CMAA

Constru

Decision-Making Under Uncertainty

Key Points

- Uncertainty consists of ambiguity, volatility, and variability.
- Large, complex projects face high degrees of uncertainty.
- When uncertainty and complexity are both high, maintaining flexibility and optionality until unknown unknowns have emerged provides for the best ability to make the right decision.
- Uncertainty fundamentally differs from risk, which can be probabilistically assessed.
- Uncertainty is a compounding factor in complex projects and is integral with complexity.
- Effective project management, especially under uncertainty, requires agility τ an ability to react quickly to emergent risks and threats.
- Effective decision-making under uncertainty must begin with strong project foundations.
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- Large scale, extremely complex projects have been delivered under high levels of uncertainty, but many of the elements of success in doing so seem to have been forgotten.
- High-reliability practices for managing uncertainty in projects are described.

Introduction

This Executive Insight examines the special case of decision-making under uncertainty. The relationship between uncertainty and complexity is explored as is their joint relationship with large complex projects. The importance of getting these projects well-founded from an ability to manage uncertainty is discussed and the aspects of these strong foundations

Inadequate view of external factors

Uncertainty of cause-and-effect relationships

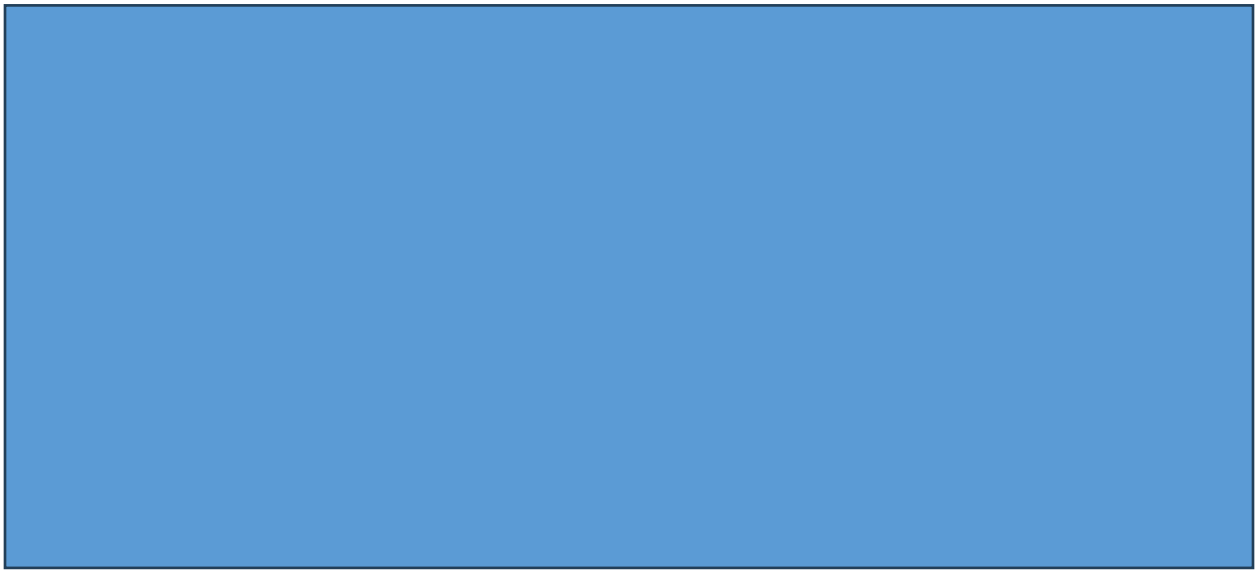
Uncertainty inherent in means, methods and their effectiveness

The importance of stakeholder engagement and an increased focus on monitoring, measuring, tracking and understanding external project impacting factors cannot be overstated. Our project control resources are inward looking while uncertainty arises external to the project.

Tight coupling of tasks without effective buffers or adequate preparation for contingent execution ignores the uncertainties and variability inherent in all activities.

Volatility is a constant source of uncertainty and is associated with unpredictable impacts or rates of change. It arises from unknown and often unknowable future events (Black Swans), but often is perceived to arise from knowable but undealt with factors (Black Elephants).

Variability is associated with a known range of potential outcomes, but with the result itself being uncertain. This is *aleatoric uncertainty* as contrasted with the *epistemic uncertainty* or



Relationship of Uncertainty to Complexity

Large complex projects face high degrees of uncertainty.

