NAC Executive Insights

Changing Risk Managers' Perceptions

Key Points

- The focus is on changing risk managers' perceptions on large complex projects.
- An overview is provided that ties together many other NAC Executive Insights.
- Weak project foundations include inadequate strategic business objectives (SBOs) clarity (#1) and incomplete project scope (#2).
- Rarely are technical failures a primary cause of poor project performance; stakeholder risks are more impactful.
- The risk manager and the role of the risk manager are directly challenged.

Introduction

This Executive Insight attempts to change some risk managers' perceptions about large complex projects[i] and the risks[ii] [iii] they face as well as some of the sources of those risks. It is organized into three main themes and is intended to provoke thought and reaction.

Theme 1 - Gantt and Fayol, in some sense the "fathers of project management," were right, but not at scale, that scale being large complex projects.

Theme 2 - Large complex project success is improbable[iv]. Note *improbable*, but not *impossible*. Remember, however, that two out of three large complex projects fail[v].

Theme 3 - Large complex projects are not closed systems, not really what Gantt and Fayol had in mind.

Theme One: Gantt and Fayol Were Right…But Not At Scale

To begin, one needs an understanding of the ideas of Gantt and Fayol, where they fall short, and why.

It is no surprise that large complex systems behave differently than smaller projects and smaller systems. As in nature, **catastrophic** events occur: hurricanes, earthquakes, tornadoes. They occur more frequently than a normal distribution would suggest.

This catastrophic behavior, however, is not limited to nature. Manmade systems such as financial markets also can exhibit extreme behaviors and at much higher frequencies than a normal distribution

would suggest. Nassim Taleb, in his book, *Black Swan*, describes this behavior and the rare birds, the black swans, which are conveniently used to ascribe many project failures.

But what do these two systems have in common? They have a plethora of actors coupled in both known and unknown ways. This is exactly what is found in large complex projects with 100,000 or more activities, numerous suppliers and stakeholders, and an ever changing set of connections.

The result—large complex projects behave catastrophically.

Now examine the theory of project management, the theory of Gantt and Fayol, through the lens of an analogy. In the world of physics, Newtonian physics did well in describing the behavior of the world that is experienced every day, much like the classical PM theory did for Gantt. Along comes Einstein, who wants to study the universe, bringing in "scale." He starts with Newtonian physics, but soon finds it breaks down at scale. The same has happened to Gantt and Fayol's classical project management (PM) theory. It breaks too down at scale.

So where does classical PM theory fall short?

Shortcomings are evident in three areas. First, the foundations[vi] of the project (and there are a number of contributors here). Second, there tends to be an overly strong focus on those 100,000 activities while not paying enough attention to the more than 100,000 "arrows" (or flows) connecting all those activities. And finally, the delusion that stakeholders can be managed.

First a look at some of the contributors to the weak foundations seen in large complex projects. Five will be discussed in this Executive Insight:

1. Governance
2. Owner readiness
3. Project readiness
4. Risk and risk modeling
5. Complexity

The second major area where classical PM theory falls short is its focus on tasks without putting enough attention on flows. This also will be discussed later, but a couple key points now:

- First those connecting arrows are not dimensionless.
- Second, large complex projects are subject to at least three types of flows . The first, transformational flows, are what we would expect if you will from those 100,000 arrows. The second and third types of flows arise because large complex projects are not as well bounded as Gantt and Fayol would have us believe.
- The third major area is our self-delusion that we can manage stakeholders. *"I have three children. I can't manage any of them. The best I can do is engage with them"* and the same is true with stakeholders on a project.

Think about the real sources of problems and the risks that materialize on large projects. Are they the result of technical failures? Rarely. More often they arise from stakeholder actions. Stakeholders include the client, suppliers, subcontractors, regulators, non-governmental organizations (NGOs), and in a sense the world at large.

Today, project control efforts are largely inward looking and maybe even more "rearview mirror" looking. That perspective was fine when projects were well bounded, but large projects are not.

Project control efforts now must include a balanced look at what is happening outside the boundaries of the project, recognizing that these boundaries are semi-permeable with influencing flows traversing them. Improvement is needed at seeing what is coming.

Shortfall: Weak Foundations

Weak foundations are the first area where PM theory comes up short when dealing with large complex projects. Five contributors to these shortcomings are discussed below:

1. Governance

Two elements of governance weakness have been observed through years of troubleshooting underperforming projects. The first is a common shortcoming in *every* large complex project personally examined by the author: the failure to clearly articulate, obtain agreement on, and constantly communicate the project's strategic business objectives (SBOs)[vii]. Hours could be spent retelling stories on just this point, but instead one example will be used to drive the point home.

