Photo credit: Dubai Airports Corporation

Optimizing performance in infrastructure project delivery

To manage costs and schedules more effectively, a four-pronged strategy can identify and limit variability in process execution.

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"The bigger the project, the bigger the problems" is an apt description for infrastructure megaprojects, which have a history of failed delivery due to poor planning and execution. Their increasing size, complexity, and risk are frequently exacerbated by disconnected project teams, inefficient processes, and siloed data. The result is schedule delays, cost overruns, and quality issues: According to McKinsey research, large capital projects typically take 20 percent longer to finish and cost up to 80 percent more than expected.[1]

The global construction industry has attempted to respond to this recurring issue by introducing process innovation and standardization to boost consistency and quality of project delivery. With the benefit of historical data, projects are now more tightly scheduled to compress cycle times and contain costs. The critical path is tracked closely, to the point of process rigidity.

The premise behind these efforts is that more consistent process execution will result in improved project performance over time. In reality, execution for nearly all project processes still varies from plan, often significantly, resulting in still longer cycle times, higher costs, and lower quality.

Variability can occur in the execution of every process and needs to be carefully managed throughout the project lifecycle. For example, the duration of a structural drawing review with a planned turnaround of six days could vary from two to 12 days. If not managed properly, such variances could undermine project delivery.

To quantify the impact of variability, we analyzed 2,768 processes executed approximately 1.8 million times on global infrastructure projects using the Aconex platform. Our findings indicate the tremendous potential of strategies that can reduce variability.

Our analysis showed that actual process times vary by 12.5 days on average—nearly twice the planned process duration. Delays in each individual process can seriously affect overall project deadlines. Since many of these processes are predefined in the contract and baked into the schedule, this variability makes it difficult to meet delivery commitments. Understanding the root causes of variability is crucial to reducing process cycle times and improving delivery.

Four strategies to reduce variability

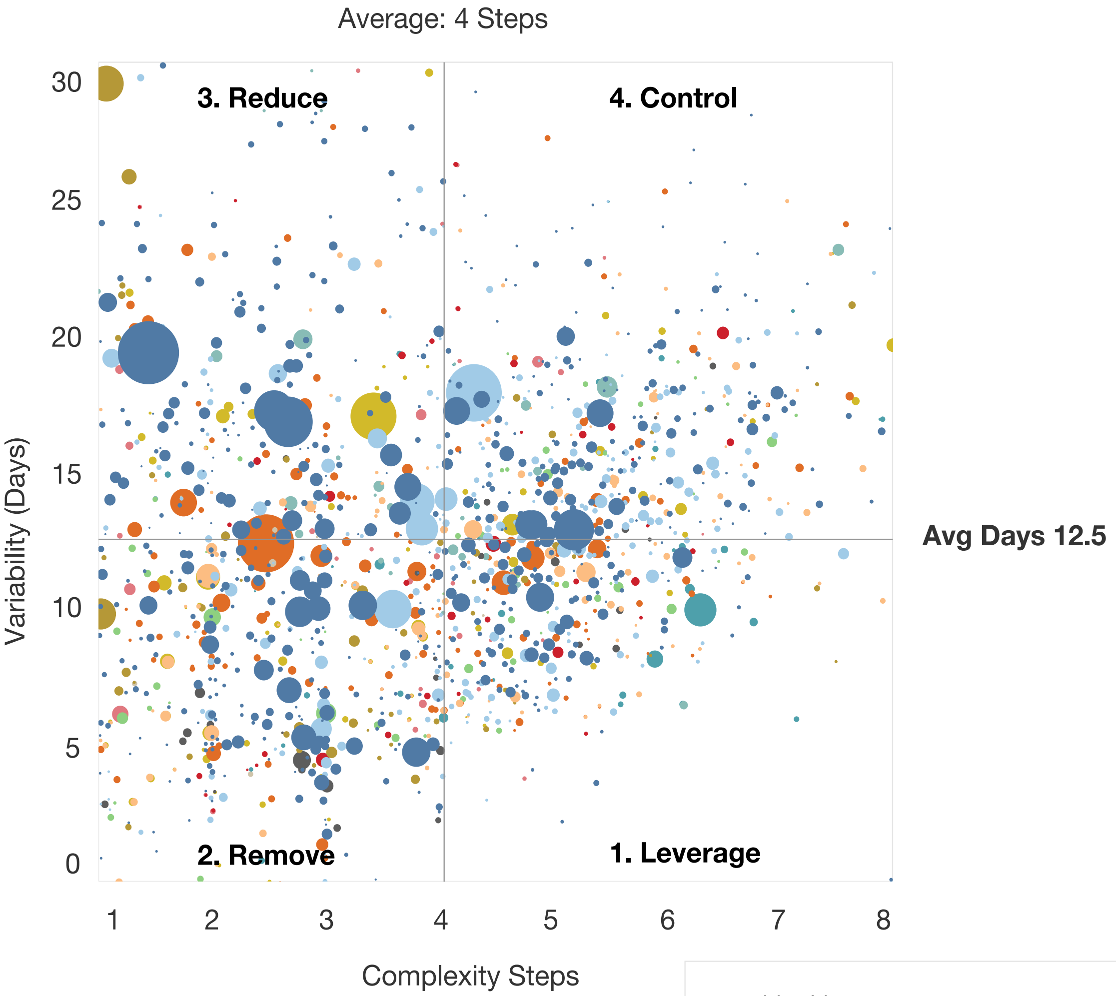
Complex processes are inherently prone to variability—and our analysis of data from real projects backs up this conclusion. Even simple processes such as interior design reviews show significant variability. We recommend a four-pronged approach to managing variability:

