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Uncertainty and Risk in Capital Projects

Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones. - Donald Rumsfeld**.**

A Black Swan event refers to a highly improbable occurrence with three characteristics: It is impossible to predict, it carries a massive impact and its shock value is stunning because people could never conceive of such an event occurring. - Aon Insurance.

The unexpected almost always pushes in a single direction: higher costs and a longer time to completion. – Nassim Taleb.

Luck is what happens when preparation meets opportunity – Seneca.

"In golf there's only bad luck and skill." I'm not sure who originated this quotation, but its sentiment is easily adopted by project managers. Faced with the outcomes of uncertainty and risk, we tend to blame bad luck for those that go wrong and take credit for those golden moments that move us forward. The less attention we pay to risk management, the more bad luck we seem to have. So as tedious as it can be, I'm an advocate of formal risk management as a component of project planning.

Firstly, let's dispense with unpredictability. It may be defined as that collection of events that either cannot be foreseen or cannot be quantified. As such, there is no way of assessing potential outcomes and, apart from providing resilient project management, conservative estimates, and adequate contingency funding, there is no point in planning for them. It is my experience it is the composition and experience of the project team that has the most influence on the outcomes of unpredictable events, good or bad.

The outcomes of hazards or opportunities impact four elements being human, environmental, property and commercial processes. All have a financial impact, good or bad. When an unforeseen hazard severely any of these, the emotional impact too often disrupts rational thinking leading to poor decisions. As the team reacts in real time, they must employ ingenuity, and mental toughness. Capable project management is often recognized as the ability to remediate uncertain outcomes, on-the-fly. This is survivor psychology. Fear, denial, and self-doubt are the catalysts of failure. Of course, we inherently accept uncertainty whenever we deal with the future, and it is this acceptance that justifies profit.

Risk, on the other hand, can be anticipated, and is measurable. It is made up of two parts: the probability of something going wrong, and the negative consequences if it does. Identifying hazards and opportunities and assigning the probability and impact of an occurrence are the key components of any risk management process. In my experience, project teams are good at identifying potential risks in their current context, poor at evaluating different contexts, and chronically underestimate the negative consequences. Good data sources greatly improve the analysis and these need to be cultivated. And as

risk evaluation benefits from facts rather than opinion, and solution focused rather than blame focused, organizational culture can significantly influence the outcome. Objectivity is essential.

Step 1. Identify the hazards and opportunities that are known:

a. Inventory good data sources (industry partners, insurance companies, consultants etc).
b. Complete a detailed project definition, then conduct a Strength Weaknesses Opportunities Threats assessment.
c. Define a scope, deliverables and performance criteria, then conduct a Failure Mode and Effects Analysis (FMEA assessment) combined with a Johari Window modified for risk evaluation.
d. Complete a work breakdown analysis and create a schedule, then conduct a Scenario Analysis with a variety of contexts ie weather, politics, leadership, suppliers, customers, technology, etc. Remember that assumptions of linearity bias event-based analyses. Look for feedback and compounding relationships. Human behavior will favor effective procedures over documented procedures (think efficient work practices over work to rule).

Example risks

- **Regulatory/legal** – These deal with permitting, licensing, patents etc.
- **Human** - These are risks stemming from risk to individuals.
- **Operational** - These are risks that have to do with distribution, obtaining supplies necessary, etc.
- **Commercial** – Customer consolidation, consumer preference, competition etc.
- **Reputational** - Loss of confidence from employees or a damage to the reputation of the company.
- **Procedural** - These are risks associated with fraud, loss of productivity, etc.
- **Project** - Project risks have to do with over-runs, jobs taking too long, etc.
- **Financial** – Project and company financial health.
- **Technical** - This has to do with failed technology.
- **Natural** - Threats from weather, earthquakes, forest fires, disease, etc.
- **Political** - Changes in government policy, taxes, etc.
- **Force Majeure** – Strikes, lockouts, war etc.

Step 2. Challenge then quantify the hazards and opportunities:

Perceived hazards may be based on erroneous beliefs. These put unnecessary constraints on an organization and are best called out and eliminated. Two factors define the risk associated with each legitimate hazard or opportunity, one representing the likelihood, the other indicating the impact of an occurrence. In assigning the severity factor it is important to determine if the outcome is dependent or independent. For example, factors effecting schedule usually effect more than project cost (future revenue, quality, site acceptance testing etc). Having to substitute one light bulb for another likely effects only cost.

