Why Good Execution is Not Enough

Justin D. Jacobsen[1] and Chris D. McLuckie[2]

[1]MBP, 3040 Williams Drive, Suite 300, Fairfax, VA 22031;
jjacobsen@mbpce.com
[2]MBP, 3200 Beechleaf Court, Suite 910, Raleigh, NC 27604;
cmcluckie@mbpce.com

ABSTRACT

Project metrics across multiple industries continue to show a performance gap between baseline expectations actual results. Practitioners should persist in seeking innovative solutions to this performance gap, rather than accepting established paradigms and practices, which routinely result in cost and schedule overruns. One such paradigm is the view each project as a unique endeavor, unrelated to other similar production processes. Relating project execution to other production processes allows observation of similarities in the impacts of variation on output delivery. Recognizing this impact and using tools to mitigate the effects is a major step in closing the performance gap. One such tool is a renewed commitment to implementation of risk management, including quantitative risk analysis. WE can also borrow approaches from other verticals, including buffering and root-cause variation mitigation.

INTRODUCTION

It is a generally accepted observation within project management as a profession, as well as an experience from project sponsors in general, that we have a problem with project execution. The assertion that projects are delivered late and over budget is rarely, if ever, contested. One study by McKinsey & Company indicates that large construction projects "take 20 percent longer to finish than scheduled and are up to 80 percent over budget." (Agarwal, et al., 2016) Construction as an industry is one of the more deterministic industry verticals, with systems and components that are generally well understood. One would expect this phenomenon to be even more acute in industry verticals with more iterative and undefined processes, such as software or technology development. There are many theories surrounding the cause of this deficient performance, but there has never been a definitive solution implemented.

There appears to be two distinct issues wrapped up in the assumption that projects are not performing according to plan. The first is a framing issue. What constitutes effective on time, within budget performance? What is the validity of the baseline budget and associated budgets? If we are to measure project performance against an established baseline, we should be sure that the baseline is valid and accounts for the totality of project scope and risk impacts. The second is an execution performance issue. Is the execution of project activities aligning with the planned values in an effective manner? If the project baseline plan is valid and accurate, well executed activities that start on time and finish within budget should then result in a well-executed project.

Project management as a discipline is filled with numerous intelligent and creative practitioners. Why is it, with all the collective talent and subsequent effort to deliver high-performing projects, we still experience this divergence of results from expectations? Within this paper we will explore one of the causes of this performance diversion and propose mitigation measures that will better align expectations with actual performance.

PROJECTS AS UNIQUE ENDEAVORS

Project Management Institute (PMI), within the first four pages of the Project Management Body of Knowledge (PMBoK), defines a project as "a temporary endeavor undertaken to create a unique product, service, or result." (PMI, 2017). One aspect of this definition often overshadows the process groups contained throughout the additional six hundred thirty-four pages of project management knowledge. This is the classification of projects as unique. While it is indeed true that no two projects are exactly the same, the notion that all projects are unique in every way must be false. How could a project management standard possibly be published if this were true? So, it is here we must agree to a common starting point for developing an understanding of project divergence. Projects are undertaken to produce a unique result, but are delivered using standardized processes, tools, and techniques which are common within project management.

THE PROJECT PLANNING PROCESS

Projects are initiated using various methods and levels of formality particular to an industry or organization. Regardless of the specific process, once a project is initiated it quickly moves into the planning process. The accepted practice of planning a project starts with defining the entire scope of the project, most often defined within a work breakdown structure (WBS). It is this structure that enables the project manager to define the various elements of work for further planning and tracking. Once the scope of work is defined, the WBS can be decomposed into major subdivisions, systems, components, subcomponents, and finally to activities. PMBoK states the "key benefit of this process is that it decomposes work packages into schedule activities that provide a basis for estimating, scheduling, executing, monitoring, and controlling the project work." (PMI, 2017)

The activities defined by the decomposition become the most detailed level of work used in the subsequent planning processes. Once the activities are defined, the path is clear to begin a number of additional process steps. One of the processes enabled is cost estimation and the development of the project budget. Another process is schedule development, which encompasses sequencing the activities using proper schedule logic, estimating activity durations, reviewing the network diagram and critical path for procedural compliance, and generating the baseline project schedule. The definition of activities at this lowest level is intended to facilitate higher accuracy in the estimating and scheduling process, but this accepted practice is also one initial source for the divergence within project execution.

