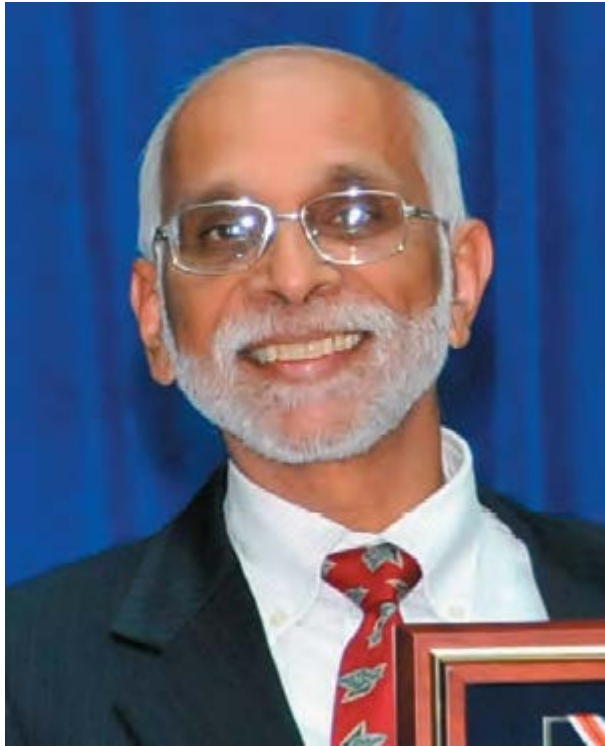




P3 Project Risk Assessment

P3-VALUE Webinar
March 7, 2015

Instructors



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Office of Innovative Program Delivery



Marcel Ham

Vice President
IMG Rebel

P3-VALUE 2.0 Webinars

- **P3:** Public Private Partnership
- **P3-VALUE 2.0:** Analytical tool to help practitioners understand processes used to quantitatively evaluate P3 options
- This is one of a series of webinars on P3-VALUE
 - P3 Evaluation Overview (January 25, 2016)
 - Value for Money Analysis (February 8, 2016)
 - Value for Money Exercise (Feb. 16, 2016)
 - Project Delivery Benefit-Cost Analysis (Feb. 22)
 - Project Delivery BCA Exercise (Feb. 29, 2016)
 - **Risk Valuation (today)**
 - Financial Viability Assessment





Webinar Outline

- Part 1 Categorizing Risk
- Part 2 Risk Management Process
- Part 3 Pure Risk Assessment
- Part 4 Lifecycle Performance and Revenue
 Uncertainty Risk Assessment
- Part 5 Risk Allocation
- Part 6 Using P3-VALUE 2.0 for Risk Assessment
- Summary

Webinar Objectives

After taking this course you should be able to:

- Categorize P3 risks
- List the steps in the risk management process
- Explain the methods for quantifying and monetizing various type of risks
- Describe the risk allocation process
- Use P3-VALUE 2.0 to perform risk assessment



