Applying Marginal Gains Theory to Project Forecasting

The concept of marginal gains has garnered a lot of attention in recent years, specifically in the domain of sports performance, and for good reason. The proven results are hard to argue against. The concept behind this theory is simple. Small, yet significant incremental improvements, lead to monumental results. Perhaps we should be considering this approach when trying to better forecast the outcomes of Capital Expenditure (Capex) projects.

The Speckled History of CPM Scheduling

Critical Path Methodology (CPM) is today a well-known technique for determining duration outcomes for large and complex projects, which are typically multi-year endeavors. While an accepted approach, the track record for accurately forecasting when a project will complete is at best, terrible. The problem does not lie at the feet of the CPM calculation though, the calculation is mathematically sound, what is problematic, is the highly subjective and easily biased nature of the inputs; how long does the work take and what is the sequence that work needs to be carried out. If the project is being managed by a loud bombastic project manager the CPM schedule can quickly become nothing more than a poorly informed subjective opinion.

In the past twenty years, there have been efforts to overcome the shortcomings of CPM. While each of these efforts, in silo, have helped somewhat, we still operate in a project management environment where forecasting the future is incredibly challenging.

Risk-Adjusted Schedules

In the early 2000's, the concept of running a risk simulation against a CPM schedule became mainstream. The risk simulation would account for variability of task durations and from this, we could determine a range of outcomes rather than a single result, unlike CPM which calculated a single outcome.

Without a doubt, **risk-adjusted schedules** do give insight and confidence to a project team but this in itself has then led to another challenge – that of **schedule integrity**.

Schedule Integrity

Both CPM schedules and their associated risk models unfortunately have an Achilleas heel and that is logic integrity. CPM schedules are highly dependent on proper modeling of what is known as precedence logic (e.g., you can't start a concrete pour before you've finished the formwork). Model one of these links incorrectly or worse still, miss a logic

link and the resultant CPM calculations that drive a project completion date are then fundamentally flawed.

Again, in the past two decades, there have been great strides in the science of critiquing and improving scheduling integrity which in turn has helped with improving schedule forecasts, but here we are in 2022 and, as an industry, we still cannot accurately forecast a Capex project completion date. So, what are we still missing?

After spending over two decades helping evolve and improve the science of scheduling, through analyzing literally thousands of CPM schedules, I have come to the determination that the output from a risk simulation is often, influenced by the unique characteristics of a schedule, as described further in the DNA section below, than the actual input ranges that are fed into the risk model itself. Akin to "nature versus nurture" argument in many ways, the outcome of a project is already largely determined by its underlying characteristics; we can only nudge improvements through nurturing small changes. If this is the case, then we need to take more notice of project characteristics DNA and perhaps less worried about the likes of modeling logic.

The Four Pillars Driving Marginal Gains

If we assume that a combination of risk-adjusted forecasting and schedule quality critiquing helps towards improving the accuracy schedule forecast, what are the other incremental additions that we can add to our repertoire when building a plan? I believe we should consider adding the two additional approaches – assessment of the DNA characteristics of the project and performance patterns from prior projects per the figure below.

Figure 1: Four Pillars

DNA Assessment

Firstly, consider the subject of project characteristics or DNA, think of this as the unique footprint that every project carries. Projects are unique in terms of material quantities, resources needed, the sequence in which work is carried out, seasonal constraints, scope, etc., the list is literally endless.

If a CPM schedule is nothing more than a mathematical model of how we plan to execute our work accounting for the above listed unique characteristics, then we should consider the characteristics of the resultant workflow. Example DNA characteristics include:

- Are there pinch points in our schedule that are dependent on multiple preceding tasks? *Are there paths in our plan that hold hostage scope of work that otherwise would be low risk?*
- How many parallel critical (or near critical) paths lead to my project completion? *I would rather have a single, highly dominant path to project completion that I can focus my efforts on rather than multiple work fronts that I have to dilute my focus across.*
- Does my work sequence depend on multiple sub-contractors interfacing seamlessly with each other? *Modeling the efficiency of crew handoff is hard to do yet is a frequent hotspot for schedule delay.*
- Are there areas of work that I should start earlier or even later in order to de-risk and yet not impact my project completion? *Pockets of float in a schedule are opportunity windows to execute work at a lower risk threshold.*
- Do I have resource bow waves that are going to cause me to delay? *Examining typical manpower or cost curves during the lifecycle of similar projects is an excellent benchmarking technique.*
- Are there "first of kind" or technical complexity hotspots that most likely will hurt us? *Have we sufficiently accounted for inevitable delay?*

