Project Controls Expo – 18th Nov 2014
Emirates Stadium, London

Practical Applications of a
Risk Management Framework

About the Speaker

Benjamin A. Hubbard, PMP

- President of Nexus Program Management Group – Dallas, Texas
- Project controls & project management in EPC industry
- Executed projects in North America, Middle East & East Asia
- Experience in Power, Mining, Metals, Biomass & O&M
- Managed more than $22B in industrial construction projects
- Specialize in cost forecast modelling, cost risk & earned value

Agenda

- Safety Topic
- Evolution of Risk Management
- The Risk Management Process (Risk Assessment)
- Practical Applications of Risk Management – Case Studies
  - Establishing corporate risk appetite and tolerances
  - Refining the estimate development process
  - Establishing an open risk culture
  - Monitoring the health of project contingency budgets
  - Managing & controlling active project risks
- Risk management implementation & infrastructure
- Questions & Comments

Safety Topic
10 Things to Hate About Sleep Loss

1. **Sleepiness Causes Accidents**: the 1979 nuclear accident at Three Mile Island, the massive Exxon Valdez oil spill, the 1986 nuclear meltdown at Chernobyl, and others.
2. **Sleep Loss Dumbs You Down**: Sleep plays a critical role in thinking and learning. Lack of sleep hurts these cognitive processes in many ways. First, it impairs attention, alertness, concentration, reasoning, and problem solving. This makes it more difficult to learn efficiently.
3. **Serious Health Problems:** Heart attack, heart failure, high blood pressure, stroke, diabetes and more.
4. **Lack of Sleep Kills Sex Drive:** ……
5. **Sleepiness Is Depressing:** Sleeping less than 6 hours leads to depression and anxiety

Project Controls EXPO

Safety Topic
10 Things to Hate About Sleep Loss

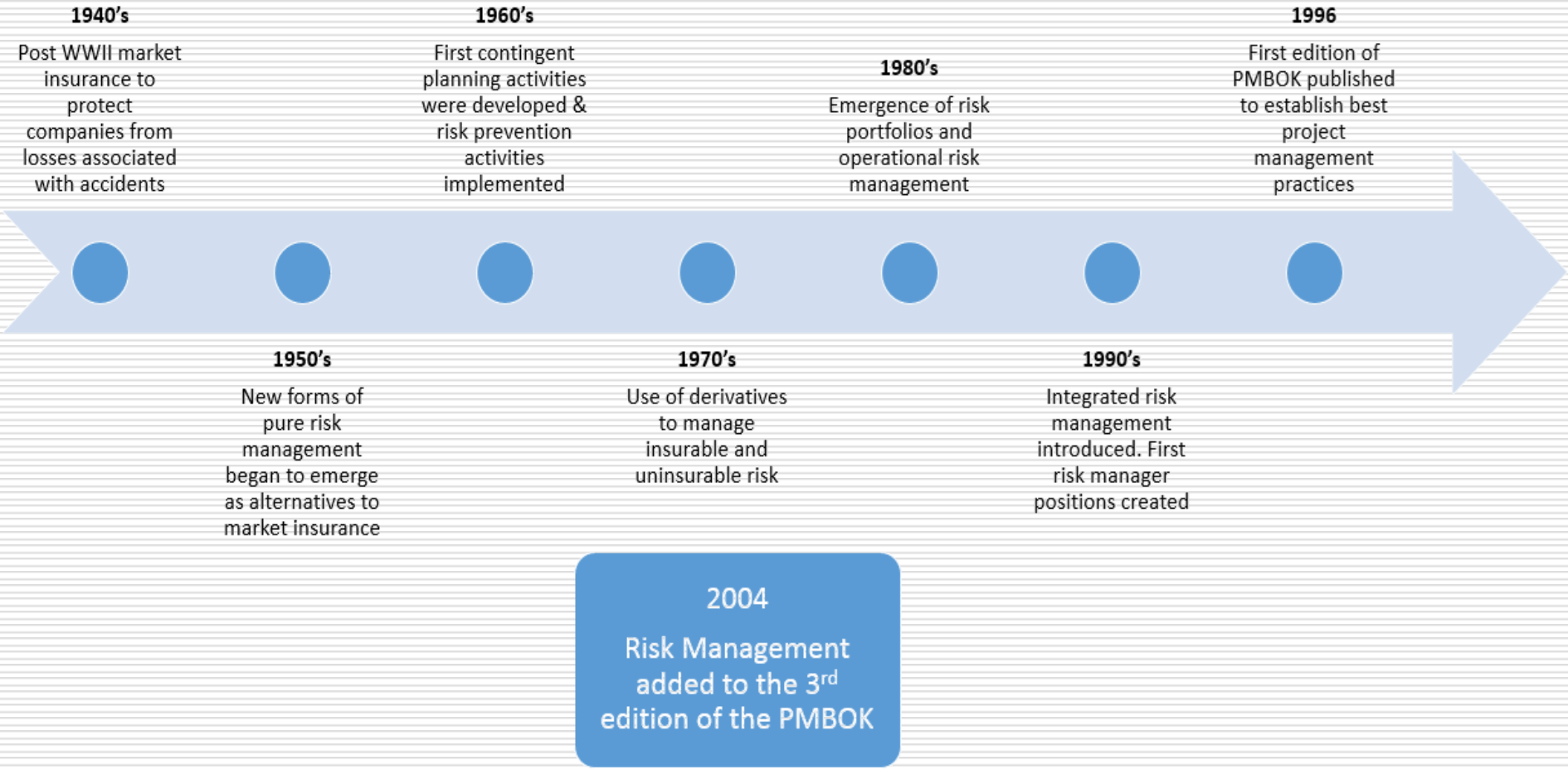
6. **Lack of Sleep Ages Your Skin**: Lack of sleep causes release of more of the stress hormone cortisol which can break down skin collagen, the protein that keeps skin “smooth and elastic”.
7. **Sleepiness Makes You Forgetful**: Trying to keep your memory sharp? Try getting plenty of sleep.
8. **Losing Sleep Can Make You Gain Weight**: According to a 2004 study, people who sleep less than six hours a day were almost 30% more likely to become obese than those who slept seven to nine hours.
9. **Lack of Sleep May Increase Risk of Death**: studies show that lack of sleep doubles the risk of death from cardiovascular disease.
10. **Sleep Loss Impairs Judgment, Especially About Sleep:** if you think you’re doing fine on less sleep, you’re probably wrong