Part 1

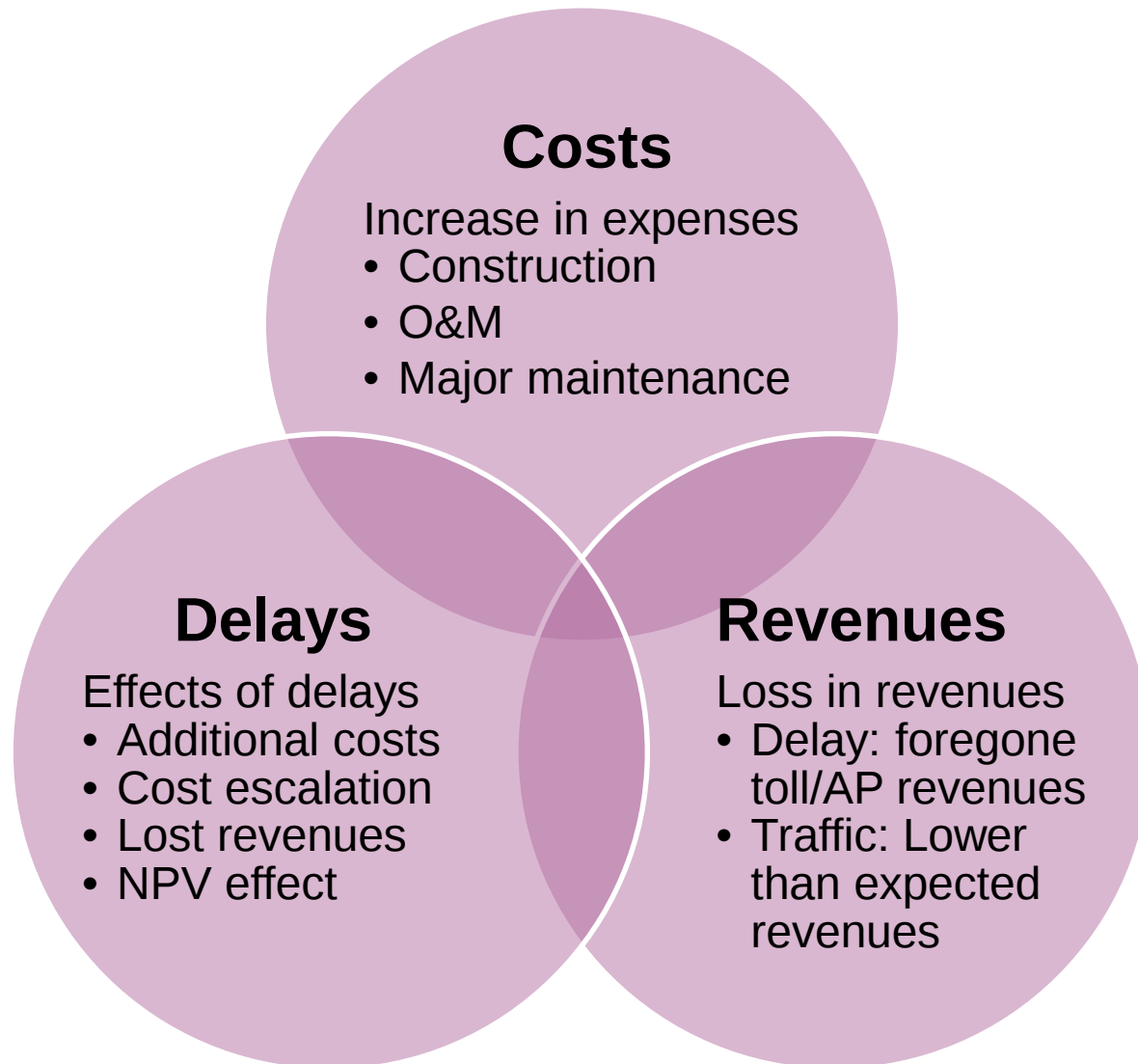
Categorizing P3 Risks



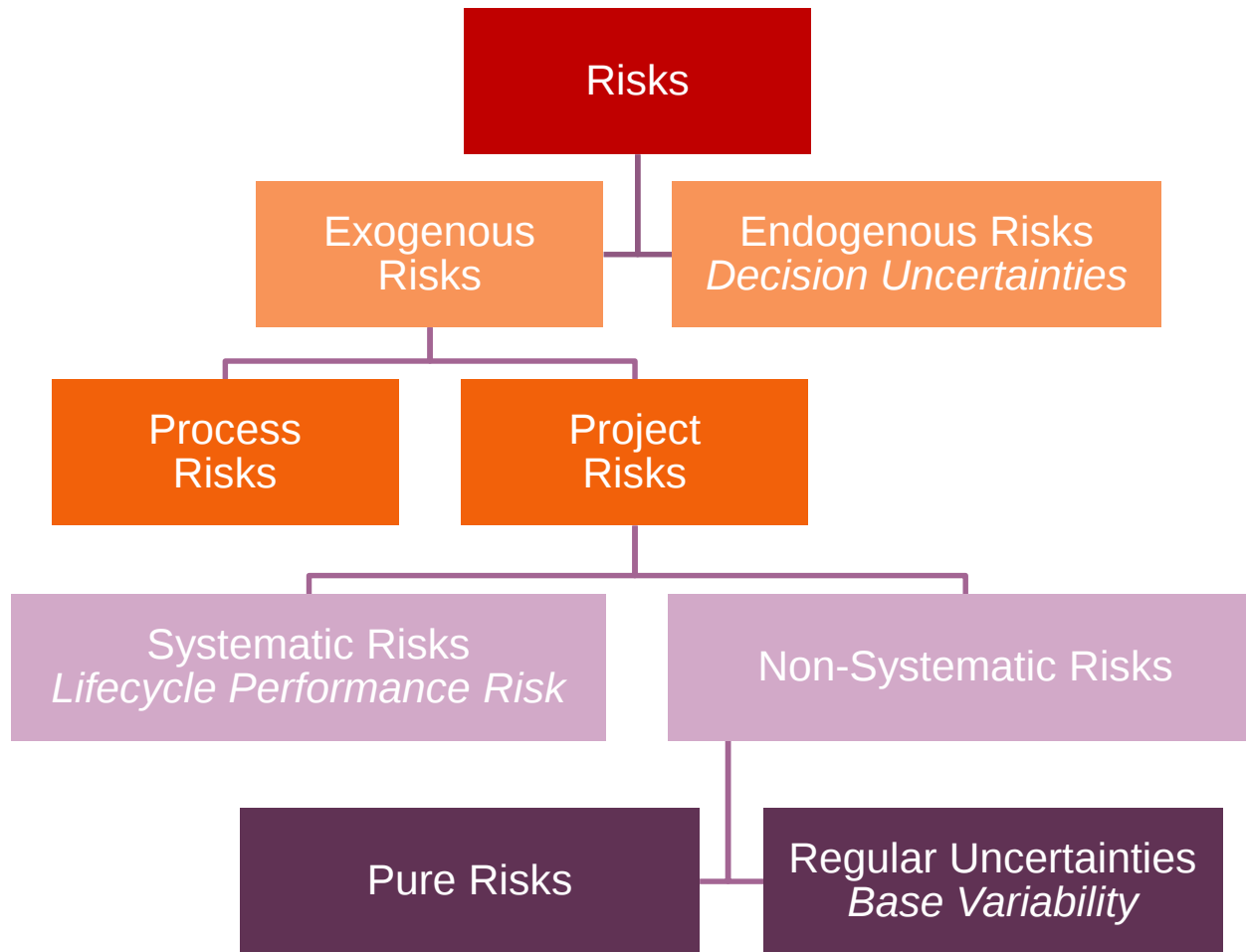
Purpose of Risk Assessment

- To calculate value of risks
- To design *draft agreement* for RFP
- To assist in *negotiation* with bidders
- To develop *risk management plans*

Financial Impacts of Project Risks



Categories of Risk



P3-VALUE 2.0 Project Risk Categories

- **Base Variability**

Example: Uncertainty in volume of asphalt

- **Pure Risks**

Example: Accident at construction site, causing cost overrun and/or delays

- **Lifecycle Performance Risks & Revenue Uncertainty**

Example: Conflicts between DB and O&M contractors, supervening events exceeding liability caps, inflation, T&R risk (for toll concessions)

