changing world

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Theme: Project Management Leadership – in a rapidly changing world

Keywords: Estimation, Errors, Biases, System 1, System 2, CCPM, Critical Chain

Abstract:

Developing or under-developed nations are not alone when it comes to delivering projects reliably. There have been many instances of unfulfilled promises while delivering projects even in the developed world as examples from USA, Japan, Australia and Israel indicate. One of the key reasons for such a gap between promise and delivery is attributed to 'Overconfidence effect' as propounded by Daniel Kahneman. We can counter this by adapting project management processes appropriately. The paper describes some innovative changes in processes using well known statistical principles and fusing them into practice through effective execution.

Every task in any project is fraught with uncertainty. Estimates of task durations cannot be precise. The estimated duration of every task has some variation. We also know that the extent of variation of the estimated duration for a chain of tasks is far less than the summation of variations across each task. Critical Chain Project Management (CCPM) exploits this statistical principle to remove local safeties from individual task estimations and provide common buffers at strategically relevant points in a project plan.

We need to revamp our processes so as to eliminate the need for local safeties. The role of senior management in introducing and sustaining change in the process of planning, executing, monitoring and supporting the progress of projects is very crucial. The paper explains the innovation behind the process change, considerations while implementing this change in project organizations and some success stories as well as challenges from the real world implementations.

Intent:

Preparing a project schedule with a realistically achievable timeline by estimating task durations is a crucial activity in the planning phase. This requires clear thinking and judgement. However, according to Daniel Kahneman, well known for his work on the psychology of judgment and decision-making as well as behavioral economics, our thinking and judgement is pervaded by several biases. An attempt has been made to create a simple understanding of these biases and how they influence the estimation process. There seems to be no absolutely reliable way in which biases can be eliminated from our estimation processes. This is where Critical Chain Project Management (CCPM) becomes relevant in delivering projects reliably inspite of the biases. This paper explains the principle behind CCPM briefly while elaborating the practical aspects of implementation and results obtained in real life.

1. Introduction

Planners are required to exercise a lot of judgement while preparing a Project schedule. However, our estimations and judgements are largely intuitive and full of biases. Hence, the project schedule is an erroneous document with inherent biases. This is supported by the fact that the schedule becomes irrelevant the day a project is taken up for execution, in most organizations. The only way to avoid biases in thinking is to be deliberate in thinking consciously. However, this is easily said than done, especially in an organizational context.

Critical Chain Project Management (CCPM) developed based on holistic thinking processes is very helpful in delivering projects reliably. Even though it was not developed to address the biases and errors in thinking, it is useful to understand the holistic thinking behind CCPM and how it helps in delivering projects reliably. A case from a large company in the consumer products, industry chemicals, agri-solutions and nutraceuticals presents an idea of how to implement CCPM successfully and the challenges involved.

2. Our estimations are biased

There has been a lot of research carried out by psychologists concerning two different modes of thinking we are endowed with. Almost always, the human brain thinks very fast – automatically and intuitively. Occasionally, when we allocate attention to the effortful mental activities that demand it, we think very slowly. The former is called as System 1 thinking and the latter is called as System 2 thinking. Examples of System 1 thinking include the ease with which one drives down a familiar route, detects hostility in a voice, completes the phrase - “Bread and …..” etc. Examples of System 2 thinking include checking the validity of a logical argument, comparing two gadgets for overall value, filling out a complicated form etc.

System 1 operates with little or no effort and no sense of voluntary control. System 2 thinking requires attention and mental energy. Our brains are prone to think fast (System 1) and follow a path of least resistance since thinking slow takes energy. We think fast to accomplish routine tasks. Unfortunately, we think fast even when we are required to think slowly.

The confidence we have in our intuitive abilities is usually justified; but not always. We are often confident even when we are wrong. Errors arising out of intuitive judgements are often difficult to prevent since System 1 thinking takes place automatically and cannot be switched off at will. System 1 operates on heuristics, which are assumptions made automatically without having thought through them carefully. They are our mental shortcuts to arrive at a response to a situation without wasting much energy of the brain. In general, heuristics are quite useful; but, sometimes they lead to biases in our thinking and judgement.

Kahneman has provided a detailed account of many biases which impair our judgement. A few important biases that contribute to poor estimation impacting the Project schedule adversely are elaborated in the following paragraphs.

2.1. Overconfidence effect

We systematically overestimate our knowledge and ability to predict. This is called the Overconfidence effect. It is a measure of the difference between what people really know and what they *think* they know.