On a $25 billion underperforming megaproject, three dozen top managers from the client, contractors, and key subcontractors and suppliers were interviewed. The shortest interview covered an hour and a half, the longest 16 hours over three sessions. The final interview was with the COO. The fourth question in was pretty straight forward:

> "Tell me in your own words what you are looking to accomplish by spending $25 billion. What are the strategic business objectives you are trying to achieve?"
>
> The COO answered, "I kind of know, but I'm not sure how to say it."
>
> The author made a note and started framing the fifth question.
>
> The COO interrupted and said, "Wait a minute. I'm supposed to know the answer to that question."
>
> "Yes, you are," the author replied.
>
> The COO then asked if the author had asked the other 35 people he had interviewed the same question.
>
> "Yes," the author said.
>
> The COO asked what the others had said. The author told him they didn't know either.

"That is a problem," the COO replied.
"No, that is the problem," the author said.

Every underperforming megaproject the author has looked at has suffered from this same lack of strategic business objective clarity. It is the **number one** reason large complex projects fail.

With regard to SBOs and governance, remember that key performance indicators (KPIs) typically measure inputs and outputs, not outcomes linked to SBOs. Make sure the most important thing is being measured.

The second governance aspect is inadequate prioritization. Prioritizing investments is critical in a financially constrained environment. Capital efficiency must be maximized by ensuring that everyone is doing the right things, doing enough of the right things, and doing right things right.

2. Owner Readiness

A second foundational weakness relates to owner readiness as contrasted with project readiness. We've already touched on one aspect of owner readiness around strategic business outcomes or objectives, but a second area of owner readiness are shortcomings in the owner's enabling processes.

Well-intentioned owner project teams have been undermined by their legal or accounts payable departments that appear to use sun dials versus stop watches when valuing time on a project. Sometimes that lack of appreciation for the value of time extends further up the owner's organization. In one case it was calculated what one minute of delay cost the project and the author wrote the amount on the white board of the owner's project manager. Six months later while in the PM's office, the amount on the white board had not been erased. The PM told the author they used the amount to calculate how long they could take to make decisions.

Owners that are not ready or who have weak supporting processes can significantly increase the cost, schedule, and risk of a project. Owners reading this Executive Insight should look closely at their readiness as an organization before setting out on a large complex project.

3. Project Readiness

The owner must be ready and so too must the project. As an industry, engineering and construction has improved in this regard, yet projects often fail due to incomplete project scopes[viii] (this is the number two reason projects fail). Even when including cost contingencies, these are not adequately reflected in schedule-related contingencies. Money takes time and time costs money.

Two specific items should be noted regarding project readiness. The first deals with an expanded basis of design[ix]. Typically, the owner's project requirements are translated into a technical or engineering basis of design. This is the foundation upon which design begins in earnest. This basis of design, however, is incomplete. It does not adequately consider construction. In effect what is needed is a construction basis of design, that is, how we plan to build the project. This is not a constructability[x]

review at an early stage of design, but rather another set of considerations that help shape the resultant design. The traditional basis of design also is lacking in relation to an O&M basis of design. Addressing this expanded basis of design up front reduces a myriad of life-cycle risks.

In addition to the expanded basis of design is the need for granularity in startup planning. In one $6 billion infrastructure project with 100,000 activities, utility relocations across five utilities were reflected with start and end milestones for each utility—five out of 100,000 activities. Six months after kickoff, the project was six months behind schedule. The 600 discrete relocations, embedded into those five activities, tied out into numerous construction packages and were not being worked by engineering or utility companies in the required sequence.

4. Risk and Risk Modeling

A fourth element of weak foundations: risk and risk modeling. A quick overview of concerns will serve as a good orientation on this element.

Engineers and estimators are optimists. This is clearly seen in estimates for large complex projects, which are historically low and thus inaccurate as these types of projects progress. These errors in estimates result from a lack of clarity around the various levels of uncertainty[xi] in the values assumed, whether money or time. The fact is that two out of three large projects exceed cost or schedule by over 20 percent. Reference-class forecasting helps provide a grounding, but even small differences can have big impacts.

Improbable is not impossible. High consequence events are often screened out too early. They should stay on a risk register even if no financial reserve has been provided for them. Why? Because they may not be as improbable as they seem. In other writings, discussions have detailed fat tails.[xii] This is where modeling makes a difference. A value that would be described as five-sigma under a normal distribution has a one in 3.5 million chance of happening. With a fat tail, however, that value can be reduced to 1 in 16. Maybe Black Swans should not come as a surprise after all.