These types of questions cannot simply be modeled or answered in the same way that schedule integrity can be modeled using a set of algorithms. There is a high degree of expertise and knowledge needed to digest and analyze the DNA characteristics of a schedule.

The past couple of years has seen an increase in attempts to leverage Artificial Intelligence (AI) within the project management space. The reality is that AI is simply another technology widget that may absolutely help us but it is not a silver bullet. Whether a computer or a human, or a combination of the two, is needed to understand a project's DNA footprint, the fact remains that this critical characteristic of a project is at the forefront of importance when it comes to more accurately forecasting. I would rank a project's DNA as more influential than uncertainty and schedule quality in terms of impacting a forecast.

Prior Patterns AKA Next Generation Benchmarking

One of the most surprising things I have seen during my career is the absence of formal mining of historical project performance data during the planning process and yet, when this is methodology is adopted, forecasts are dramatically improved.

If we can overcome the complexity of making meaningful benchmarking more applicable to schedules (i.e., overcome the non-structured data issue associated with the freeform nature of schedules), then our forecasts will, without question, be more resilient and defendable. Again, emerging technologies are making the mining of historical data which help with determining useful patterns, that can then be applied to our in-hand forecasts, better. Some may argue though, that with increased project complexity comes less analogous patterns with prior projects and hence less value from benchmarking. This is something that I do not believe to be true. Irrespective of how unique and complex a project is, break it down into small enough components, and you can always draw an analogy from something in the past.

In the past four years, without exception, every single schedule and risk assessment that I have conducted has involved some degree of benchmarking and comparison against prior projects and with good reason. Benchmarking is an excellent means of challenging a project team during a risk assessment to help validate duration, cost estimates and sequence of work inputs. If *"Experience is the teacher of all things"* then we need to take heed.

The challenge here is not availability of historical information, but instead how to efficiently mine this plethora of unstructured and often disparate information. This is an area that I believe is going to see some very exciting progression in the coming years within the project management space.

Defendable Plans Aligned with Execution Resilience

Each of the discussed four pillars of marginal gains (Figure 1 above), do not on their own solve poor forecasting, however in combination adopting these four pillars together will drive the ability to better forecast project schedules.

Better forecasting is not about driving an earlier completion date. Quite the opposite. Better forecasting is our ability to home in on a more achievable completion date and be able to stand behind and defend that date.

But what if our defendable plan turns out to be wrong due to unforeseen external circumstances? The drivers of execution overruns are many but as part of our marginal gains approach to planning, we should also consider mitigation and remediation during the planning phase so as to improve what I'd like to term "**execution resilience**". That is, a plan that is sturdier and more resilient to the occurrence of external detrimental

impactors such as risk events. I would rather execute a 36-month project knowing it is highly resilient to risk and delay than try and execute the same project against an accelerated 24-month timeline knowing that there is a very high chance I will actually slip to 48 months.

The concept of forecast sensitivity or **resilience** is one that warrants further research and development in the same way that CPM scheduling has evolved in the past half century.

Marginal Gains Make Absolute Sense

Discrete improvements to the science of CPM scheduling such as risk modeling and schedule critiquing have without a doubt helped projects' better forecast. However, to date, the software tools and approaches adopted to support these improvements have been highly focused on a specific solution e.g., risk analysis. If the sum of the parts is greater than each discrete method, then we should be adopting more of a multipronged approach to better forecasting. This paper has touched on four methods that drive project forecasting realism but there are of course more. The key takeaway here is not really what the methods are but the fact that we should be adopting a multi-facetted approach to help better plan the future outcome of Capex endeavors.

About the Author

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