Project Controls EXPO

Safety Topic
How to Sleep Better

Project Controls EXPO

Evolution of Risk Management



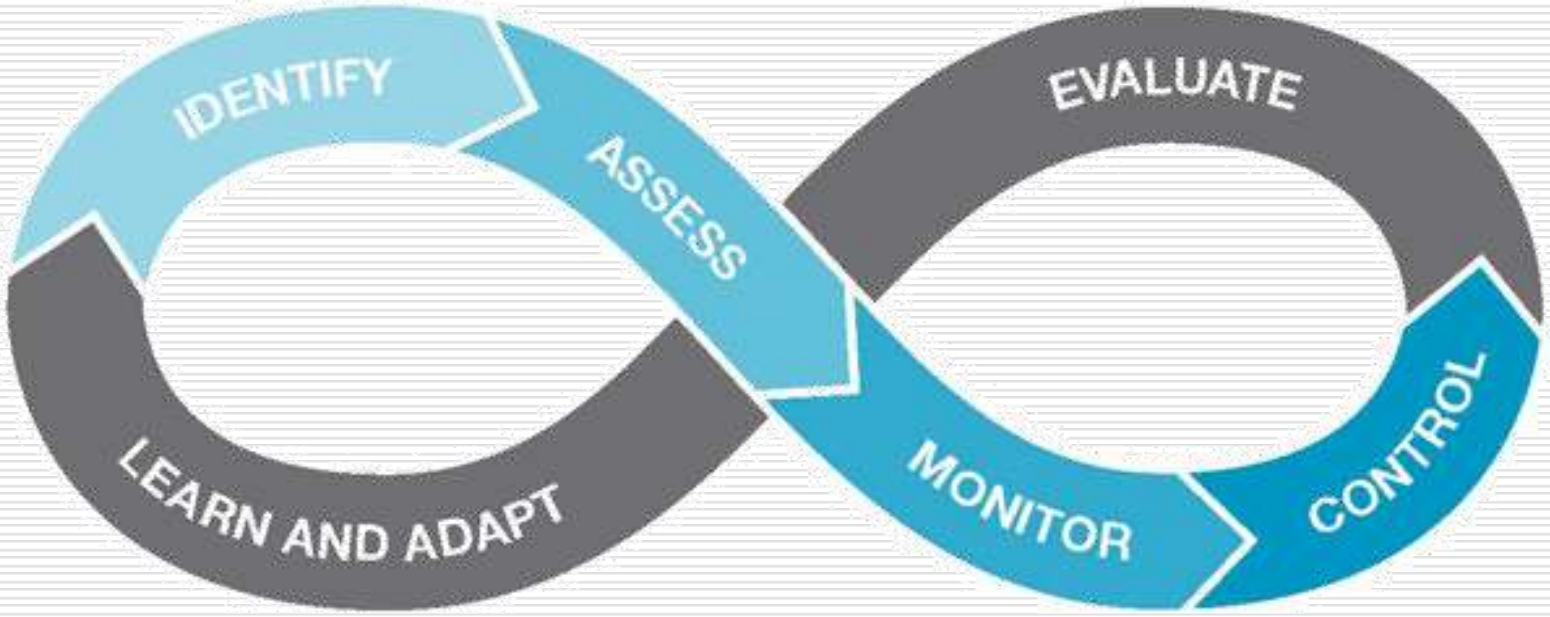
Project Controls EXPO

Purpose of Risk Management

- **All organizations must take risk to achieve their objectives**
- Every organization and/or project is exposed to some level of constraint and uncertainty, and a risk management program seeks to minimize exposure through the planning and controlling of activities
- By understanding risk to both individual projects and portfolios, management is able to make better strategic decisions.
- Cost commitments, revenue pipelines, and profit forecasts will be accurately stated for each level of risk, and the sensitivity of the forecasts will be better understood.
- As a result, targets and contingencies can be set at correct levels, contracts can be negotiated with an accurate understanding of potential challenges, and risk mitigation strategies can be created in advance.

The Risk Management Framework

- The integrated philosophy, process & structure for identifying, quantifying and managing risk.



Source: Solicitors Regulation Authority (SRA)

Project Controls EXPO

The Risk Management Framework
Identifying Risks

- Identifying events that could impact the achievement of objectives
- Key events for identifying risks:
  - Project execution plan development
  - Contract inclusions/exclusions review
  - Cost system and various cost report reviews
  - Detailed schedule workshops
  - Staffing plan reviews
  - Scope reviews
  - Quality control and assurance audits
  - Procurement & delivery reports
- Key methods for identifying risks:
  - Brainstorming
  - The Delphi Technique
  - Interviews
  - Root Cause Analysis
  - Project audit findings
  - SWOT analysis
- Do not forget about secondary/consequential risks
- Do not disregard small risks (risk evolution)

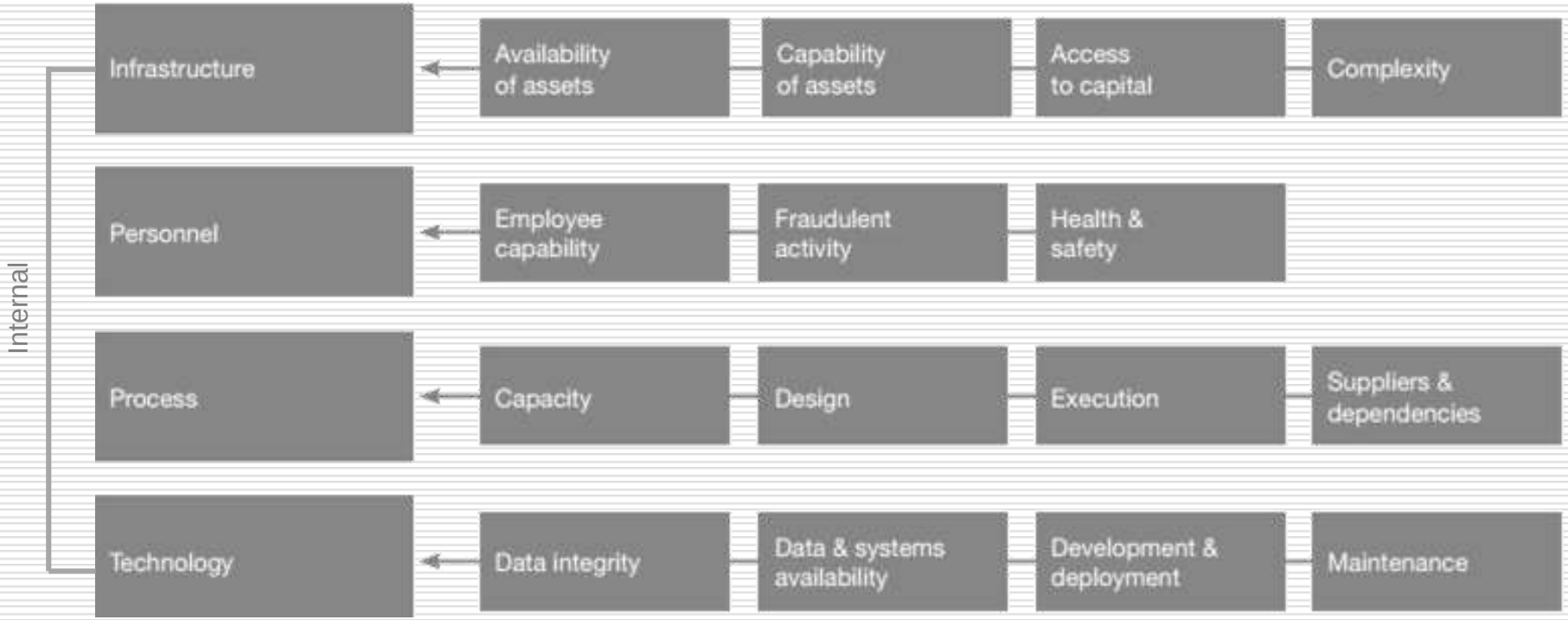
The Risk Management Framework
Identifying Risks