A survey has found that 93 percent of the U.S. students judged themselves to be "above average" drivers. However, that figure should have been exactly 50 percent—the statistical median. Similarly, 68 percent of the faculty at the University of Nebraska rated themselves in the top 25 percent for teaching ability.

It is pertinent to note that the Overconfidence effect is more prevalent amongst experts than laypeople. This effect is not driven by incentives and not counterbalanced by the opposite 'Under-confidence effect' which does not exist.

Effects of such overconfidence are evident all over the world:

- The proposed new Scottish parliament building in Edinburgh was estimated to be completed in 1997 with a cost of £40 Million. The building was completed, after 5 upward revisions, at an approximate cost of £431 Million in 2004.
- A survey of rail projects undertaken between 1969 and 1998 shows that in more than 90% of the cases, the number of passengers estimated to use the rail system was over-estimated by as much as 106% and the average cost overrun was 45%.
- There are many other big projects - Airbus A400M, Boston's Big Dig, Airport in Tel Aviv and Sydney Olympic stadium – standing testimony to Overconfidence effect.

Poor estimation and unreliable project delivery are not confined to developing or under-developed nations alone, as popularly believed. It is a universal problem due to overconfidence.

2.2. Confirmation bias

Science prescribes that any hypothesis has to be tested by trying to refute the hypothesis. However, most managers (and also many scientists) seek data that are likely to be compatible with the beliefs they hold. This is called as Confirmation bias. Warren Buffett was alluding to Confirmation bias when he said, "What the human being is best at doing, is interpreting all new information so that their prior conclusions remain intact". In the context of estimating task durations, Confirmation bias moves planners away from actual reality to what they believe is the reality. Thus, errors creep into the timelines.

2.3. Anchoring and Priming

Anchoring effect takes place when people consider a particular value for an unknown quantity before estimating that quantity. Professional real estate agents were given a tour of a house and asked to estimate its value in an experiment. They had been provided a randomly generated listed sales price beforehand. The anchor influenced the professionals. i.e. those who had been provided a higher figure quoted a higher number. The more uncertain the value of something, the more susceptible even experts are to anchors. Pre-existing Project plan templates act as anchors for a new project plan.

If we are exposed to an idea that influences us to think about an associated idea it is known as Priming. In the context of estimating task durations and project timelines, planners are subject to extensive priming by the Sales function and also senior management.

2.4. Availability heuristic

When people are required to estimate an unknown event, the ease with which they are able to retrieve an event influences the size of the estimate of the event. For example, those who are exposed to school shootings overestimate the number of gun crimes and those have got mugged overestimate the frequency of muggings. We're prone to give bigger answers to questions that are easier to retrieve. A task which went totally against expectations and created deep emotional impressions, such as criticism by top bosses, is bound to be over-estimated even though the frequency of such an occurrence is very low.

2.5. Planning fallacy

Planning fallacy refers to plans and forecasts that are unrealistically close to best-case scenarios and could be improved by consulting statistics of similar cases. Failure to learn from other similar projects increases the potential for failure.

The planning fallacy is particularly evident when people work together. Groups overestimate duration and benefits and systematically underestimate costs and risks

In summary, Project timeline estimation is replete with errors and biases introduced by System 1 thinking and influencing the managers to compress the time lines. The need for an effective Project planning and execution mechanism, despite the inadequacies of the estimation process is fulfilled by Critical Chain Project Management (CCPM). Even though it was not developed to address the biases and errors that we have seen so far, it is useful to understand the holistic thinking behind CCPM and how it overcomes the inadequacies of System 1 thinking.

3. Critical Chain Project Management

Theory of Constraints (TOC), developed by Dr. Eliyahu M Goldratt, is a holistic improvement methodology using logical thinking processes to focus on system constraints. Critical Chain Project Management (CCPM) is the TOC solution to the challenges of planning and executing projects reliably. CCPM challenges and invalidates several assumptions. One of them is: "Every task has to be completed on time in order to complete the project on time".

This assumption has implications in planning as well as execution. During the execution phase, task completion within the planned duration is seen as something sacred. Any task which is delayed with respect to its estimated duration is seen as a failure of the manager. However, no manager wants to be seen as responsible for project's delay. Therefore, managers spend considerable energy in adding a lot of cushion for each task while planning. Managers estimate timelines with a lot of biases and errors (System 1 thinking) resulting in tasks with a lot of local buffers.