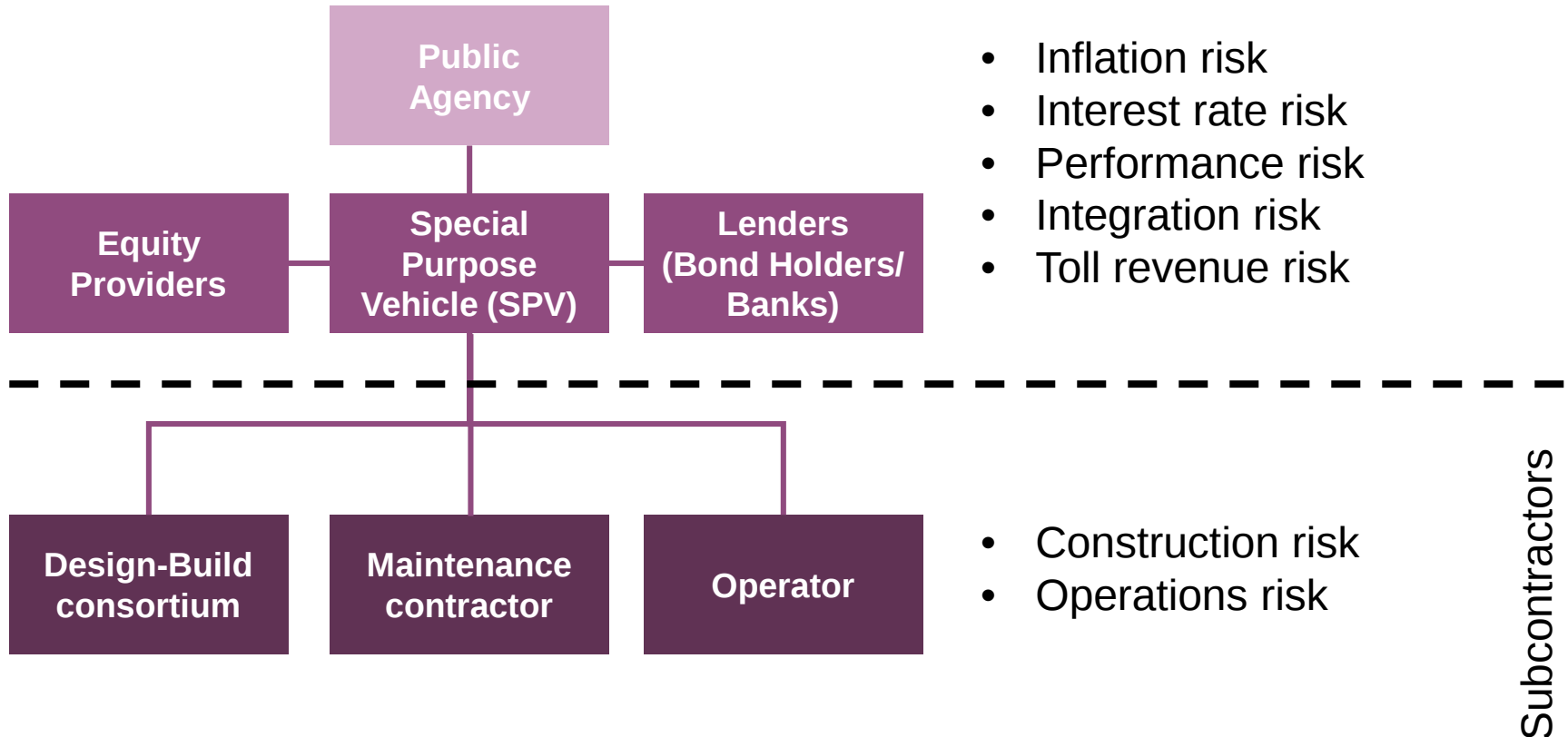


Valuing Base Variability

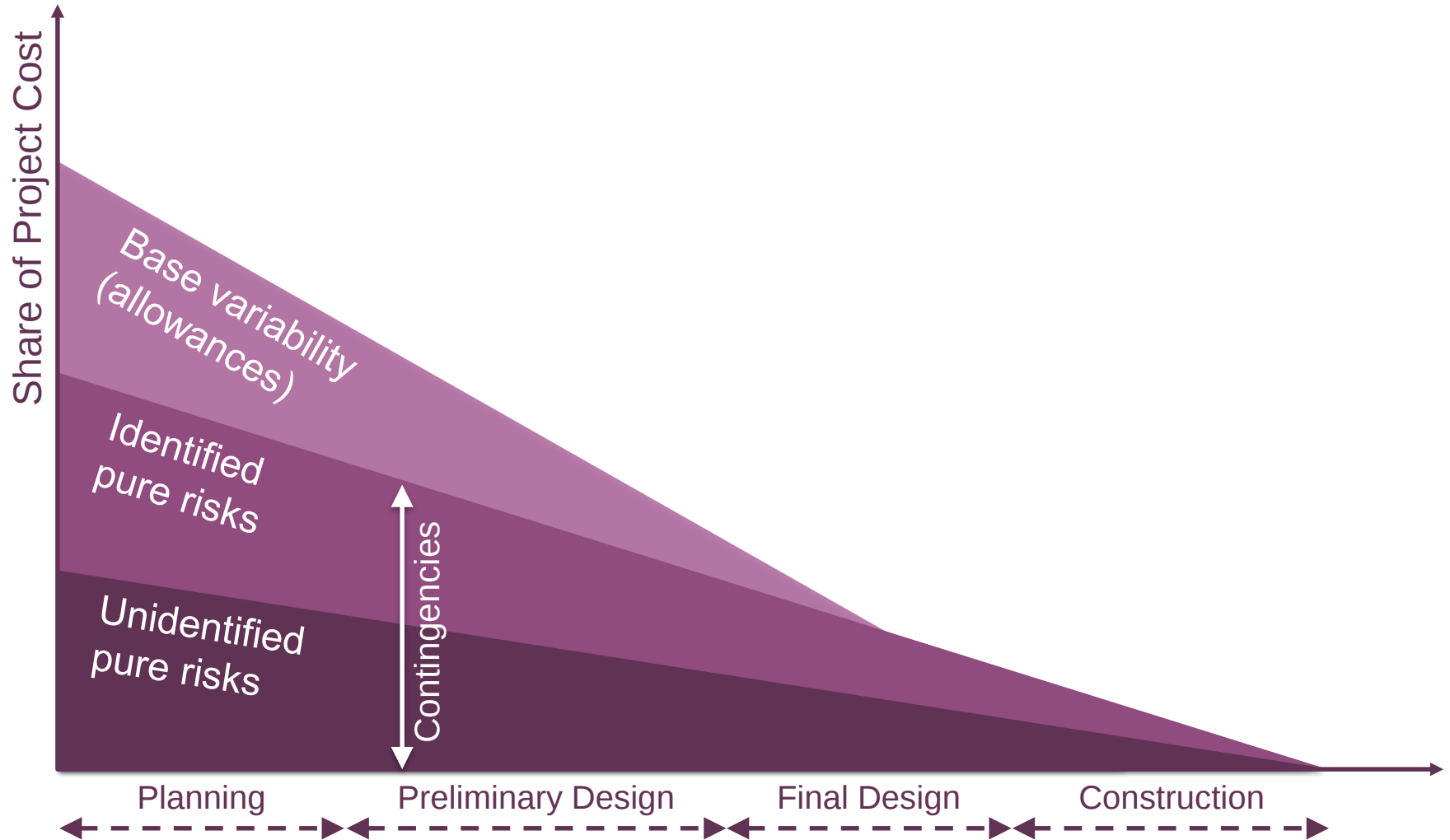
- Typically a percentage of costs (+ or - variation)
- May differ by project phase
- Reflects the uncertainty in cost estimates – will reduce as the design level becomes more detailed
- P3-VALUE 2.0 uses a factor (percentage of base cost) to estimate cost impact
- Example:
 - Base variability: 20% of construction cost
 - Construction cost: \$200M
 - Value of base variability: $20\% \times \$200\text{M} = \40M

Who Bears Project Risks in a P3?

