AUGUR

Triage the Sub-Projects:
Calculating and Applying Portfolio Contingency

ICEAA Cost Workshop 2024

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Agenda

- **Goal**: Evaluate the behavior and implications of probabilistic contingency calculations at the project vs. portfolio level
  - What is the impact to time or capabilities?

Outline

- Define contingency
- Contingency example
- Contingency example portfolio
- Joint Probabilities
- Example Portfolio
- Alternative Approach
- Conclusion

Contingency Definition

- Define contingency and highlight ways to calculate
  - Fixed percentage
  - Probability informed model
- Reference DOE 413 and AACE RP for guidance on contingency

Contingency Example

- Walkthrough simple example of contingency calculation
  - Lognormal, 50% CL of $10M, standard deviation of $2.5M

Portfolio Contingency Example

- Define a portfolio of projects
- Walkthrough of contingency calculation for a 5 program portfolio
  - Each program identical: lognormal, $10M 50% CL, $1.5M standard dev

Problem of Portfolio Contingency

- Show calculated portfolio contingency on portfolio CDF
- In the real world, portfolios will prioritize projects under funding constraints
  - Reference Tim Anderson brief (slide 8)
  - Over allocating contingency limits ability of portfolio to fund all programs

However, this philosophy constrains the total number of programs the decision-maker can fund.

If all programs are budgeted this way, then the total budget will be larger than necessary to achieve success on a portfolio of programs.

Joint Probability Distributions

- Explain mathematically what is occurring
  - Show behavior at scale
- “The likelihood that something goes drastically wrong across all programs in a portfolio uniformly is lower than the likelihood that something goes drastically wrong in a single program.”
  - Program A may use all of its contingency, Program B may use very little, Program C may use half of its contingency, etc.
  - At the portfolio level this comes out to heavily underutilized contingency
  - National insurance analogy

Example Portfolio

- Portfolio of capital asset projects: construction laboratory campus for 1,000 personnel
  - Building A: Office with personnel facilities
    - Dining hall, kitchen, gym + locker-room
  - Building B: site visitor site (reception, security, etc.)
  - Building C: state of the art high energy laser laboratory
  - Building D: in-house production/fabrication facility
  - Building E: parking garage
- Portfolio max funded for $30M (BY24) per year

Example Portfolio con.

- Build out risk profiles for each project
  - Building A – Medium Risk
  - Building B – Low Risk
  - Building C – High Risk
  - Building D – Medium Risk
  - Building E – Low Risk
- Calculate portfolio level cost + contingency by year

Example Portfolio con.

- Schedule is stretched out largely due to funding constraints
  - Level set order of projects so that annual funding cap is not exceeded

Example Portfolio Con.

- Step through time to show “actual” costs in execution
  - Break out the burndown in program contingency vs portfolio
- So what is the problem?
  - Contingency at portfolio level highly underutilized
  - Exasperated impact by pushing schedule to the right
- Is there a better way?

Alternative Approach

1. Risk-informed cost models for each program in portfolio
2. Define correlation between programs in portfolio model
3. Prioritize programs and apply weighting factor
4. Calculate contingency at portfolio level
5. Allocate contingency to program level
   - Individual variability of programs
   - Weighted prioritization level

Guideline restrictions to this approach DOE 413.B

Alternative Approach Con.

- Using same base risk profiles calculate portfolio contingency and then redo the phasing of work for the example portfolio
- Apply same actual costs “rephased” to align to redone schedule
  - Same total cost in BY$ just done faster
- Project gets done faster (more capabilities in same time)
  - Waterfall of Buildings A → E is tighter

Conclusion

- Program contingency calculations may over estimate portfolio level contingency
  - In a funding constrained environment → push schedule right
- Caveats
  - All of this is based on having well built estimates & risk analysis
    - Poor estimates in aggressive contingency strategy → more issues
  - DOE 413 currently only advises program contingency, not portfolio
  - Lack of liquidity for contingency in a portfolio
    - Can’t take contingency from another program if issues arise

Backup

Alternative Approach Con.

- For sake of transparency on limitations to this approach, it would be worthwhile to show impact to the portfolio if one program estimate is poorly built in this example portfolio
  - Building C was marked medium risk → contingency too low → portfolio level failure
  - Exceeded budgets + schedule delays

Abstract

Risk-adjusted cost estimates are necessary to understand the potential spread of actual costs through execution, and the resulting distributions are often used to quantify project contingencies by generating higher confidence levels above expected costs. In a portfolio of projects, allocating uncertainty at the portfolio level will result in higher confidence level draws at the project level, and so it is unclear whether a portfolio should allocate and manage risk-informed contingency at the portfolio or project level. This topic will explore the cost impact of allocating at different levels of a portfolio and provide recommendations for which level to utilize for a given portfolio.