3.1. Project planning in CCPM

The planning methodology in CCPM provides a global buffer as against local buffers. As long as the assumption that every task has to be completed on time in order to complete the project on time holds each task would be estimated with a lot of cushion (local buffers). However, CCPM invalidates this assumption. It is well known to all that even if a few tasks are delayed in a series of tasks, the rest of the tasks could be completed faster thus completing the entire series of tasks as planned or with much less delay.

In order to elaborate this, let us consider a series of simple tasks: Drive to Office – Attend a Conference call – Review sales performance – Finalise the next year's budget. If each task is mandated to be completed within the estimated duration, one would add some safety cushion to each estimated task duration in order to take care of the inherent variation within each task. Fig 1 shows a sample schedule under such practices.

Fig 1. Activities with local safeties

While we know that any task is capable of being delayed due to inherent variations, we also know that not every task would be affected by variations at the same time. Hence, we could pool the local safeties together and use to compensate any variation that could take place in the whole series of tasks. In fact, it is enough if we use only a fraction of it. This will mean that the estimated durations for each individual

task will be devoid of their local safeties. It has been empirically observed that most managers provide almost half of their task estimate for local safeties. In this example, nearly about 4 hours is accounted because of local safeties. If we use 2 hours of this duration as a common buffer, instead of local safeties, the schedule would look as shown in Fig 2. It is possible to complete the series of tasks on time, even though some (not all) of the tasks may not get completed as planned due to variations. Notice that the planned project lead time is shorter on account of replacing local safeties with a common safety.

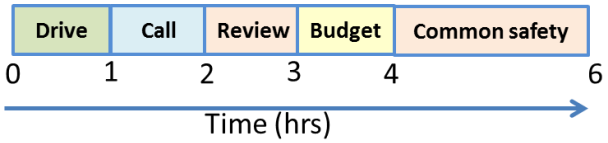

Fig 2. Activities with Global safety

Statistically speaking, the sum of local variances is far higher than the global variance. This idea is used in the planning phase while planning projects the CCPM way. The entire project network is drawn without any local safeties. The estimated task durations are known as 'Aggressive But Possible' (ABP) durations. When planners are required to provide ABP durations, they are forced to think deliberately (best possible methods of accomplishing a task, the sequence of sub-tasks, appropriate technical dependencies etc) to arrive at task durations. This is System 2 in action, by design. It is also recommended that they use optimal number of resources to keep the task durations low.

Once a project network is prepared, the Critical chain of the project (the longest chain of dependent events for which resource contentions have been levelled) is determined. A common safety, called as the Project buffer, is added to the Critical chain. This protects the project end from any variations in the project tasks. Similarly, a common safety is added for each non- Critical chain (called the feeding chain) at the point where they integrate with the critical chain. This is called as Feeding buffer which protects the critical chain from the variations of the tasks in the feeding chains.

Figure 3 shows a typical project plan with local safety in each task. Each colour represents a unique resource with a capacity of one unit.

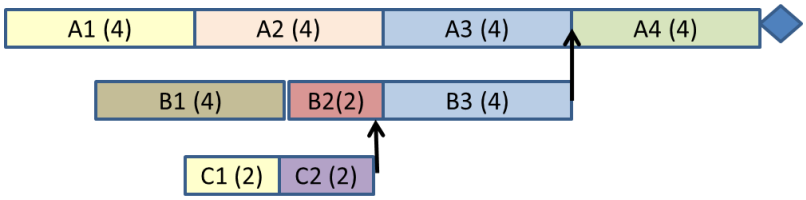

Fig 3. Project plan with local safeties

Figure 4 shows a plan without local safeties i.e. the durations are Aggressive But Possible (for the purposes of illustration, it is assumed that 50% of the initial task estimation was the local safety in each task). Please also notice that Fig 4 shows a resource levelled project schedule. The chain of tasks B1 – B2 – B3 – A3 – A4 represents the critical chain. A1 – A2 and C1-C2 are the feeding chains.

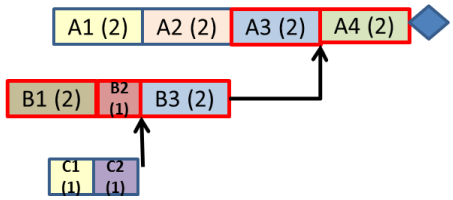

Fig 4. Resource levelled project plan without local safeties

Figure 5 shows the Critical chain project plan with Project buffer and Feeding buffers. Since the length of the project buffer is less than the sum of local safeties removed from the critical chain tasks, planned project lead time is lower than the original schedule with local safeties.