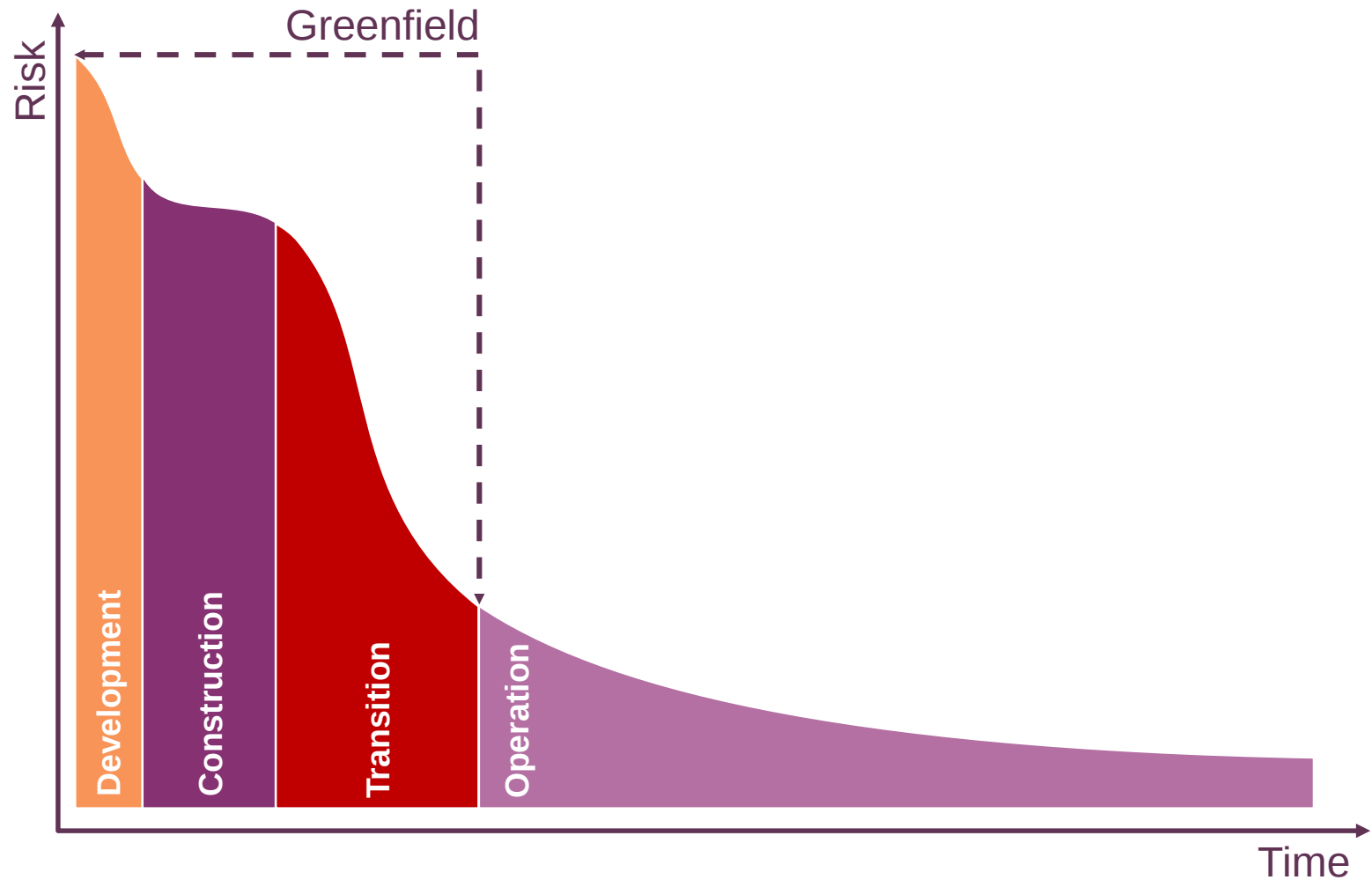
Includes both systematic and some non-systematic risks



Risk through Project Completion



Risk over Project Life



Audience Feedback

True or False

- All project risks are pushed down to subcontractors of the concessionaire.

Questions?