- External risks are out of your control but require monitoring and controlling

Source: PwC

The Risk Management Framework
Identifying Risks

- Internal risks are those for which the observer can be held accountable



Source: PwC

The Risk Management Framework
Assessing Risks

- Risk assessment starts with identifying any and all risk exposure. All risk details are tracked using a well defined risk register.

- Key inputs to the risk register include:
  - Risk item description
  - Cause/Trigger
  - Risk mitigation action
  - Risk owner
  - Date identified, target date to close
  - Current status
  - Estimated impact value ($)
  - Probability of occurrence
  - Qualitative impact
  - Class of risk

Place emphasis on the cause/trigger of a risk event and what your appropriate actions will be and who will implement them if the risk event is triggered

The Risk Management Framework
Assessing Risks

- Quantitative vs. Qualitative risk assessment

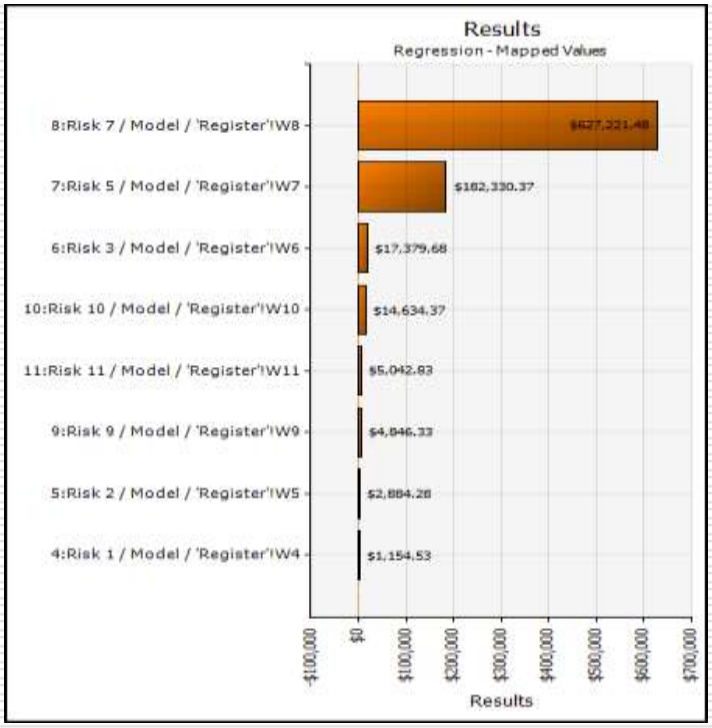
Response	Qualitative	Quantitative
Definition	process of prioritizing risks be assessing and combining their probability of occurrence and impact	process of numerically analyzing the effect of identified risks on overall project objectives
Basis	Fixed numerical values (within margin of error)	Interval scale i.e high, medium, low (beyond margin of error)
Benefit	Enables project managers to reduce the level of uncertainty and focus on high-priority risks	Enables project managers to review overall project risk profile and potential unmitigated uncertainty exposure
Technique	Risk probability and impact assessment (matrix)	Three point estimate (Monte Carlo)
Output	Risk classification and scoring of high, moderate or low risk (based on project specific rules)	Analyzes aggregate effect of all risks affecting the project or organization

The Risk Management Framework
Assessing Risks

	Risk Impact Scale				
Risk Impact	Very low	Low	Moderate	High	Very high
Cost	Insignificant cost increase	< 10% cost increase	10-20% cost increase	20-40% cost increase	> 40% cost increase
Time	Insignificant time increase	< 5% time increase	5-10% time increase	10-20% time increase	> 20% time increase
Scope	Scope increase not a factor	Minor area scope changes	Major areas of scope impacted	Scope change unacceptable to sponsor	Project scope deliverable rendered useless
Quality	Quality decrease not a factor	Only very demanding application impacted	Quality decrease requires sponsor approval	Quality decrease unnaccpetable to sponsor	Project deliverable rendered useless

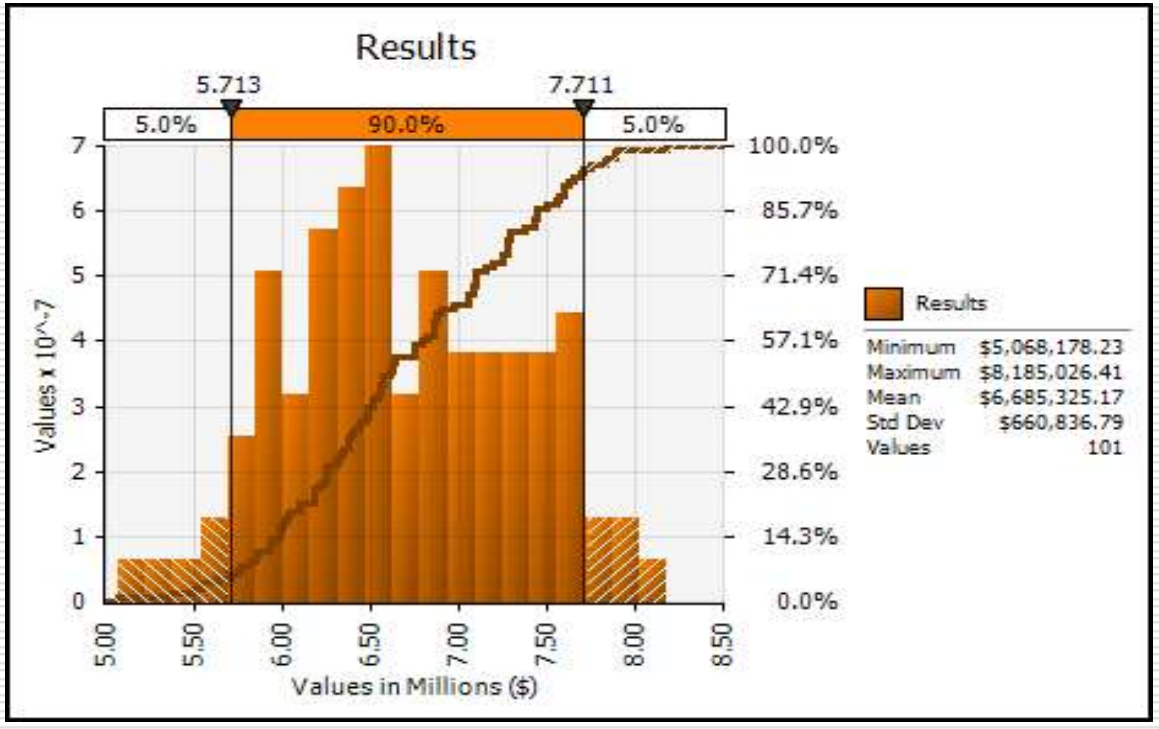
The Risk Management Framework
Assessing Risks