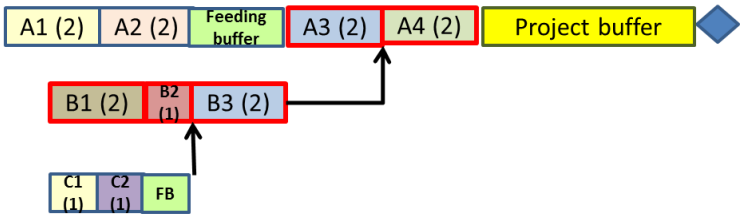

Fig 5. Critical Chain Project plan

3.2. Project Execution in CCPM

The Critical chain plan arrived as above is elegant. But, an elegant plan per se does not guarantee reliable delivery. That leads us to understand the way projects are monitored and controlled under CCPM methodology.

As the project is executed, some tasks may get delayed. Whenever a task gets delayed, the project buffer or the feeding buffer gets consumed to the extent of the delay. Similarly, if any task is completed ahead of its planned duration, the corresponding buffer is gained. As the execution progresses, the percentage of completion of critical chain is compared with the percentage of consumption of project buffer. If the project buffer has been consumed to a greater extent than the level of critical chain completed, the project is likely to be delayed and hence a recovery action is warranted. These two factors are presented in a Project fever chart and project control actions are taken regularly right from the start of the project. Fig 6 shows a typical Project fever chart.

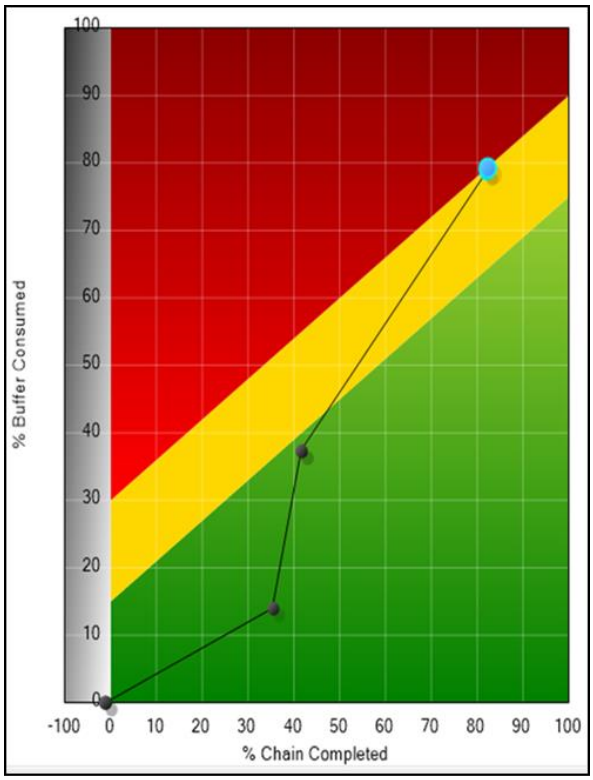

Fig 6. Project Fever Chart

The green zone represents an area where % Critical chain completed is greater than % Buffer consumed – a healthy sign. The yellow zone is an ideal zone for the project to be in. When the project is in the red zone, actions are required to be undertaken to reduce the level of buffer consumed in relation to the level of critical chain completed. Since this chart is available from day 1 of execution, project would be controlled very effectively.

4. Implementing CCPM – a case in brief

Project delays were very common in a large company belonging to a well-known Indian industrial group. The company has significant presence in the consumer products, industry chemicals, agri-solutions and nutraceuticals space. The problems caused by delayed projects were so rampant that the company's Audit committee had made critical observations and the matter was taken seriously by the board. At this juncture, they decided to manage all their capex and maintenance projects through CCPM methodology to enhance the reliability of project delivery.

Most project planners have a tendency to use spreadsheet or similar software to record their draft project schedules. These would be mailed to other stakeholders for their review and approval which was customary. However, as part of this initiative, the entire project team assembled in a hall and generated

the project schedule with details of tasks, dependencies, resources etc for each project. They engaged in meaningful debates to arrive at the estimated durations (System 2 thinking). Care was taken not to add local safety while estimating task durations. The team's availability during the estimation helped enhancing the level of ownership among all stakeholders. Also, the team used post-it® pads on a plain white sheet to generate the project schedule. This helped all of them to visualize the project clearly and gave them the flexibility to modify the schedule easily. The team went on to save the agreed schedule in a software that had the features to manage projects the CCPM way.