Step 3. Mitigate risks:

Mitigation normally involves the assignment and management of system constraints to control the risk or sharing the risk through swaps or insurance. Manage the known knowns and anticipate the known unknowns.

Step 4. Evaluate the mitigation:

Apply this analysis to the mitigation and contingencies to determine the risks in managing the risks. View these in broad context. This provides further insight into the known unknowns.

Step 5. Recognize the inter-dependencies:
Carefully reassess the risks for interdependencies and feedback. Interdependence magnifies the consequences. A schedule delay may prevent access to a key resource that causes an additional delay impacting seasonal weather or labor availability, that causes a late startup, leading to a missed qualification at a customer. This results in a project cost over-run and a significant revenue shortfall.

Step 6. Evaluate the project for approval:
Prepare a detailed budget and perform financial sensitivity modeling including the risk evaluation. Is the project still viable within an accepted risk tolerance?

Step 7 Control the project risks in real time:
Revisit the schedule to determine the milestone dates for abandoning/deferring project elements and establish stage gate review points. Revisit the un-remediated risks and uncertainties at each stage gate. Occasionally an uncertain event cannot be resolved, or a risk mitigation fails that puts the project in peril. Although it is emotionally difficult to abandon a project, risk management prevents good money following bad. Also understand the point of no return; that point in a project where cost or schedule is exhausted, and the project cannot be saved.

Step 8 Evaluate project outcomes:
Implement a formal project review process with feedback from the project team, sponsors, customers and suppliers. This adds to the data bank for future projects and builds on the team's survivor psychology.

Examples of lessons learned:

1. Underestimating Risk

   Geological assessment was incorrect. Risk assessed as low. Basement shoring failed. Required complete excavation and reforming. Delay ran project into rainy season. Extended the build significantly. Project included install of leading edge technology available from only one vendor. Delay impacted vendor's availability leading to further delays. With final opportunity to qualify at customer looming the process was commissioned without total shakeout of the inspection technology. Qualification failed vendor's acceptance test. Requalification delayed 12 months as vendor chose to remain with existing supplier. Significant economic hardship. Postmortem indicated that geological risk was initially rated at a 6, but talked down. Lessons learned, carefully evaluate the interdependencies. Treat risk management like internal audit, keep it away from influencers and groupthink.
2. Incomplete Context

   Political dispute interrupted gas supply. Risk assed as 5/10. Fuel oil back up was installed. With all of Europe freezing, no fuel oil was available. Furnaces cooled off causing damage and costly repairs. Major customer moved to another supplier. Significant financial hardship. Lesson learned, evaluate the contingency plan in various contexts.

3. Incomplete Context

   Severe weather caused a two-week power outage during commissioning. Project had standby power and significant fuel. However, plant workers were focused on their homes and families and did not report to work. Skeleton crew were unable to save all assets. Lesson learned, in a widespread emergency, personnel will focus on their families and not their work responsibilities. Contingency needed to be reviewed in a broader context.

My Golden Rules of Risk Management

1. It won't happen to me – avoid denial.
2. We'll be the first to do this – avoid the leading edge.
3. We've always done it this way – avoid blind spots and bias (see Johari Window technique}.
4. He's the best in the business - avoid proceeding based on a single source of information.
5. We're going to ask another engineer – avoid group think, ask those outside your profession.
6. This will take too long/cost too much/been done before – avoid expediency.
7. This is the President's pet project – avoid political pressure.
8. Why is the contingency so high? – avoid concessions associated with risk mitigation.
9. We're really close to solving it – avoid authorizing the next phase until all risks are mitigated.
10. That's one for the books – avoid focusing on failure, also learn from what went well.

The resources needed for success

1. A project team with survivor's mentality.
2. An objective organization with a defined risk threshold.
3. Facts and data sources.
4. A balance between subject matter experts and outside reviewers.
5. Controlled scope creep.
6. A well-defined process.
7. A strong project rescue capability.
8. The support and confidence to abandon a project when the risk threshold is exceeded.
9. Time and money.

A modified Johari Window suitable to evaluating risk

Risk factors	Known to the organization	Unknown to the organization
Known to others in the competitive space	The known known	The unknown known, the blind spots
Unknown to others in the competitive space	Competitive advantage or unnecessary constraint	The unknown unknown and Taleb's quadrant four