The implied theory underlying this approach is firstly, that decomposed elements are of sufficient granularity to generate an accurate and achievable cost and time estimate to completion. And secondly, that once these decomposed elements are reassembled into a network of dependencies, we will have an accurate model for the completion of the project in terms of both schedule and budget. The cost-loaded schedule and associated network diagram represent the most likely case for project execution performance developed through the planning process. If each activity is completed according to the scheduled start time, duration, and budget, the theory implies that our project will be completed on time and within budget. This also leads to the belief that well-executed project management can achieve the plan as modeled.

VARIATION IN PROJECT DELIVERY

Since we have previously acknowledged the lack of project performance compared to project plans, we must look at this project planning paradigm critically. When doing so, the first item that comes to our attention is the deterministic nature of the activity estimates. Dr. W. Edwards Deming, often recognized as the "Father of Quality," points out in his work, The New Economics for Industry, Government, Education, that all processes are part of nature and as such are affected by variation. (Deming, 2018) Variation for the purposes of this analysis should be defined as the difference between expected outcome and actual results. The deterministic estimate of both cost and duration fail to account for this ever-present natural phenomenon. At the outset, one must acknowledge the base elements of our planning model do not account for the variation acting upon them.

ACTIVITIES AS IPO MODELS

Secondly, project management as commonly practiced and reinforced by the PMBoK uses the transformation theory of production. (Koskela, 1999) Project management processes as well as the activities themselves are defined by taking a set of inputs and transforming them into one or more outputs. This input-process-output (IPO) model of production is an effective way to define the requirements of a process, but it also highlights a weakness of our accepted planning process. The network diagram and planning process are generally effective in defining the activity process and resulting component output. In construction, an activity is often defined in a verb-noun manner identifying the process and resulting output. For example, "form, reinforce, pour slab-on-grade" may be one activity that defines the process steps and resulting deliverable.

The weakness of our accepted planning process introduced by the IPO model is caused by the input side of the model. Inputs are rarely introduced into the project schedule, and if so, are seldom comprehensive. The primary reason for this is that the introduction of such detail would make the schedule so large the schedule would be unusable. It is assumed that the task leader will take all necessary steps to ensure the inputs are ready for the intended start date of the activity.

If we pause to consider the diverse nature of these inputs, the risk involved in that assumption will become apparent. In construction, a single activity will have inputs as diverse as material selection and procurement, labor quantity staffing, craft skill and knowledge, project-specific information requirements, logistical support, space requirements, cross-trade coordination requirements, pre-work completion and acceptance, third-party inspections, safety requirements, and administrative requirements. The collection of all the input requirements into a single merge point on the start date of the activity presents an elevated level of risk that one or more of the inputs will push the scheduled start later in time. The method in common use to model the project schedule assumes away this risk, which applies to each activity using the IPO model and having multiple merging inputs which are outside the schedule model.

INTERDEPENDENCY BY NETWORK

Finally, the high-level view of the network diagram reveals that each of these individual activities are interconnected. Merriam-Webster defines a system as "a regularly interacting or interdependent group of items forming a unified whole." The interdependent nature of project activities as defined in the network diagram presents a view of the project as a system of production. This production system combines the outputs from an interdependent set of activities into a unique production output that satisfies the goals and objectives of the project. A focus on the temporary and unique aspects of a project can often disguise this fact. The interdependent nature of the activity components creates a systemic impact beyond just the immediate effect on the next activity in sequence.

These three levels of interaction, activity cost and duration estimates, the activity IPO model, and network interdependency, show us the three levels at which variation occurs or can be introduced into our production system. This variation is one of the primary sources of project results diverging from the baseline project planned values.

Dr. Walter Shewhart, credited by Dr. Deming with originating the paradigm, identifies two distinct types of variation acting upon a system. (Deming, 2018) Common cause variation is that type of variation caused by natural effects on production processes. Common cause variation is part of the system as designed and presents itself as background noise within the recorded data. Special cause variation, on the other hand, is not part of the system. Special cause variation is identified as variation created by an identifiable causal element acting from outside the system.

Both types of variation can act independently or jointly upon each level of our systems model.