Progress of tasks was updated everyday by feeding in the remaining durations for every open task. This data was used to generate the Project fever chart which indicated whether the project was healthy or not. If any project was found to be entering the Yellow zone (from Green zone), action plans to complete more of critical chain with less of project buffer consumption were drawn and communicated (but not acted upon). These plans were called as Buffer recovery plans. If the project entered the Red zone, actions listed in the Buffer recovery plan were taken up. This helped in recovering buffers which had been consumed disproportionate to the level of critical chain consumption.

Multi-project fever chart as shown in Fig 7 were used to identify projects requiring managerial attention and focus. This chart represents all the projects running in the organization in a single two dimensional report with % Critical chain completed vs % Buffer consumed. Thus the relative standing of each project is clearly visible in a simple manner. This helped the top management to focus where their attention was required the most – regardless of whether the project was in the initial stages or in the final stages.

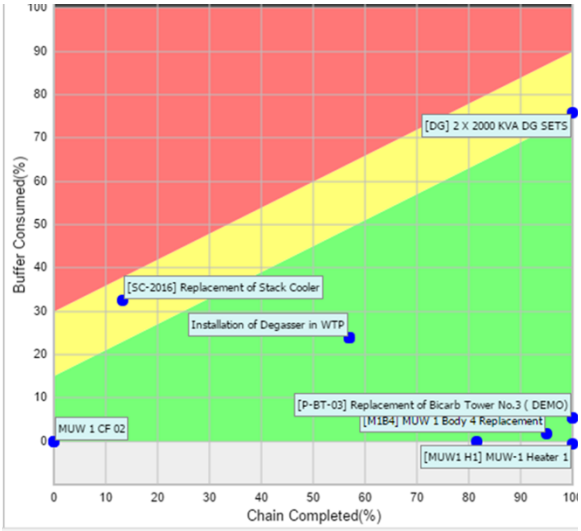

Fig 7. Multi-project fever chart

The organization has realized many benefits. A rigorous planning process and a strong alignment between planning and execution processes was the most important one. Apart from this, managers have been able to balance resources to projects and also augment the capacity of resources where needed –

during the planning as well as execution phase. Another unique benefit of this methodology is the visibility it offers to the top management right from the early stages of the project. Hence, timely and appropriate decisions could be taken to keep the project on course right from its start.

The on-time delivery of projects has risen up beyond 90% levels. This is a significant improvement considering almost every project was a delayed project. In the words of their General Manager – Projects, "Individual tasks vary in duration from the plan / estimate. Rather than attempting every task to complete on time, we monitor the project buffers created during the planning stage". The head of maintenance says, "It is the best project management philosophy and tool I have seen. We can track and review multiple projects at a glance just by looking at the fever chart. It is now easier to explain to management where problems existed and get resources allocated to those problem areas in time for them to impact the project schedule".

Based on the success experienced in their old established plant in India, the management of the company decided to implement the same methodology in their North American operations also apart from managing all their Corporate Office projects the CCPM way.

5. Implementation considerations and challenges

Staffing the CCPM implementation initiative adequately is an important pre-requisite for success. A steering committee of executives to guide the internal champions who would have understood the principles of CCPM well would be required for a successful implementation. Senior management would be required to remove all hurdles that may come up during the implementation.

The most important consideration would be to recognize that implementing CCPM in a project organization is an exercise in change management. That would require communicating to several layers of managers and convincing them of the need and urgency to change. Since every manager may have a different perspective of his / her need, proven change management methodologies would need to be deployed for a successful implementation. The success of any change initiative depends on how well the company is able to move away from old habits and form new habits.

Introducing CCPM in an organization is not a question of installing and using a new software. It is changing the paradigm of managers from a traditional way of doing things (System 1) to a way of logical and holistic thinking (System 2).

6. Conclusion

The general human thinking style which is largely intuitive (System 1) and rarely deliberate (System 2) has an important influence in task duration estimation and Project scheduling processes. Many biases and erroneous thought patterns of intuitive thinking such as Overconfidence effect, Confirmation bias, Anchoring and Priming, Availability heuristic and Planning fallacy distort the project timeline at the planning phase. There have been examples from all over the world to show project performance has

been affected. There seems to be no quick and systemic solution to this issue since the two different ways of thinking are wired into our brains.

The Planning and Execution processes of CCPM methodology requires planners and other executives to resort to System 2 thinking to a great extent. Even though it was not developed to address the biases and errors arising out of System 1 thinking, it is useful to understand the holistic thinking behind CCPM.

There have been many successful organization wide initiatives to implement CCPM as the way of managing projects. Committed leadership, introducing CCPM as a change initiative (not as software implementation) and forming new habits while discarding old ones have been important factors in the success of CCPM.

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