Submit a question using the chat box

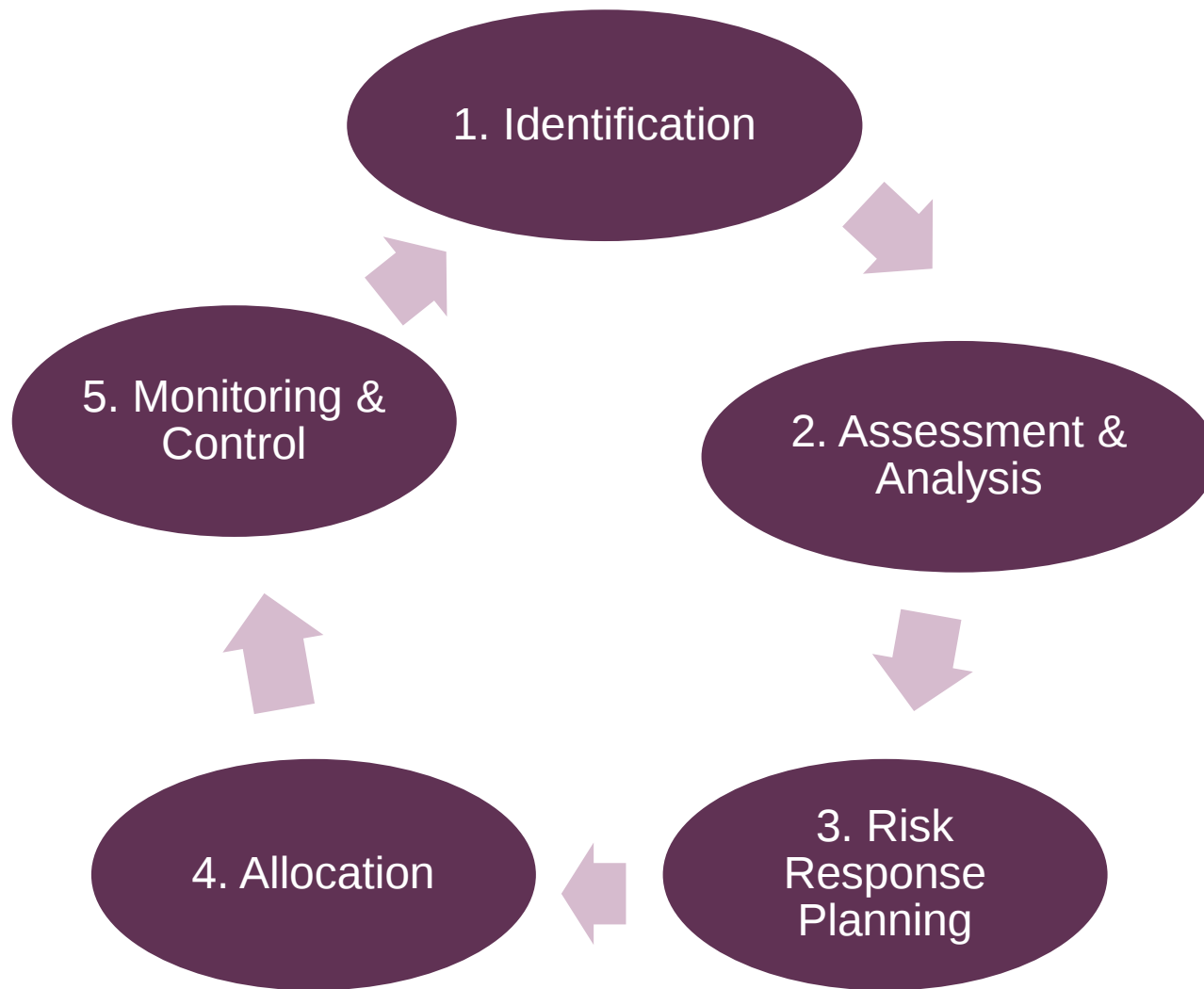




Part 2

Risk Management Process

Risk Management Process Overview



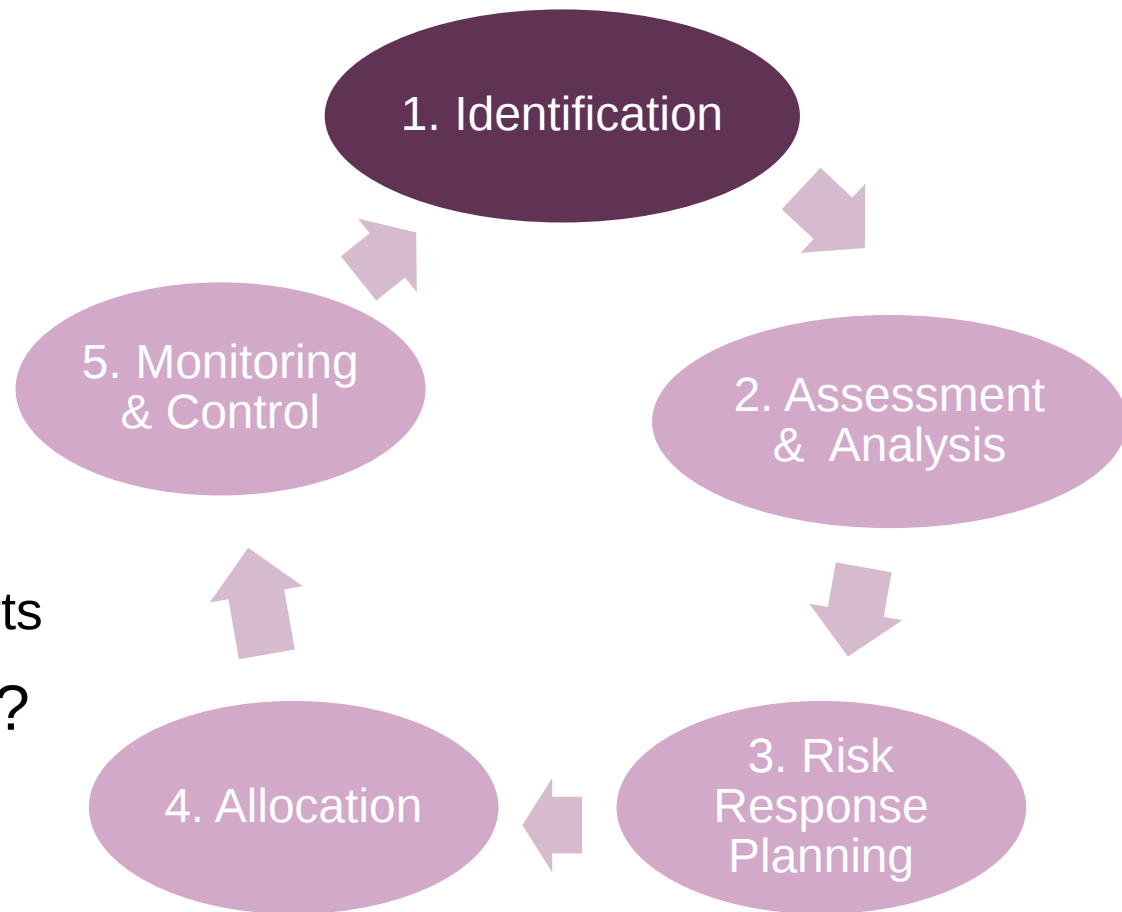
1. Risk Identification

Risks:

- Threats
- Opportunities

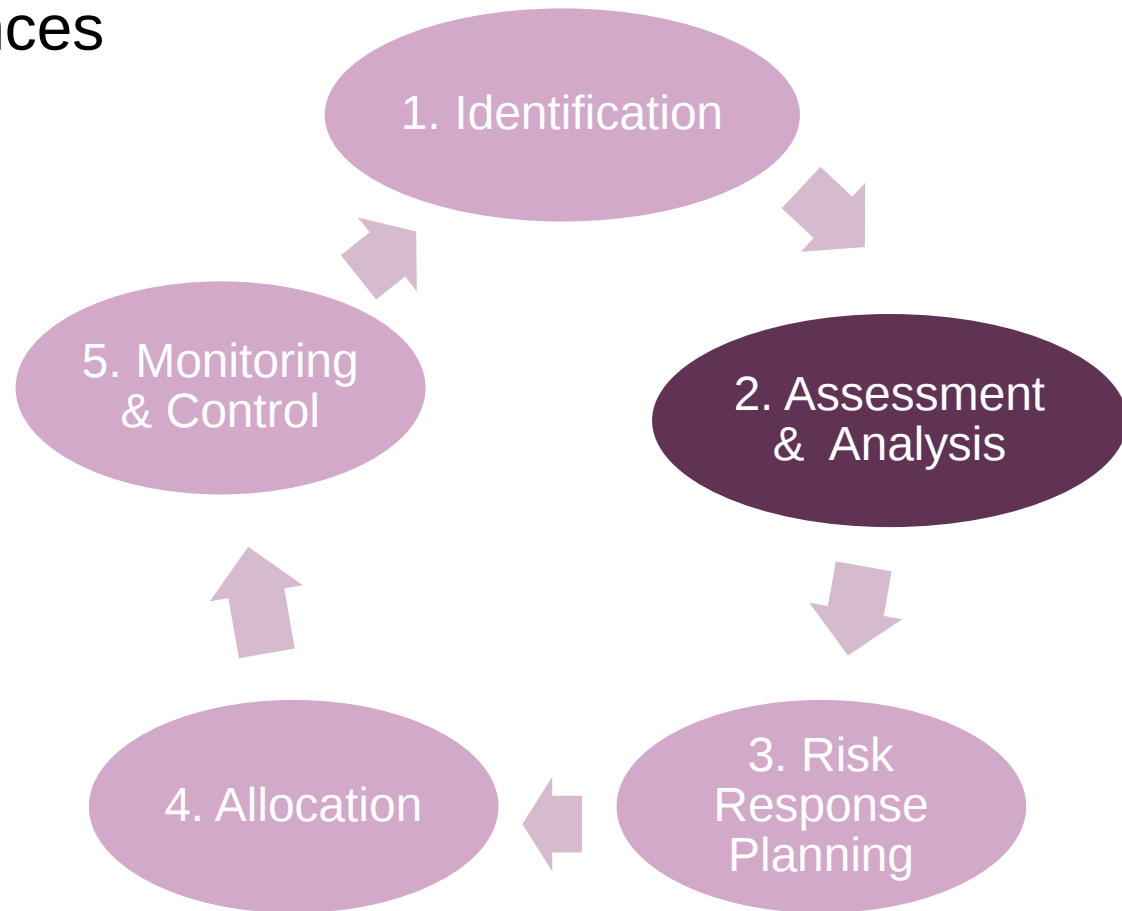
Risk Workshops

- Who?
 - Facilitator
 - Subject matter experts
- What tools are used?
 - Risk checklist
 - Risk register