PROJECT RISK MANAGEMENT

PMBoK acknowledges the effects of uncertainty within the project delivery process through the project risk management knowledge area. The generally accepted process of project risk management is consistent regardless of industry silo or practice category. First, the risk management process itself is planned, allowing for adjustment to the intensity of the risk management effort tailored to the project size and importance. The next step is the initial identification of specific project risks using appropriate tools and techniques. Once the risks have been identified, they can be characterized and ranked according to probability of occurrence and impact on the project budget and or schedule. This qualitative analysis serves as a basis for addressing project risks throughout the life of the project.

Once the project risks have been identified and defined qualitatively, the process can move on to assigning specific quantities to each risk, and correlations to each activity for further quantitative analysis. There are a variety of techniques utilized in quantitative risk analysis with the current standard being simulation through Monte Carlo risk model analysis. The simulation model provides an opportunity to run thousands of simulations of project performance accounting for the range of possible results surrounding estimate metrics, such as unit costs, quantities, and durations. Monte Carlo simulation uses probability distributions to assign values to target metrics on each iteration of the simulation. Analysis software is then is used to evaluate the aggregation of each of the simulation runs to provide a picture of the risks and uncertainties inherent in a particular project.

Once the qualitative and quantitative risk analysis is complete, the project team can move forward to plan mitigation and follow-on risk responses. Risk mitigation is intended to reduce the probability, impact, or a combination of both probability and impact of the risk on project outcomes. Risk response plans are intended to provide a backup or contingency plan in the case that a risk is realized in spite of previous mitigation efforts.

The project risk management process is intended to account for the effects of risk and uncertainty on project performance. One of the drawbacks to this process is the scalability of risk management effort. Since the level of risk management effort is intended to be scaled according to the size and importance of the project, the process is often economized in an effort to reduce the burden on project management staff operating near capacity limits. Risk management often does not receive the level of care and rigor required to sufficiently mitigate project risks. Secondly, the unique nature of project outputs means there is often a lack of historical data for use in analyzing project risks. This creates a reliance on expert judgement and subjective opinion within the risk assessment process which can reduce the accuracy of the results. Despite these drawbacks, the project risk management process remains the most effective means of mitigating project risk and uncertainty.

VARIATION AS RISK AND UNCERTAINTY

It is through the quantitative risk analysis process where the alignment between project risk and uncertainty and system variation is exposed. Uncertainty is often described as an unknown-known in that project participants are unable to define the degree to which uncertainty will affect a given activity, but they are sure that it will have some effect. While risks are often described as known unknowns in that project participants can identify the risk but remain unsure if the risk will occur and impact the project. (Kim, 2012)

This view of uncertainty brings alignment between common cause variation, which always exists due to the nature of systems, and project uncertainty, which is introduced both in the estimating and execution processes. Likewise, there is an alignment between special cause variation which has a proximate cause, and project risks which can be defined as proceeding from similar root causes. The alignment between common and special cause variation and project risk and uncertainty allows us to observe both gaps in our current project execution process, as well as to identify some potential solutions to those gaps.

It seems that within the current body of knowledge we have a mechanism for accounting for risk and uncertainty within the project planning process. But it is here that we discover a breakdown in the implementation as typically conducted on projects. As previously identified, there can be issues with lack of rigor and lack of relevant data, but these issues can be overcome through observing best practice techniques. Despite the application of best practices, we continue to see a reluctance to apply the results of quantitative risk analysis back into the project planning process as additional contingency and mitigation budgets. It is only through the application of the results of quantitative risk analysis that we will begin to see project results converge with project plans.

As we consider the view of a project as a special case of a production system, and of project risk and uncertainty as a form of variation, we can start to relate the project delivery process to other unrelated production processes. It can be beneficial to look at these dissimilar production processes for useful tools and techniques that may assist in improving our project execution process. When taking that perspective, we can turn to manufacturing to provide some potential solutions to improving our results.