Sensitivity Analysis (Tornado)



Ranks and prioritizes individual risks factoring probability and impact

Cumulative Distribution

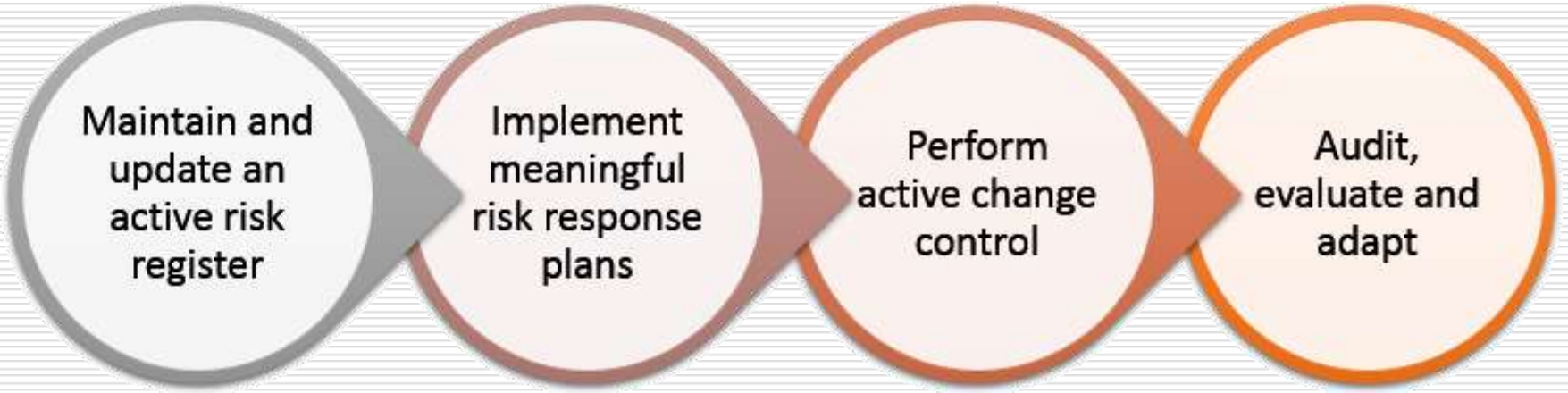


Demonstrates the aggregate impact of all evaluated risks at various probabilities

Project Controls EXPO

The Risk Management Framework
Monitoring & Controlling Risks

- The process of tracking existing risks, monitoring secondary (residual) risks, identifying new risks, executing risk response plans and tracking effectiveness
- Success of the process is defined by creation of a well balanced risk culture & accountability with authority



Project Controls EXPO

The Risk Management Framework
Risk Mitigation

Appropriate: It is necessary to determine the correct level of response based on the size and severity of the risk.

Affordable: The cost-effectiveness and benefits must be considered so that the cost and time required to fulfill the risk plan is not greater than the benefit achieved or the budget constraints.

Actionable: The time by which each response must be implemented is essential for prioritizing but also to determine if there is enough time to implement the action.

Achievable: Responses must be realistic and feasible whether that be within scope, capabilities or responsibilities.

Agreed: The course of action should be agreed to and approvals obtained formally by the relevant stakeholders per the approval process.

Allocated & Accepted: Each risk response and implementation plan requires a single owner who accepts accountability and responsibility.

Project Controls EXPO

The Risk Management Framework
Risk Mitigation

- Negative risk response strategies

Response	Strategy	Examples
Avoid	Risk avoidance is a strategy where the project team takes action to remove the threat of the risk or protect from the impact.	• Extending the schedule • Reducing/removing scope • Change the execution strategy
Transfer	Risk transference involves shifting or transferring the risk threat and impact to a third party. This does not eliminate the risk, rather transfers the responsibly and ownership.	• Purchasing insurance • Performance bonds • Warranties • Contract issuance (Lump sum)
Mitigate	Risk mitigation is a strategy whereby the project team takes action to reduce the probability of the risk occurring. This does not remove the risk or potential impact, but rather reduces the likelihood of it becoming real.	• Increasing testing • Changing suppliers to a more stable one • Reducing process complexity
Accept	Risk acceptance means the team acknowledges the risk and its potential impact, but decides not to take any preemptive action to prevent it. It is dealt with only if it occurs,	• Contingency reserve budgets • Management schedule float • Event contingency

The Risk Management Framework
Risk Mitigation

- Positive risk response strategies

Response	Strategy	Examples
Exploit	Risk exploitation is used when a team wants to ensure that the risk opportunity is realized and remove any uncertainty.	• Developing a project team with the most talented resources • Upgrading technology to reduce cost and project duration
Enhance	Risk enhancement is used to increase the probability or impact of a positive risk occurring. The strategy requires identifying and maximizing the key drivers.	• Fast tracking an activity or overall schedule by adding additional resources or shifts to achieve an incentive
Share	Sharing a positive risk involves allocating some or all of the ownership of the risk and opportunity to a third party who has the best chance of meeting the objective.	• Risk sharing partnerships (JV's) • Subcontracting to firm with technical experience and adding incentive targets
Accept	Accepting a positive risk means you intend to take advantage of the opportunity if it becomes available, but not actively pursuing it.	• Meeting incentive dates naturally • Discounted equipment or material costs