2. Risk Assessment

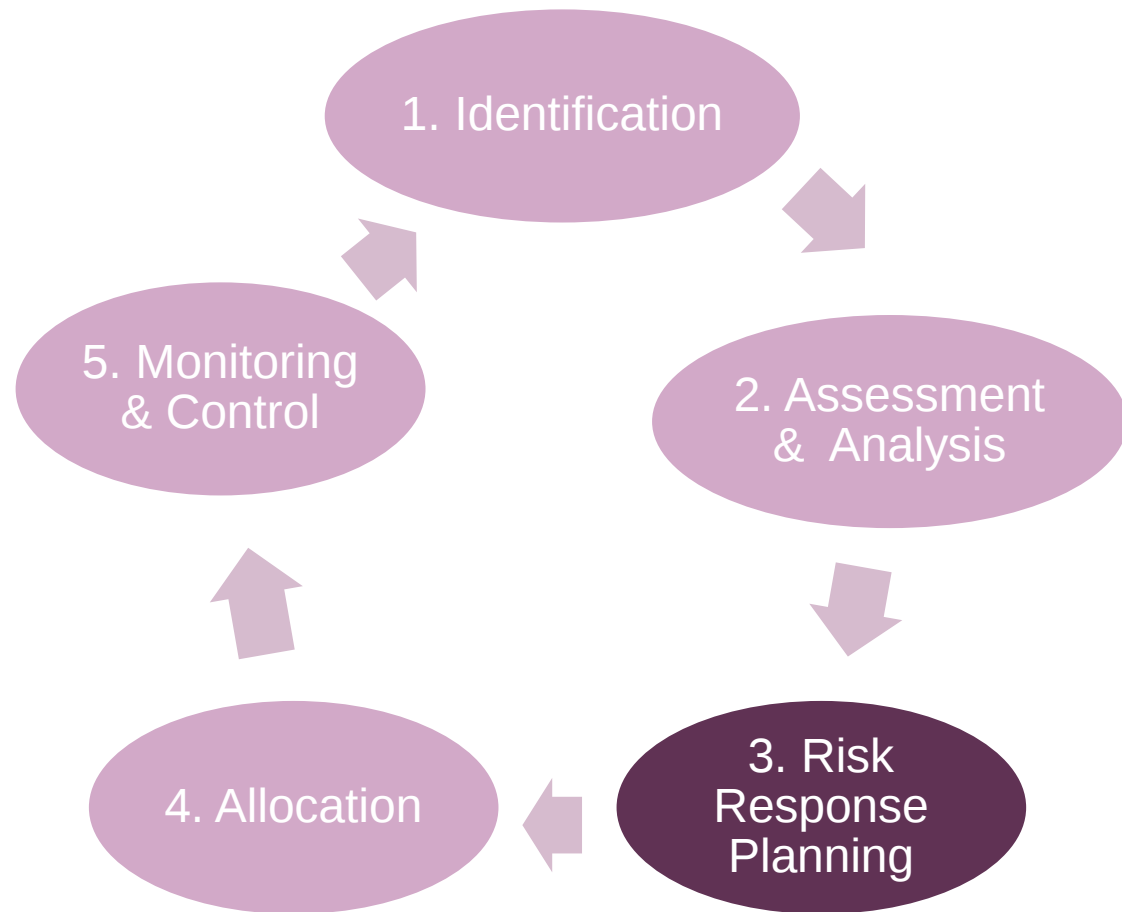
- Probability
- Potential consequences
 - Cost
 - Schedule
 - Scope/Quality
 - Revenue
- Value