BUFFERING

One immediate action taken in a manufacturing setting to mitigate the effects of variation is buffering. A buffer can take several forms: inventory, work in progress, capacity, budget, etc. If we consider buffering as a mitigation measure in the project setting, we may quickly see the applicability. Nearly every project approved for execution has a line item in the project budget for project contingency, which is a financial buffer. These funds are set aside to account for those unknown knowns. We know that additional funds will be required, but do not know exactly when or how much will be required. There are multiple methods in use for estimating the extent of these project contingency funds, including policy, historical precedent, thumb-rules, and expert opinion, among others. In fact, most project managers would not think of proceeding with project execution without some level of cost contingency.

If we concede that buffers are necessary for effective execution, and proactively identify cost contingency amounts within the planning process, why do we not do the same for time? Time contingency and supporting policy are conspicuously absent from accepted practice. We have observed the three levels at which variation can be introduced into the execution model, but we do not acknowledge the need for mitigating this variation within our execution plan. Applying both cost and time buffers is the first step towards correcting the divergence of execution from planned values.

In order to appropriately size these buffers, we can turn to our recognized process of quantitative risk analysis. When using quantitative risk analysis best practices, including Monte Carlo simulation, we can estimate the required buffer sizing to achieve a given confidence level in a resulting cost and duration performance. This gives us the ability to move beyond heuristic approaches in buffer sizing to a more robust method for determining appropriate buffer size.

There are multiple arguments against this approach. One such argument is that schedule float is already present within the schedule as a buffer. Our counterargument is that schedule float is not a proactive management technique, but an artifact of the critical path method and network scheduling in general. The project manager is not able to insert float within a project schedule as a proactive means of buffering without invalidating the scheduling process itself. Proper scheduling technique dictates that activity relationships and durations must dictate the nature of the schedule.

Likewise, there is an argument that time contingency is included within the activity duration estimates. This may, in fact, be the case during the initial planning process. But once the execution phase begins, this distinction becomes invisible. Because the project execution team cannot visualize actual duration and time buffer within the planned duration, thus, it becomes irrelevant. Parkinson's law comes into effect and the work extends to consume the allotted time. Without an explicit time buffer in the project schedule, the project manager is unable to monitor, control, and conserve this valuable project resource. Removing embedded contingencies from within duration estimates and creating a placeholder activity identified as a time buffer at the end of the project is a proactive step towards solving this problem. The draw-down of this buffer can then be monitored and controlled by the project manager in a comparable manner to project cost contingency treatment.

One final argument against the process is simply a belief in the achievability of the results from the current planning process. Turning back to the belief that if each activity is completed according to plan through excellence in project management, the plan should be achievable. For this argument, we must turn to a simple demonstration. We take a simple project plan of five sequential activities with assigned durations between 25 days and 50 days. We then assign a simple triangular uncertainty distribution to each activity of -5% to +10% representing that common cause variation is present in all systems.

This uncertainty level represents a difference of -1.25 days to +2.5 days for the shortest 25-day activity while the other activities have results in proportion to their respective durations. Once the schedule is modeled and this conservative uncertainty level assigned, we run a Monte Carlo simulation with 5000 repetitions of the simulation, with the software selecting values at random from the identified probability distribution. The results of this simulation can be viewed in the accompanying table and graph in *Figure 1*. Were we to execute this project, we would have only a 46% confidence level in achieving the planned results. While we acknowledge that a project could theoretically be completed according to planned values if the stars align, we do not hold a 46% confidence level out as a responsible target metric.