Practical Applications

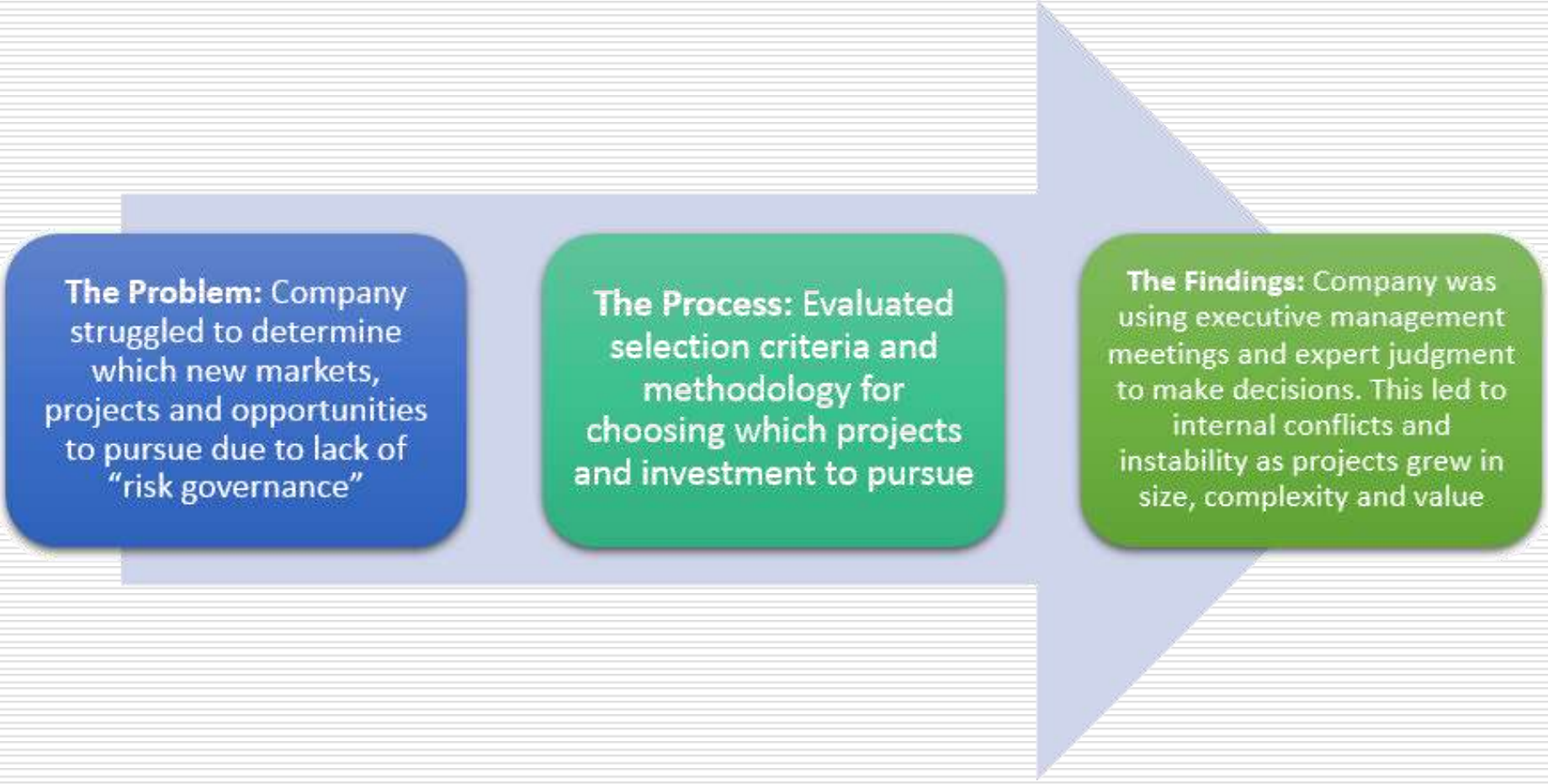
- Risk management has a wide range of applications varying by industry, but where is the “bang for the buck?”

Project Controls EXPO

Practical Applications
Corporate Risk Appetite & Tolerances

- Risk appetite is the amount and type of risk that an organization is prepared to pursue, retain or take
- Risk tolerances act as the metrics that allow the ability to implement and enforce the risk appetite
- Risk appetite is a higher level statement that considers the broad levels of risk whereas tolerances are narrow and establish the levels of variation around objectives
- Important to align risk appetite and tolerances to strategic goals and business performance objectives
- Example, P85 for Lump Sum vs. P50 for Cost-Reimbursable

Practical Applications
Risk Tolerance Case Study



Project Controls EXPO

Practical Applications
Risk Tolerance Case Study

The Solution: Created a risk management team, set corporate risk appetite and establish well-defined key tolerance metrics

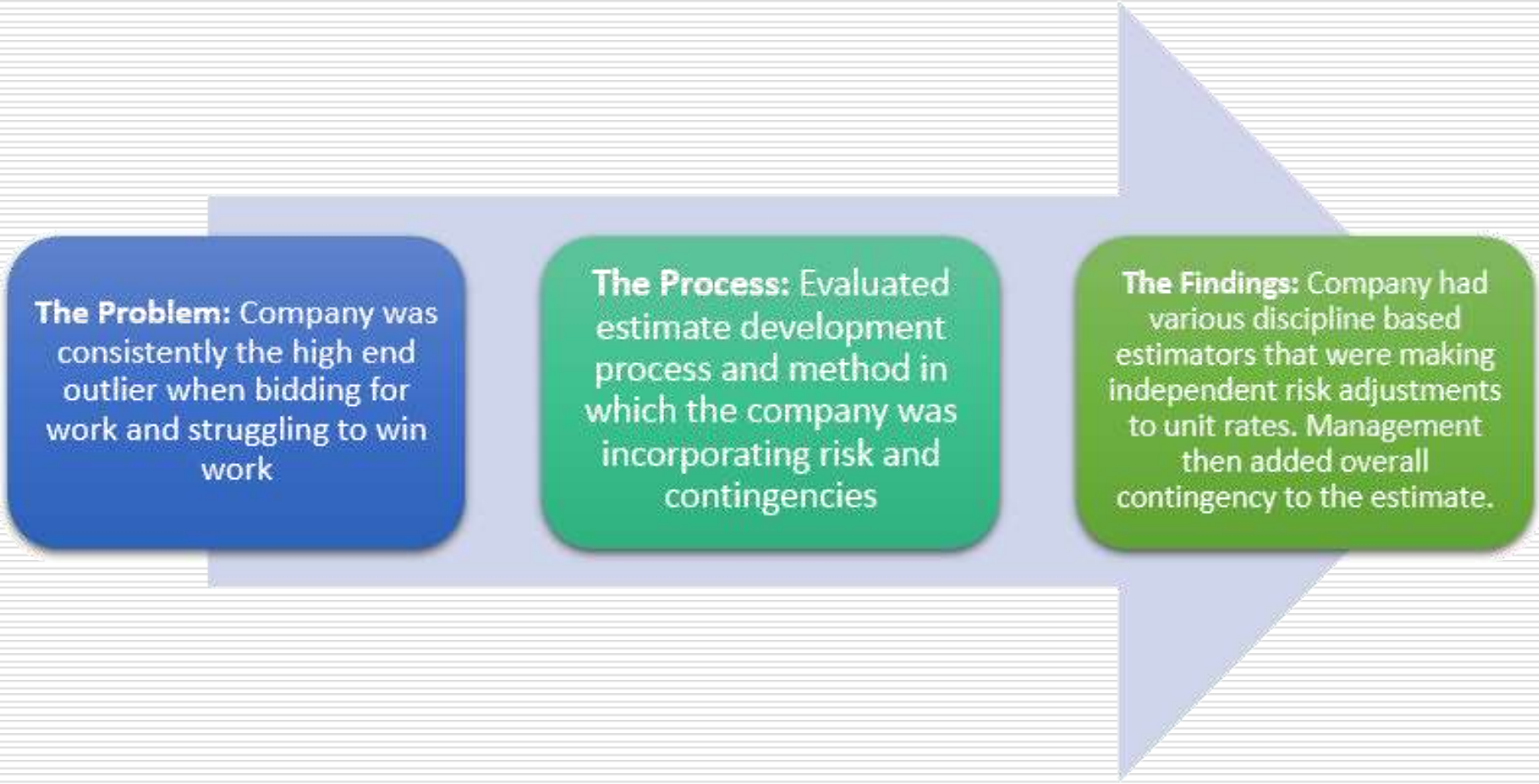
Sample Result:

Before	After
Company spent hours discussing whether or not to bid on a project and often could not agree creating internal conflict	Company determined the would not bid any work if the uncertainty was greater than 8.5% of the total estimated cost (measure via Monte Carlo)
Company had no corporate risk reserves or funds to protect for external threats	Company established a corporate risk reserve of 4.5% of total annual budget that was monitored quarterly
Company expected an 18% return on investment	Company is not willing to take more than a 25% chance that an investment leads to a loss of more than 35% of existing capital
Company will not enter new markets if they will be difficult to penetrate and turn profits	Company would not accept more than a 5% risk that a new line of business would reduce operating earnings by more than 5% over 10 years

Practical Applications
Estimate Development Case Study

- Adding formal risk assessment processes into estimating helps create estimate confidence and eliminate “compound contingency”
- “compound contingency” is the concept of factoring risk into your detailed rates, and then adding contingency and allowance budgets to the overall estimate
- Estimate confidence is supported by the ability to define, evaluate and quantify uncertainty independently from a base estimate
- By building and evaluating an estimate risk model, it allows for the ability to truly analyze the overall risk profile and measure against the corporate risk tolerances

Practical Applications
Estimate Development Case Study



Project Controls EXPO

Practical Applications
Estimate Development Case Study

The Solution: Refined process where estimators were only able to use base rates and built a separate model for quantifying project specific uncertainty and overall estimate factoring

Sample Result:

Before	After
Company would piece estimates together from various sources who built independent risk adjustment into their unit rates creating "compound contingency"	Centralized the estimating team and process to standardize discipline based labor, install and material rates not factored for internal and external project risks
Management team would determine overall project contingency percentage based on expert judgment and previous project benchmarks	Held an estimate risk evaluation meeting and used a quantitative Monte Carlo risk model (risk ranging) to evaluate true exposure and determine contingency requirements
Company would factor the overall estimate for site specific conditions, weather, region, union needs etc.	Developed and utilized a labor productivity risk model to factor labor cost with a supporting basis

Practical Applications
Estimate Development Case Study

Labor Productivty Factoring Conditions

Weighting Profile Basis:	North America
Working days / week:	5.0

FACTOR CATEGORY	SELECT FROM DOWNDOWN	FACTOR	WTG	WTG FACTOR
Region	US - South West	1.18	3%	0.04
Union / Non Union	Union	1.40	18%	0.25
Craft History working together	25%	1.05	6%	0.06
Subcontract execution %	20%	1.00	3%	0.03
Site condition	Level & Dry	1.03	5%	0.05
Climate	Hot Summers	1.14	6%	0.07
Greenfield / brown field		1.00	12%	0.12
Workweek		1.09	5%	0.05
Average craft working height		1.25	8%	0.10
Craft Saturation (sqft / person)	400	1.00	3%	0.03
Brass Alley & Travel Time	15	1.02	6%	0.06
Schedule Type	Phased	1.04	13%	0.14
Skilled Craft Available	Minimal Risk	1.00	3%	0.03
Field Staff Available	Minimal Risk	1.00	3%	0.03
Construction Equipment & Small Tools Available	Minimal Risk	1.00	6%	0.06
			100%	12.1%

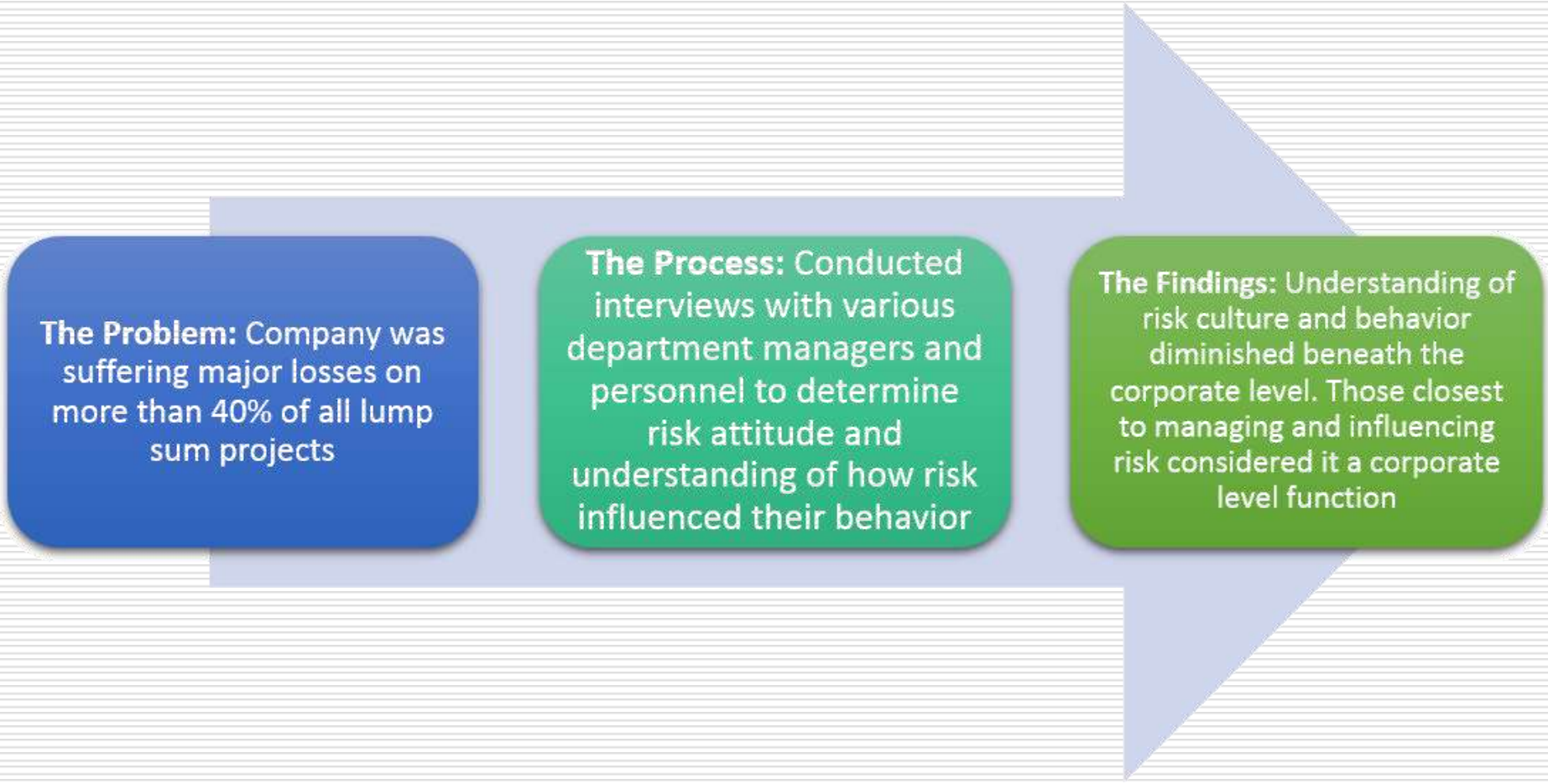
Harsh Winters
Hot Summers
Mild
Heavy Rains