1. *Leverage.* When complex processes are standardized, they can be used as templates for other, more variable processes. However, complex processes differ from project to project. For example, on a hospital construction project, request for information (RFI) and site instruction processes are considerably less variable than they are on a power

1 "Imagining construction's digital future," McKinsey & Company, June 2016.

Exhibit 1

Process variability in large infrastructure projects



1. **Leverage –** Learn what is working from these processes and apply it more broadly for portfolio-wide benefits.
2. **Remove –** Aim to eliminate variability in these simple processes.
3. **Reduce –** Minimize variability in these simple but highly variable processes.
4. **Control –** Expect variances in these complex processes but control them to avoid excessive time overruns.

The chart above illustrates processes executed on the Aconex platform for large infrastructure projects since 2013. The size of each circle represents the number of times the process has been executed. Variability is measured as the number of days required to complete the process, against baseline duration, and complexity is measured in the number of steps in the process.

engineering project. These differences should be factored into the adaptation of standardized process templates.

2. *Reduce.* The focus here is on processes where complexity is low—typically requiring just two to three steps—and yet variability is significantly high. An example would be structural and "as-built" documentation reviews on health projects, which we have seen vary by 16 to 19 days, on average. Clearly, delays in structural reviews can have an effect on construction. Yet by planning for handover early in the project, variability in as-built reviews can potentially be eliminated, with the output of these reviews feeding directly into asset operation and maintenance.

3. *Remove.* Many simple processes exhibit variability for no apparent reason. They go unnoticed and are often ignored because of their perceived minimal impact. But cumulatively, they can cause significant issues throughout the project. These processes, such as the simple reviews for facades or elevators in vertical construction projects, should be tackled before complex processes.

4. *Control.* Complex processes typically exhibit higher variability, but these should be tackled only after all the simpler processes have been addressed, as decreasing their variability may require considerable effort. Design reviews, contract administration, and change management, including variations, all fall into this category. These processes are intricate by nature because of contractual clauses, legal implications, risk impact, and financial considerations.

The next challenge is to reduce or remove variability in process execution. Although more commonly used in manufacturing, the DMAIC (define, measure, analyze, improve, and control) model can be a useful tool in the construction sector—provided a suitable project collaboration platform is in place to support the measurement of key process metrics such as duration, volume, and throughput.

Predictive analytic tools are also valuable in understanding the impact of performance against these metrics on project outcomes. Access to historical data and industry benchmarks makes measurement even more efficient, as it can form the basis for setting performance targets.

For infrastructure project managers, variability increases process cycle times and reduces quality, affecting schedules and budgets. Process execution should therefore be measured routinely during the project lifecycle and on practical completion.

If a specific process typically takes three days to complete, plus or minus one day, yet is trending toward more than six days, further analysis and corrective action can help reduce downstream schedule delays. Conversely, well-defined processes that are executed efficiently and consistently should be considered best practice and adopted for future projects.

Exhibit 2

Approach		Action
Define	Define the processes that you want to start tracking. Start with standardized processes because there is a pre-defined expectation of performance.	Process: • Request For information (RFI)
Measure	Set up measurement frameworks and start measuring the variability of the processes identified across multiple projects.	Process metrics: • RFI median = 7 days • RFI standard deviation = 8 days
Analyze	Analyze the variability data using standard root cause analysis tools to uncover reasons for the underlying variability.	• Fishbone analysis / cause & effect • Monte Carlo simulation & sensitivity analysis of RFIs to identify levers for reducing variability.
Improve	Improve the processes analyzed by making changes based on the analysis. For example, if variability is caused by differing contract types, consider standardizing contractual terms.	• Change RFI process based on analysis. • Change expected RFI close-out times on different projects / phases. • Measure change in turnaround times.
Control	Use a system to regularly and continuously monitor process performance across projects for at least a year. If deviations creep back into the processes, apply the model again.	• Run regular reports on RFI turn around times and volumes and the impact of changes.

The chart above describes the DMAIC approach to infrastructure projects, with a sample process.

Objective measurement of variability, coupled with close management of its longer-term effects, can drive successful delivery and continuous improvement across the project portfolio. With nearly $50 trillion in capital investment projected over the next 15 years, managing variability will be critical as the world builds new infrastructure to meet accelerating demand.[2]

2 *Fostering investment in infrastructure: Lessons learned from OECD Investment Policy Reviews*, OECD, January 2015