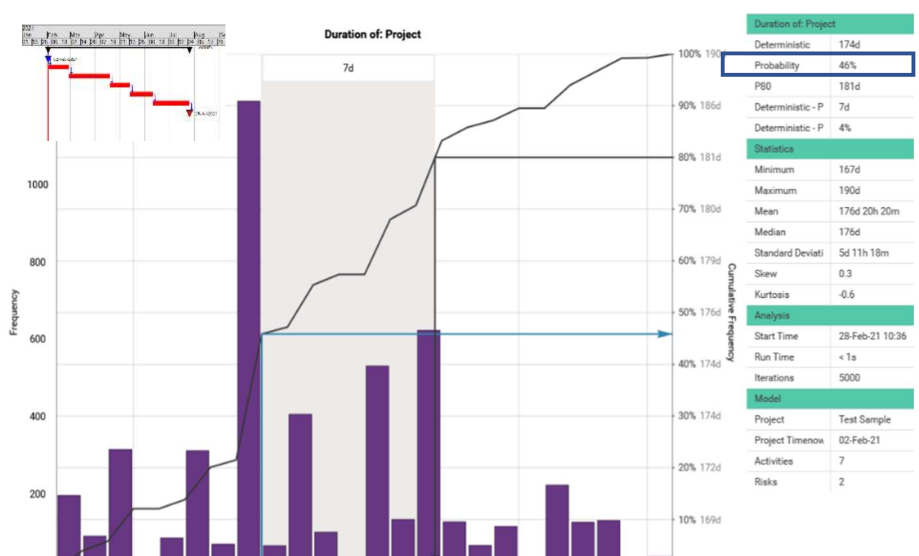

Figure 1

ROOT CAUSE ANALYSIS

We have identified the need to insert buffers to address common cause variation. This approach is effective since we know that uncertainty will affect the project, but we do not know exactly when or to what degree. Dr. Shewhart, as recounted by Dr. Deming, identified the mistake in conflating the reaction to common cause variation with the appropriate response to special cause variation. Special cause variation requires a separate tool for mitigating effects on project outcomes.

Special cause variation and project risks are similar in that we can identify a root cause. An effective qualitative risk management and mitigation planning process will identify these potential causes and develop countermeasures. Implementing these risk countermeasures is part of an effective project management effort. The quantitative risk analysis process enables the project team to quantify any residual risk remaining after mitigation measures have been put in place so an appropriate buffer can be added to project cost and time. It is at this point that one remaining gap can be identified in consideration of the difference between a project risk and pure special cause variation.

The remaining difference is that a project risk has yet to occur. Once a risk has been realized it becomes an issue to manage rather than a risk, as well as becoming a measurable instance of special cause variation. The appropriate response to an issue is not to simply use identified contingency buffers to mitigate disruption effects and proceed with project execution. The appropriate response is to conduct a root cause analysis to determine the source of variation and develop additional mitigation measures. For instance, a root cause analysis may identify special cause variation created by a lack of timely project information through request for information (RFI) responses. One potential solution might be a regular joint information review meeting in which the project team can coordinate and clarify immediate information needs. If this mitigation step is not taken, the root cause is likely to remain to continue causing disruption to project progress and further divergence from project plans. Utilize the time buffer not just to avoid disruption, but to provide time to conduct root cause analysis and develop countermeasures to reduce future occurrences. This step allows a project manager to reduce the amount of "firefighting" efforts on a project and to focus on improving overall project performance.

CONCLUSION

Project performance when compared to baseline budget and schedule estimates continues to be a problem across multiple industries. Practitioners should persist in looking for solutions to this performance gap, including questioning accepted paradigms and practices. One such paradigm is the view of the project as a unique endeavor, unrelated to other similar production processes. When we compare project execution to other production processes, we can see the effects of variation, both common cause and special cause, on various levels of the project execution process. These moments at which variation could be introduced into the system should be addressed using tools adapted to mitigating variation. One tool for mitigating common cause variation is the introduction of cost and time buffers. These buffers can be appropriately sized using quantitative risk analysis and Monte Carlo simulation. Some tools for addressing special cause variation already exist within the risk management process but should be enhanced with the application of root cause analysis to realized risks. Providing time buffers to balance disruption caused by uncertainty and to provide time to conduct root cause analysis and countermeasures will move project performance estimates and actual results closer together.

REFERENCES

Agarwal, R., Chandrasekaran, S., Sridhar, M. (2016). "Imagining construction's digital future." *Capital Projects and Infrastructure June 2016*, McKinsey & Company, Singapore.

Deming, W. E. (2018). *The new economics: For industry, government, education* (3rd ed.). MIT Press.

Kim, S. D. (2012). "Characterizing unknown unknowns." Paper presented at PMI® Global Congress 2012—North America, Vancouver, British Columbia, Canada. Newtown Square, PA: Project Management Institute.

Koskela, Lauri. (1999). "Management of Production in Construction: A Theoretical View." *Proceedings IGLC-7*. University of California, Berkeley, California.

Merriam-Webster. (n.d.). System. In Merriam-Webster.com dictionary. Retrieved March 1, 2021, from https://www.merriam-webster.com/dictionary/system

Project Management Institute. (2017). *A guide to the Project Management Body of Knowledge (PMBOK guide)* (6th ed.). Project Management Institute.