Project Controls EXPO

Practical Applications
Risk Culture Case Study

- Risk culture is the values, beliefs, knowledge attitude and communication about risk shared by an organization
- A well established and effective risk culture is one that enables and rewards team members for actively identifying, communicating and taking action on positive and negative risks
- Accountability and ownership of risk encouraged while supporting communication without fear or blame
- Corporate risk culture flows down through all levels of the organization. Everyone is responsible for risk management.

Practical Applications
Risk Culture Case Study



Project Controls EXPO

Practical Applications
Risk Culture Case Study

The Solution: Designed a culturally sensitive risk management program focused on driving engagement and interaction at all levels of the organization (risk governance)

Sample Result:

Before	After
Company only had a corporate risk program that was more of formality and a basis for managing the risk profile of the company and projects	Established a multi-tier risk governance program to include a corporate level, functional level and project level. Risk was reported upward through the appropriate channels
Company only included executive management in risk management meetings and communication channels	Risk program was expanded to include many more team members to incorporate those that are closest to the risks at each respective governance level
There existed no meaningful incentive for team members who are already loaded up with work to prioritize risk in their daily schedule	Created a quantifiable and meaningful incentive program to encourage risk identification and pro-active response planning and implementation

Practical Applications
Risk Culture Case Study

- Sample risk governance structure for a larger organization

Corporate Risk Team	Divisional Risk Team	Project Risk Team
• CEO • COO • CTO • Sales Lead • Head of Business Development • Business line executives • Custom to Organization…	• Appointed Risk Officer • Construction • Engineering • Procurement • Business Services • Contracts • Custom to Organization…	• Project Manager • Engineering Manager • Construction Manager • Procurement Manager • Lead Estimator • Client team members • Custom to Organization…

Practical Applications
Risk Culture Case Study

- Keys to an effective risk culture

Make the risk program procedures available, clear and concise

Make team members aware that a risk program is not a means to point blame or define failure, but rather a means to strengthen the execution and identify opportunity

Encourage team members to think and talk about risks with the intent of strategizing on how to minimize them

Hold risk training programs and workshops to educate employees on the risk program, its value and intent.

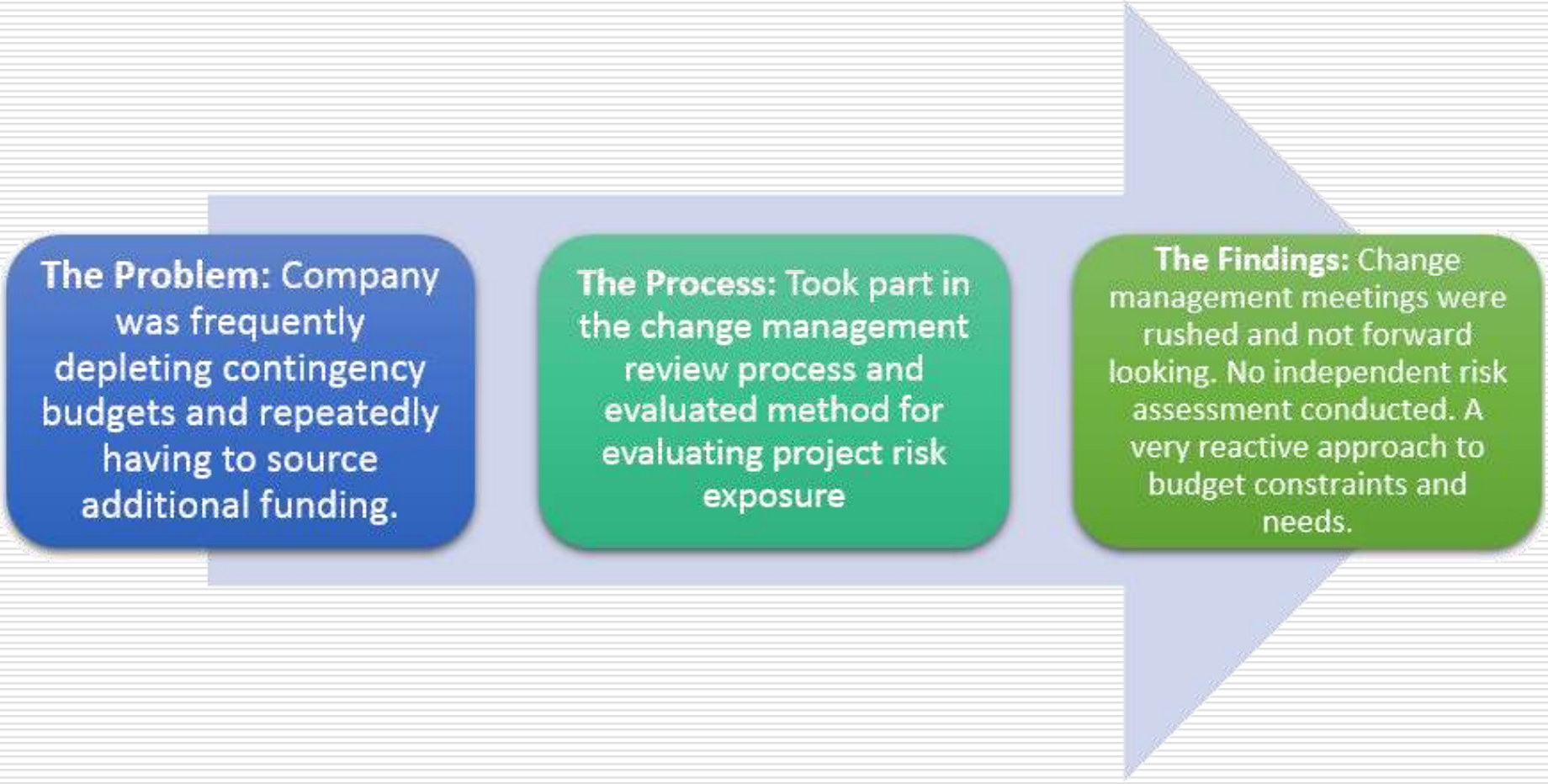
Encourage team members to document risks in writing