Also consider the risks (and opportunities) in the "white spaces"[xiii] [xiv] on a project or the thundering Black Elephants (those problems that are obvious to all, but that no one wants to acknowledge) getting angrier all the time, and that go unaddressed. Couplings[xv] of various forms also receive insufficient consideration both in scheduling and risk assessment. On two 10-year projects, repackaging to take out unnecessary precedents reduced overall schedules by 15-20 percent.

Regarding risk correlation, many projects look at breaking things into many smaller pieces that are easier to estimate. In the process, however, the greater management challenge and the increased correlation between the discrete bits are often ignored.

5. Complexity

The final element of weak foundations goes back to the shortcomings of classical PM theory. Recall the earlier analog with Newton and Einstein and open[xvi] versus closed systems, although this warrants a

much deeper conversation. One element of large complex projects, however, is just that: complexity[xvii]. How does one measure complexity, if not absolutely, then relatively? This is a challenge for all. However complexity is measured, it is necessary to recognize that it exponentially increases risk and uncertainty.

Assumptions[xviii] migrate. Many are never even written down. Even fewer are tracked.
Are you satisfied with your assumption registers?

Lastly, a project's risk profile changes over time. Think of that project risk curve as dynamic, not static.

Short Fall: Flows

A second area where classical PM theory falls short and increases risk deals with the flows experienced in large complex projects. Large complex projects are often characterized by the equifinality and multifinality found in open systems. Complexity creates an ever changing set of likely outcomes. It also challenges teams to ensure the final result falls within the range of acceptable outcomes already established.

First, **transformational flows** are largely the flows that Gantt and Fayol saw in their well-bounded projects.

A second type of flow is referred to as **influencing flows**. These arise from outside the project proper within a broader stakeholder ecosystem than is traditionally considered from a stakeholder management perspective. These stakeholders can include the owner's board of directors, political figures or regulators, suppliers, and the general public. The flows they set up may impact cost or time, change various risk exposures, or represent new ideas that reshape the project that is already underway. These flows cross the semi-permeable boundary of these large projects and violate one of classical PM theory's foundational assumptions of being well-bounded. These influencing flows interact both with tasks and with transformational flows. They "mess with the arrows."

The final set of flows are **induced flows** and they arise from the interaction of various influencing flows with each other as well as with the transformational flows of the project itself. Not only are these induced flows sudden and surprising, but they can set up eddy-like currents that may represent destructive feedback loops.

Stakeholder-to-stakeholder interactions, outside the project proper, also can create strong eddy-inducing influencing flows. These have been seen on several large natural resource projects, where international NGOs shape local stakeholder behaviors.

Also recognize that while the surrounding ecosystem acts on the project, in turn the project shapes its environment. This is where opportunity[xix] to manage risks lies.

Short Fall: Stakeholders

A recap of stakeholders, the third area where classical PM theory falls short, is provided here.

The problem is the self-delusion of believing external parties can be managed. The best one can do is **engage** and hopefully influence, but certainly not manage.

Large complex projects require a significant shift in project control efforts from primarily internal ones, underpinned by the notion of a bounded project, to a more balanced internal and external focus that reflects the semi-permeable project boundary that is actually observed.

Theme Two: Large Complex Project Success Is Improbable

Discussions thus far have covered where and maybe why Gantt and Fayol fall short on large complex projects. Can these projects be successful, especially considering that two out of three large complex projects fail?

David Hand, author of the book, *The Improbability Principle,* posited several worthwhile ideas. Consider two of his "laws" to help understand the risk perspective when undertaking these challenging projects. Each should cause project and risk professionals to think deeply about the inherent risks in 100,000 activities, millions of items of supply, thousands of vendors and laborers, and extended time frames. Perhaps the improbable is not only not impossible, but may be more probable than what is likely to be considered.

Law of Inevitability

In its simplest terms, the law of inevitability states that ***something must happen.*** The *c*orollary, Borel's Law, states that sufficiently unlikely events are impossible, and this is what gets us into trouble.

Two examples illustrate the case:
Example #1 – **A 100-year storm** means a one percent chance of happening in a one-year period. For a 10-year project, that risk now rises to 10 percent during the project period. *Extended project periods are risk aggregating.* That is why schedule control is so important.

Example #2 - **A small "off normal" performance** has the ability to impact coupled project execution activities. Even considering that a significant disruption from just "off normal" performance of an activity is extremely rare, such that extensive disruptions from mere "off normal" performance happens only once out of every million executions of an activity. Borel might have everyone ignore this.

