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What You Should Really Seek When Conducting a Schedule Statistical Analysis

We have observed that Schedule Statistical Analysis, when implemented, is often interpreted wrongly or does not bring the expected value. Beyond the obvious results (finish date) however, such an analysis can bring troves of useful information, through a deeper understanding of the project schedule's drivers. In particular, Schedule Statistical Analysis can be used to identify improvements that can significantly enhance the robustness of a project schedule.

What are the objectives you should have for schedule statistical analysis?

Schedule Statistical Analysis (SSA), also often called Schedule Risk Analysis, aims at understanding the impact of variations in the activities durations on the overall project outcome. It is a bottom-up method where the possible variations on all relevant activities are input in a model which then uses a Monte Carlo model to simulate the project schedule outcome statistically. In the model, the activities are linked logically so that delays on an activity will delay the start of the following activity, etc. Most of the time, the prime motivator for management to request for a schedule statistical analysis is to have an idea of the distribution of the finish date of the project. This is often important for contractual and investment justification. However we argue that this should not be the main objective of such an analysis. A SSA can bring much more value in a number of areas than just an estimate of the finish date, which will be inaccurate anyway (more on that in the section on limitations). Actual value to be drawn from the method include:

- Generation of a simplified schedule showing the actual drivers of the project, that is a very valuable asset for communication, induction;
- Identification of the critical path and measure of the actual subcriticality of other chains of activities, that give a good idea how to drive the project execution
- Improvement to the schedule resilience by observing criticality ratios and by testing 'what if' scenarios and observing their impact on the project execution.

How to perform Schedule Statistical Analysis

It does not make sense to perform the SSA on the basis of a full integrated project schedule covering thousands of activities, for the two following reasons:

- It is impractical to have meaningful statistics on the variability of thousands of activities; in addition people generally can respond to questions relative to aggregates, not detailed activities;

- It is not appropriate from a mathematical perspective (as multiplying the number of activities in a Monte Carlo simulation automatically diminishes the overall variance).

The first step – and the most important, requiring the most work, is thus to devise a simplified schedule, linked logically with aggregate activities. It can thus not just be a roll-up of the overall schedule; it needs to be carefully crafted to reflect the actual critical path, the subcritical chains of activities, and in general, reflect appropriately the high level logic of the project execution. To achieve this, people familiar with the project and the schedule need to be mobilized.

Only when this is done, can data be sought regarding the possible variability of the activities of the simplified schedule. It is rare that companies have hard data on the matter and often, it is necessary to resort to professional's experience. A word

The distribution of the finish date of the project should not be the main objective of the analysis. And anyway, this result is wrong.

of caution – professionals will tend to underestimate the variability brackets unless appropriate questions are asked like 'have you ever seen this happening', or a proper calibration of risk estimates has been done prior to the exercise.

A risk register can be applied to the model to include a number of discrete risks and scenarios to the simulation, however this additional complication is not always needed.

The final part of the SSA, running the simulation using a tool such as Primavera Risk analysis is actually the simplest. Mathematical consistency needs to be checked to ensure a sufficient number of iterations has been used for the Monte Carlo procedure.

The limits of Schedule Statistical Analysis

Like any model of reality, SSA has a lot of limitations and its results should absolutely not be taken as granted. It has the advantage over straightforward Monte Carlo procedures like the ones used for cost to take into account logical relationships between activities. However, there are still a number of issues that are not taken into account, in particular:

- Common / shared resources used by several activities and actual resources limitations and constraints;

- Low probability, high consequence risks are poorly modelled whereas they can have significant importance in real life projects.

It is thus important to underline that in spite of its very attractive approach and presentation, SSA should not be taken as a full representation of reality. It is only a model that shows the effect of certain events but is necessarily much simplified. In particular, projects very often show delays which are much greater than whatever had been found using SSA, due in particular to real-life cascading consequences of delays in terms of resources utilization and exhaustion.

What results should be analysed?

The overall result on the expected delay of the project should thus be considered with much caution and should not be supposed to represent reality. It can be used in a number of processes, e.g. as a contingency that can be added to the schedule.

Unfortunately, a lot of organizations only focus on that particular result and not on what is really interesting in a SSA result.

SSAs provide a raft of results for each activity in the schedule being modelled, including distributions for its start, end, float, how the duration of that particular activity is correlated to the overall project's duration, and what is the probability for that activity to be critical.

We believe this last parameter is one of the most interesting. What is really important is to understand how robust the critical path of the deterministic schedule really is. It happens often that this analysis uncovers that actually the critical path is only marginally critical and that there is a number of other paths that can become critical with a high probability (>20%). This is an important issue that needs to be tackled.

Tips for enhancing schedule robustness and project steerability

One of the most important things to know when you execute a project is to know where your current constraint (or bottleneck, critical chain) to project delivery is. It is important that it remains stable during project execution. Hence, it is preferable that the critical activities remain critical, and that the critical path does not jump unexpectedly from one side of the project to the other.

This is why observing in the SSA the resilience of the critical path is possibly the most important result.

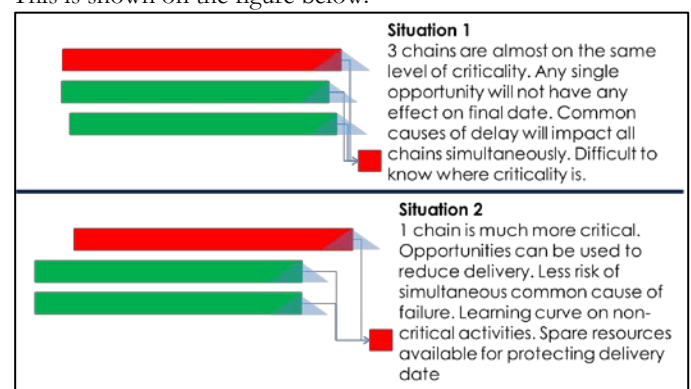
Should this observation show that several work streams are competing for criticality to the point of creating a situation where the critical path can jump easily and

unexpectedly, this needs to be fixed. It will enhance significantly the schedule robustness and the easiness of execution.

In particular in the situation where two or three similar chains of activities happen in parallel and compete for criticality, removing this competition (e.g. by starting some chains earlier, and not the critical one) provides great benefits:

- Less strain on resources if similar resources are used
- Resources used on very subcritical chains of activities can de facto be used as a buffer to add resources to critical activities that would need such support, without creating a situation where the critical path would jump somewhere else
- The learning curve will happen on non-critical activities instead of impacting directly the critical path.

This is shown on the figure below:



Conclusion: Schedule Statistical Analysis is a great tool if it is used properly looking at the right result

A very large proportion of our clients do not use Schedule Statistical Analysis (SSA) properly, and do not look at the right results. This tends to diminish the value of SSA in the eye of decision-makers.

This paper has shown in detail what is the right approach for SSA and what are the types of results that can be – and cannot be – expected. As with any tool, SSA is a very powerful tool if its limitations are properly understood as well as what type of understanding it can really bring.

Project Value Delivery provides services to teach organizations how to implement effectively schedule risk analysis and support actual analysis. [Contact us](#) for details.



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