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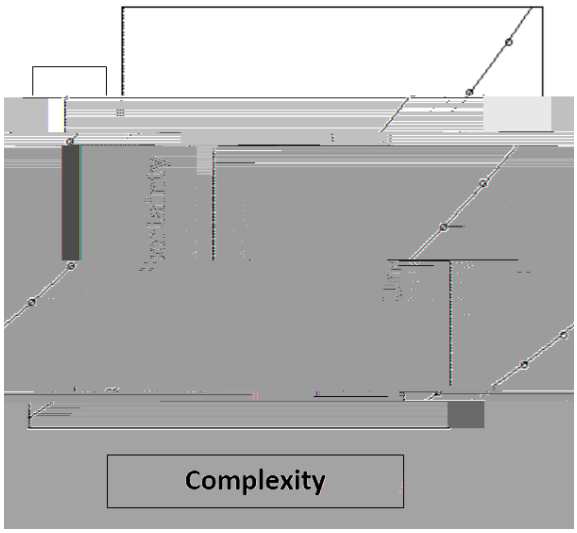

When uncertainty and complexity are both high, maintaining flexibility and optionality until unknown unknowns have emerged provides for the best ability to make the right decision. This requires valuing conceptual slack, which is a heterogeneity of perspectives focused on maintaining a variety of viewpoints to protect against άgroupthink.έ

High uncertainty and complexity are characteristic behavior of large complex projects. High uncertainty, even in less complex projects, still demands a level of flexibility beyond what traditional project management organizations provide. This contrasts with low uncertainty and complexity, where standard project management and risk practices suffice.

Uncertainty fundamentally differs from risk, which can be probabilistically assessed. Uncertainty represents an unknown future with equally unknown impacts. There is no information to support a calculation, but there is enough insight to suggest maintaining capabilities and capacities to address and deal with uncertainty is valuable.

Relationship of Complexity, Uncertainty, and Large Complex Projects

The increasing complexity of projects necessitates a better understanding of increasing risk and uncertainty. Underestimating complexity results in a mismatch of risk and uncertainty.

Sources of complexity include:

- Technical complexity
- Financial/funding complexity
- Time

Complex projects have an inherently contingent nature of outcomes resulting from the multiplicity of interactions characteristic of such projects. A degree of unpredictability and unknowability exists, despite efforts to provide structure, control, and risk assessment.

Uncertainty is a compounding factor in complex projects and is integral with complexity. Uncertainty exists not just in the interactions within a complex project, but often in the form of ambiguity in the strategic business objectives (SBOs) that the project is meant to accomplish. Additionally, given the longer durations of many projects, it is not unusual to see these SBOs change in response to perceived changes in future uncertainty. The result is changed project requirements, scope, frameworks, and potentially stakeholder relationships. Even means and methods experience adds complexity as the goal posts are moved or even the game itself is changed.

If uncertainty is to be understood, one must begin by measuring and tracking complexity, recognizing ŭKI·ŭ Ŏ2Y˙LJfŜÈ LJ№2¿ŜŎŭă KI·ØŜ ádzyãűI·ble input-output relationships, changing system boundaries over time, I·yŘ ăèăűŜY˙ ōŜKI·Ø№2№ ŭKI·ŭ №ă y2ŭ ȯŦdzftfèú ŘŜLJŜyŘ№yƎ 2y˙ŭKŜ LJI·ăŭ℗ɛ

Effective Decision-Making under Uncertainty

Effective project management, especially under uncertainty, requires agility and an ability to react quickly to emergent risks and threats. Uncertainty may be foreseeable (risk) or unforeseen. Unf8iaeq0.00000oreseE4c

These foundations must be allowed to prevent άsatisficing,έ that is, selecting the first viable solution when faced with a dilemma arising from uncertainty. Divergent views and challenges must be promoted while recognizing the need to move forward. The goal is to reach an *acceptable* decision, not an *optimal* one. Expertise and relevant experience must be given weight over role and rank. Maintaining organizational resilience is important so that all may adjust as required and recognize uncertainty often leads to a cascading set of unexpected events.

Decisions under uncertainty will have been more fully informed if the correct foundations are already in place and if the scans of changes in the environment have been rigorously carried out. Decision-making under uncertainty is an area that will benefit from the capabilities of Big Analytics.

Decisions under uncertainty also ōŜyŜŦλύ Ŧℕƨ2Y ΄úKŜ LJℕƨ2ȣŜŎú Y΄I·yI·∃Ŝℕ I·yŘ ΄úŜI·Y΄ℚå Y΄λyŘŦdzfyŜăă✩ aλyŘŦdzfyŜăă is the ability to be fully present, aware of where one is and what one is doing, and not being overly reactive or overwhelmed by what is happening. It is the result of the organizational resilience that has been put in place, beginning with strengthened foundations.

Sensemaking further reinforces the collective understandings and actions required under uncertainty.

What are the Required Features of Large Complex Project Management to Address Uncertainty?

Large scale, extremely complex projects have been delivered under high levels of uncertainty. Historical

Accept that all is not knowable at the outset of a project and recognize that parallel efforts, especially related to non-standard technologies or means and methods, may be necessary (experimenting, prototyping, testing).
Instill a strong sense of team and trust, sharing knowledge, and collectively learning from mistakes.
Support with a no-blame culture and team-focused, monetized KPIs (key performance indicators).