3. Risk Response Planning

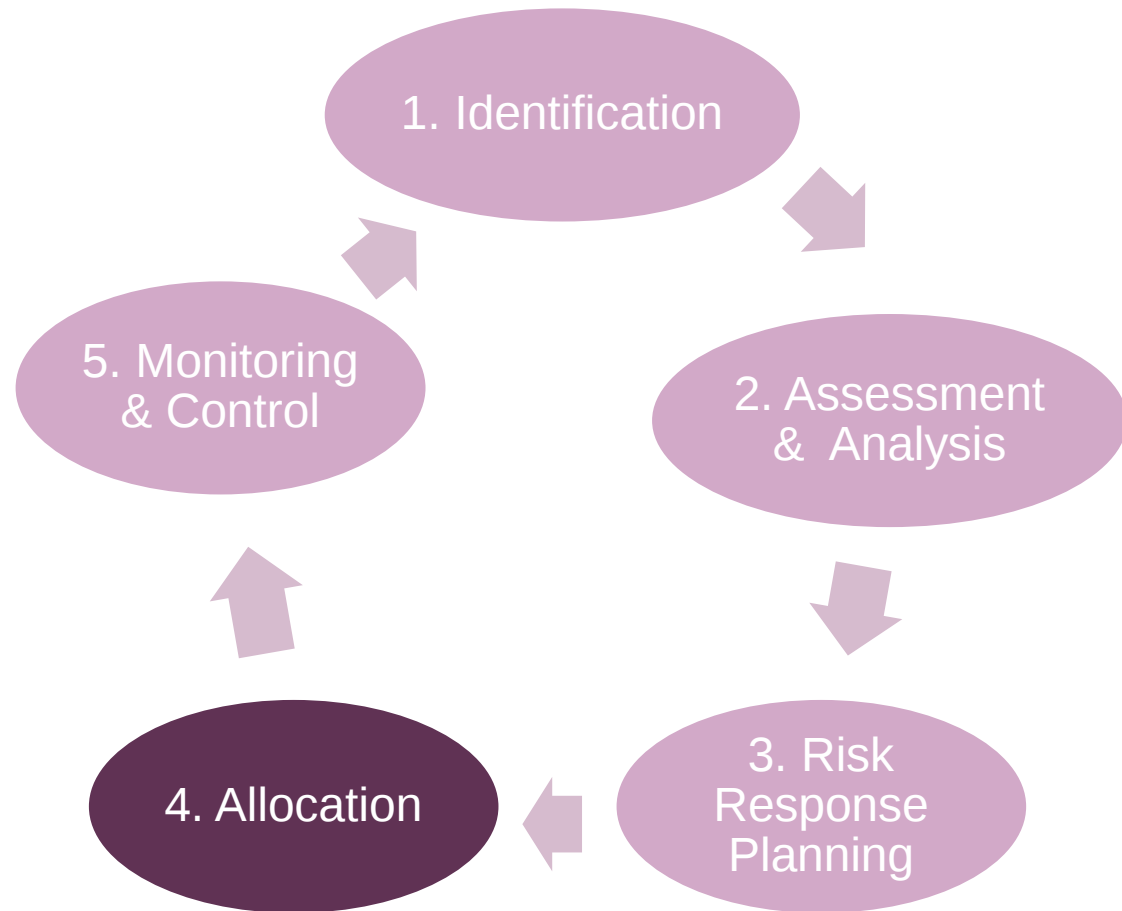
Risk Response Strategies

- Avoid
- Mitigate
- Transfer/Share
- Accept



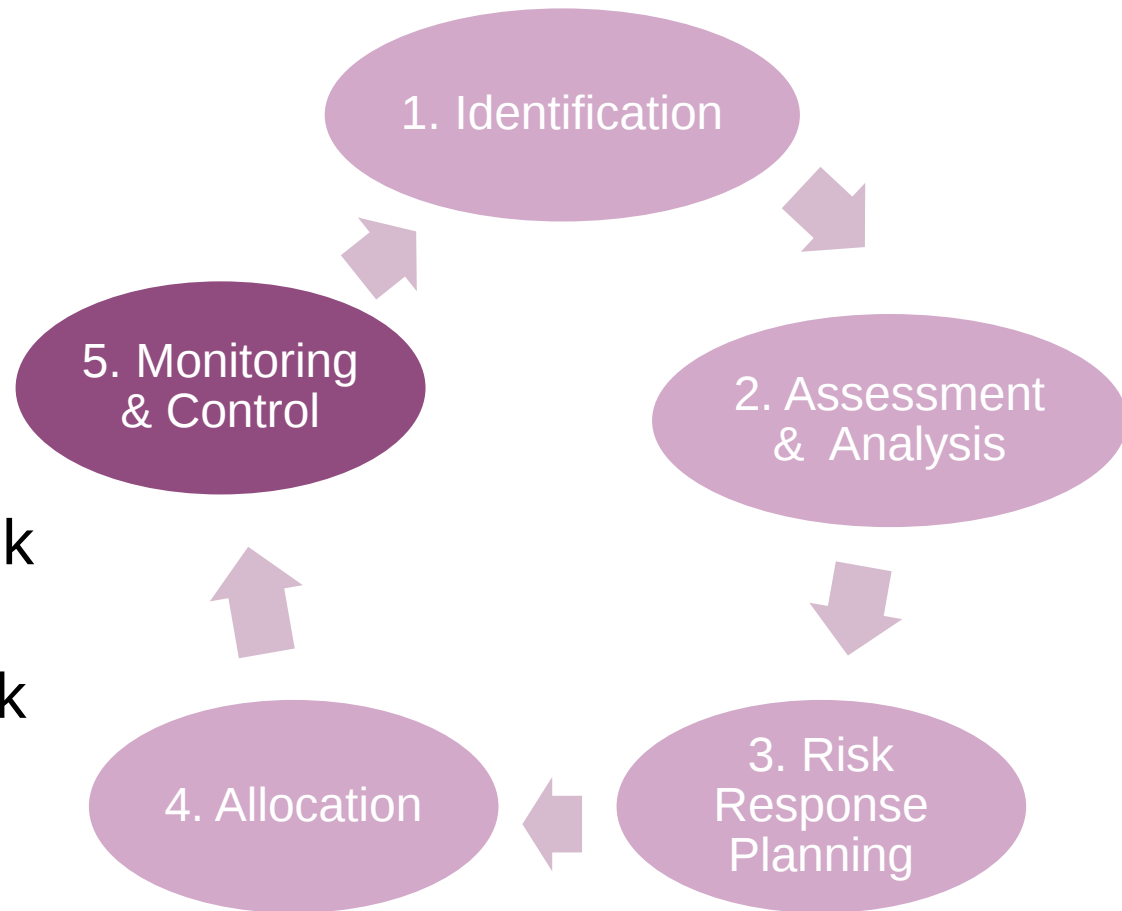
4. Risk Allocation

- Transfer or retain
- Share



5. Risk Monitoring & Control

- Performance metrics to monitor risk
- Understand P3 risk management provisions
- Avoid taking back transferred risks
- Validate previous risk identification, risk assessment, and risk response planning



Audience Feedback

True or False

- The probability and potential consequences of a specific risk must be quantified in order to estimate its cost impact

Questions?

Submit a question using the chat box

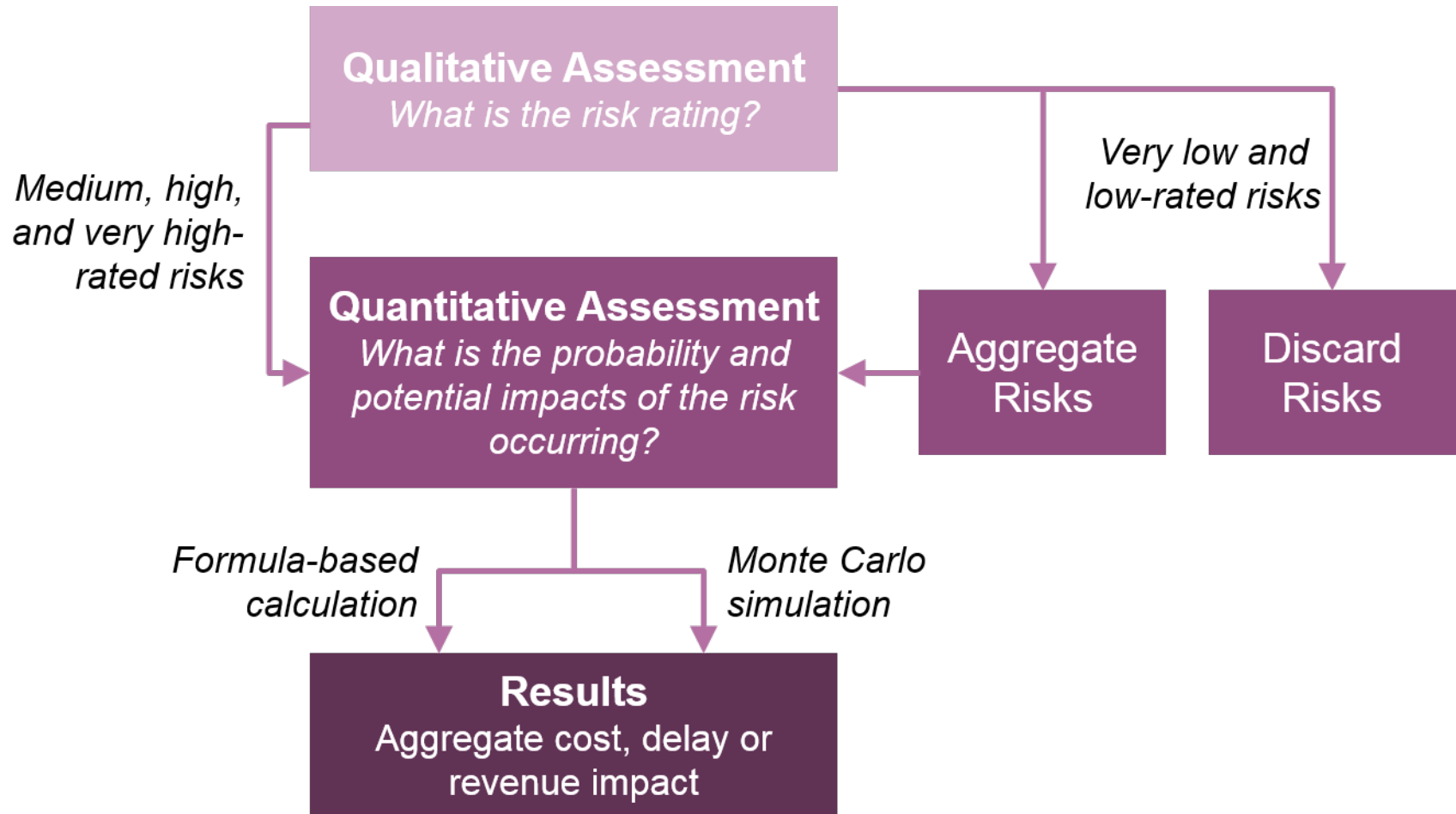




Part 3

Pure Risk Assessment

Pure Risk Assessment Process



Qualitative Assessment

- Probability of risk occurrence
 - Very low
 - Low
 - Medium
 - High
 - Very high
- Scale of impact if risk occurs
 - Very low
 - Low
 - Medium
 - High
 - Very high