For a large project with 100,000 or more activities, however, there is a 10 percent chance of one activity's "off normal" performance leading to a significant disruption.

There is an *extended risk consequence of disruption*.

Law of Truly Large Numbers

A second law from David Hand: the law of truly large numbers. This law states that with a large enough number of opportunities, any outrageous thing is likely to happen. Large projects provide many large pools of opportunities for outrageous things to happen. And they do happen.

What is found in large projects? These type projects include total project durations measured in decades; project schedules with tens of thousands to a 100,000 or more activities; workforces that number from the thousands to tens of thousands to 50,000 or more; miles of welds; thousands of field connections; thousands of tons of modules and prefabricated assemblies moved, collectively, tens of thousands of miles; and finally, countless thousands of inspections.

Two specific examples follow:

Example #1 - Losing a shipping container. The probability of losing one is small, but for a project with 1,000 containers, the chance is now measurable. In one very large project, loss was almost certain. The question to ask is: What was in that container?

Example #2 - The impact of a delayed critical component. On a project with 1,000 critical components, there is a 63 percent chance of experiencing a significant delay. How many critical components are there on the next project?

Theme Three: Large Complex Projects Are Open Systems

Consider now the third theme: large complex projects are not closed systems.

Large complex projects do not behave as Gantt and Fayol assume. They have high uncertainties, large numbers of independent actors and actions, and at times the very objectives to achieve continue to evolve. **They are emergent**. This is not what best practices are based on.

Classical PM breaks down and a further change in perspective is required. Unknown unknowns exceed expectations, in part because of fat tails, but also because stakeholder needs continue to evolve through the project period. Project execution cannot be simply best practices and highly structured rigorous processes. Innovativeness is required, which introduces new risks…and new opportunities.

Neo-classical PM differs from classical PM theory in several important ways, but of particular importance is a project's impact on, interaction with, and continuous flow of new and ever-changing risks from that throbbing mass of stakeholders that encapsulate the project.

Increasingly, the predictable becomes unpredictable and flows of various impacts shift from linear and manageable to highly turbulent.

The project suffers from a surplus of data but a paucity of actionable information.

So, given the need to strengthen foundations, focus on flows, and deal with an open system versus a closed one…how does the role of the risk manager change?

Risk Manager—A Challenge to Change Perceptions

The risk manager must challenge perceptions. What is perceived to be the best practice is not delivering the best results.

Recognize the major risks created by weak project foundations and focus on them. Ensure they have been mitigated. This means moving beyond the traditional boundaries of the risk manager. The risk manager's job is to call out risks wherever they are found.

The risk manager can do much to improve outcomes by engaging earlier and focusing strongly on the number one (SBO clarity) and number 2 (scope completeness) risks described earlier in this Executive Insight.

External actions, that is actions by stakeholders, must be clearly linked to individual construction work packages and have the granularity that is required.

Think about how risks are modeled…and then think again.

Have the fat tails inherent in complexity and open systems been considered? What about the risks in the white spaces? Have all the various tools available to risk managers been used or limited to Monte Carlo analysis?

Has correlation been accounted for?

Are assumptions being tracked? Do not underestimate the importance of this.

Monitor the flows, not just the tasks. Think in terms of **third derivatives,** not just rate and acceleration.

Become more aggressive in planning for potential futures and future trajectories in order to mitigate risk. This is not just the realm of construction planning.

Monitor **external risks** and monitor them on a real time basis. Artificial intelligence[xx] [xxi]can aid greatly in these efforts. The engineering and construction industry has been slow in taking advantage of AI to monitor stakeholder intentions.

Recognize that influencing stakeholder intentions is a risk management strategy.

Understand not only the value of time, but its role as a **risk aggregator**.

New measures of uncertainty, complexity, and emergence are required. These will have to be developed by the risk manager and monitored by the risk manager.

Finally, large complex projects are not just open systems, but also one system in a **system of systems**. Risk assessment capabilities in such a system of systems setting are virtually nonexistent. Improvement in this regard by everyone is required.

Final Thoughts

The purpose of this Executive Insight is to cause all project professionals, not just the risk manager, to think differently and be willing to go beyond current best practices, which are not delivering best results. Hopefully, it has unlocked at least one person's thinking.

About the Author

Bob Prieto was elected to the National Academy of Construction in 2011. He is a senior executive who is effective in shaping and executing business strategy and a recognized leader within the infrastructure, engineering, and construction industries.

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