Create an incentive program to ensure that risk management is factored into the daily thought process

Practical Applications
Project Contingency Case Study

- Project contingency positions help to define the overall health of a project budget at a given period in time
- Risk analysis can be used to quantify threats that may not be ready for the change management process
- Performing a Monte Carlo risk analysis on remaining to spend budget accounts independently assesses contingency needs
- Leverage the Monte Carlo model used to develop the original contingency position

Practical Applications
Project Contingency Case Study



Project Controls EXPO

Practical Applications
Project Contingency Case Study

The Solution: Re-structured the change management process to include a larger audience and more scrutinized review. Added an independent Monte Carlo assessment to analyze total exposure and compare against current contingency budget

Sample Result:

Before	After
Project team rushed through change management meetings, no meeting minutes and participation was lacking	Change management meetings included a larger audience, meeting participation was mandatory, a change management coordinator was established and meeting minutes & actions followed up on
No risk model was maintained or evaluated to add a layer of project budget health analysis and compare against remaining contingency budget	Incorporated a Monte Carlo model and made the risk ranging exercise part of the Change Management meeting. This provided a P85 assessment of the remaining budget needs to compare against current budget

Practical Applications
Project Contingency Case Study

- Sample comparison of model output being compared to current project contingency position.
- Helps validate change management process as well as establish confidence in contingency position

	Current Contingency Position	Monte Carlo To-Go Contingency Reqt. P50	Monte Carlo To-Go Contingency Reqt. P85	Potential Contingency Surplus (Deficit)
	A	B		(A)-(B)
Subproject 1	$2,910,037	$1,283,973	$1,592,963	$1,626,064
Subproject 2	$979,000	$1,513,468	$1,742,692	($534,468)
Subproject 3	$1,112,018	$1,077,731	$1,341,370	$34,288
Subproject 4	$347,034	$367,084	$581,211	($20,050)
Total Project	**$5,348,089**	**$4,242,255**	**$5,258,236**	**$1,105,834**

Practical Applications
Managing Project Risk Case Study

- Managing project risk is more than attending a mandatory monthly or quarterly risk meeting
- The true value in project risk assessment is planning, implementing and monitoring mitigation strategies to reduce risk exposure or capitalize on opportunities
- Project risk assessment is only valuable if the risk culture is well established
- Consider meaningful and measurable risk incentive programs

Practical Applications
Managing Project Risk Case Study

Project Controls EXPO

Practical Applications
Managing Project Risk Case Study

The Solution: Demonstrated the value in making the project risk assessment process a priority. Created a project based risk management team and established a risk coordinator position to manage the overall program and ensure actionable follow up on responsibilities.

Sample Result:

Before	After
Project management team was forced to accept any risks as they were realized to late in the process to mitigate or avoid	An estimated $14.7M was saved through the risk response planning process and more than $4.5M was recognized in exploiting positive risks
There were major swings in the project cost and profit forecast model due to risk impacts that were unforeseen	Built the risk output model into the cost & profit forecast model to help ensure accurate project financial reporting

Practical Applications
Managing Project Risk Case Study

Examples of effective project risk management

Project Risk	Risk Response
Construction activities being completed prior to IFC drawings and with various holds	Increase field engineering presence with field routing experience and accept re-work cost funded by contingency
Extension in time claims are received from contractors claiming other contractors held up their work	Develop and maintain integrated master schedule with activities coded to each contractor allowing for the ability to measure delays
Late delivery of key equipment holds up work fronts for key contractors	Analyze impact to schedule, quickly determine manpower strategy and analyze other work fronts on the critical path that contactors can work
Fluctuating FOREX causes budget constraints or savings opportunity	Closely monitor currency exchange rates and book savings if favorable or establish hedging position
Delayed availability of permanent power due to third party not being ready	Analyze temporary power mitigation options, or discuss with third party ability to provide capital or resources to help accelerate schedule

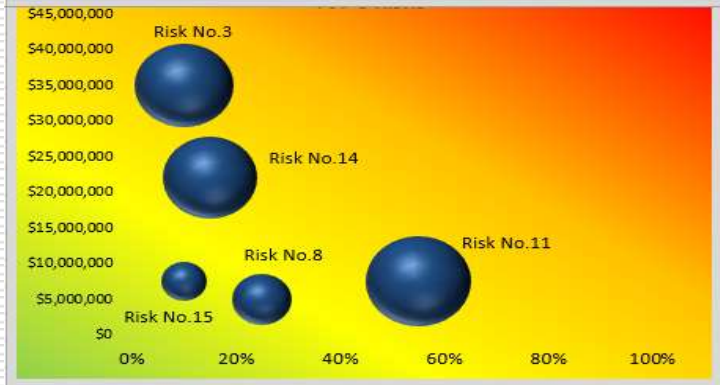
Practical Applications
Risk Management Implementation

1. Define the purpose for risk management within your organization
2. Evaluate existing risk program or current risk management practices
3. Understand the available frameworks as there are different standards per industry
4. Seek internal & external support as required (find those familiar with your industry)
5. Keep it simple and focus on objectives not technical jargon
6. Roll out the program in “pilot version” on a small project or business line
7. Demonstrate the value early on
8. Grant authority to those closest to the risks
9. Focus on growing the culture before the infrastructure
10. Report progress of the risk management program

Practical Applications
Risk Management Infrastructure

- The risk management infrastructure is dependent on size of organization, needs and objectives
- What do you need?
  1. A **customized policy & procedure** outlining the program including company specific thresholds, risk officers and governance overview
  2. A **risk hit list** that lists internal & external risks to consider
  3. A **risk register** with all the required input fields that ties to the Monte Carlo output model
  4. A **risk simulation software** (excel add-in or separate ERM system)
  5. A **risk reporting dashboard** customized to the desired needs of the key stakeholders

Practical Applications
Risk Infrastructure



Notes from the risk management meeting:
1.
2.
3.
4.
5.

Risk Exposure

Total Register Exposure	**$14,427,500**
Exposure Unmitigated (Open)	$14,027,500
Potential Exposure (On Hold)	$400,000

Risk Status Report

select | Total Risks | 16

By Category	Minor	Medium	Serious	Major	Catastrophic
Very Unlikely	4	1	1	1	0
Unlikely	2	1	0	0	2
Possible	0	0	0	1	0
Likely	0	0	1	0	0
Almost Certain	0	1	0	0	1

Aging Report (Days)

Project Controls EXPO

Practical Applications
Questions & Comments

Project Controls EXPO