Qualitative Assessment Matrix

Example

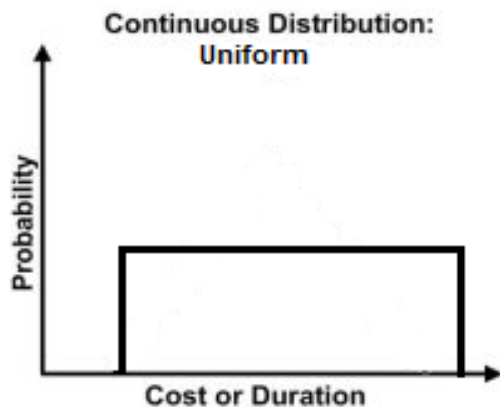
Representative Cost Impact Assessment Matrix						
		Cost Consequence				
		5	4	3	2	1
Probability	Scale	> 25%	10% - 25%	3% - 10%	1% - 3%	<1%
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low
Representative Schedule Impact Assessment Matrix						
		Schedule Consequence				
		5	4	3	2	1
Probability	Scale	> 365 days	120 - 365 days	30 - 120 days	7 - 30 days	< 7 days
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low

Quantitative Assessment

- Probability of risk occurrence
 - % probability (0% - 100%)
- Scale of impact if risk occurs
 - Dollar amount or number of days of delay

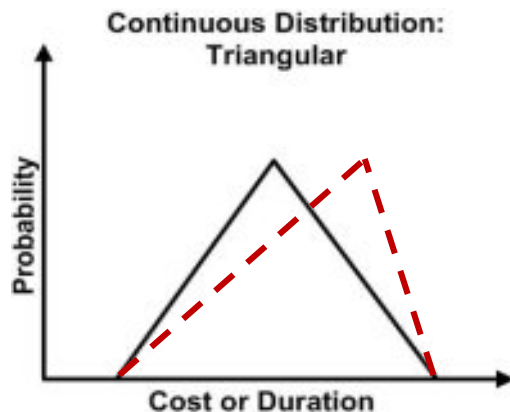
Valuing Pure Risks (Formula-Based)

- Risk Value = Probability X Impact (distribution)
- Example for *uniform* probabilistic impact distribution:
 - Probability of occurrence: 10%
 - Minimum impact: \$2M
 - Maximum impact: \$4M
 - Value = $10\% \times \frac{1}{2} \times (\$2M + \$4M) = \$0.3M$



Valuing Pure Risks (Formula-Based)

- Risk Value = Probability X Impact (distribution)
- Example for *triangular* impact distribution:
 - Probability of occurrence: 10%
 - Minimum impact: \$2M
 - Maximum impact: \$4M
 - Most likely impact = \$3.5
 - Value = 10% x (\$2M + 3.5 + \$4M)/3 = \$0.32M



Aggregate of Pure Risks

- Central limit theorem can be used if pure risks are independent:
 - Distribution of the sum of a sufficiently large number of independent random variables is approximately normal
- To apply central limit theory, variance and mean value of each individual risk must be calculated and added

Central Limit Theorem Applied

Example using uniform risk distributions (P3-VALUE 2.0)

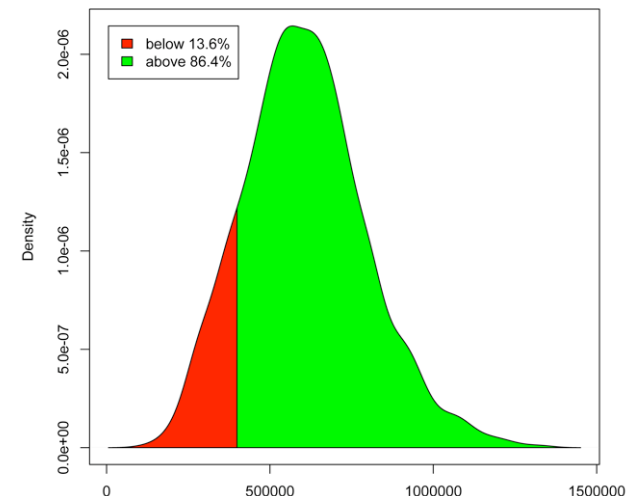
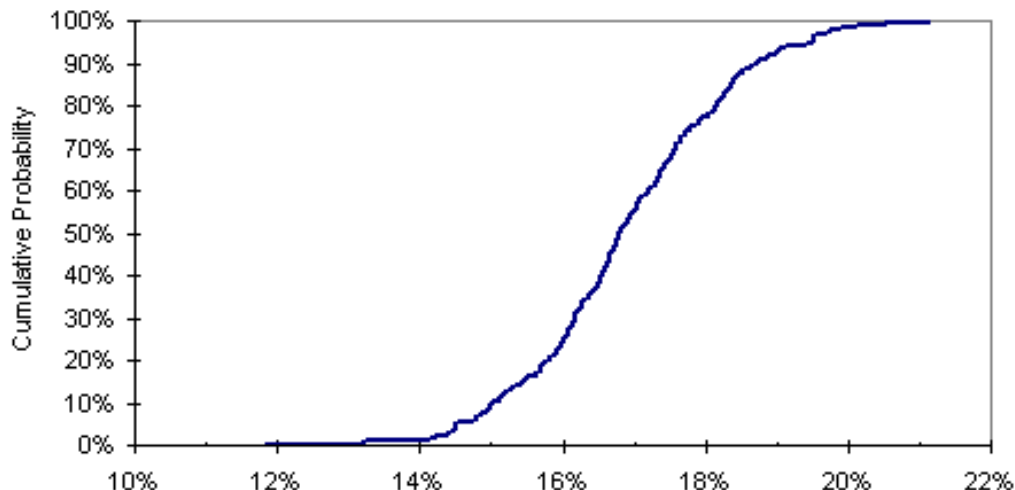
Risk Item	Probability A	Most likely Impact B	Most likely value C = A x B	Minimum value D	Maximum value E	Shape
Risk 1	20%	\$10,000k	\$2,000k	-20%	+50%	Uniform
Risk 2	25%	\$4,000k	\$1,000k	-20%	+50%	Uniform
Risk 3	50%	\$4,000k	\$2,000k	-20%	+50%	Uniform
Risk Item	Minimum value F = C – D%	Maximum value G = C + E%	Mean value* H = ½ x (F + G)	Variance* I = (G – F)² / 12		
Risk 1	\$1,600k	\$3,000k	\$2,300k	\$163,333k		
Risk 2	\$800k	\$1,500k	\$1,150k	\$40,833k		
Risk 3	\$1,600k	\$3,000k	\$2,300k	\$163,333k		
Total	\$4,000k	\$7,500k	\$5,750k	\$376,500k		

- Mean value: \$5,750k, standard deviation of \$606k
- Using Excel NORMINV function, P70 risk value: \$6,068k

Valuing Pure Risks (Monte Carlo)

Monte Carlo simulation

- Simulation of large number of scenarios based on probabilities of risk occurrence and probability distribution of magnitude of impact
- Result is a probability distribution of aggregate risk value
- Provides estimates at confidence levels



Audience Feedback

True or False

- The aggregate impact of pure risks on costs may be estimated either by using a formula-based method or by using Monte Carlo simulation.

Questions?

Submit a question using the chat box





Part 4

Assessment of Lifecycle Performance Risk and Revenue Uncertainty Adjustment

Valuing Lifecycle Performance Risks

Ways to value lifecycle performance risk

- Use information available to Agency on lifecycle performance risk costs/cash flows
- Use market-based P3 financing conditions as a proxy to determine the value of lifecycle performance risk



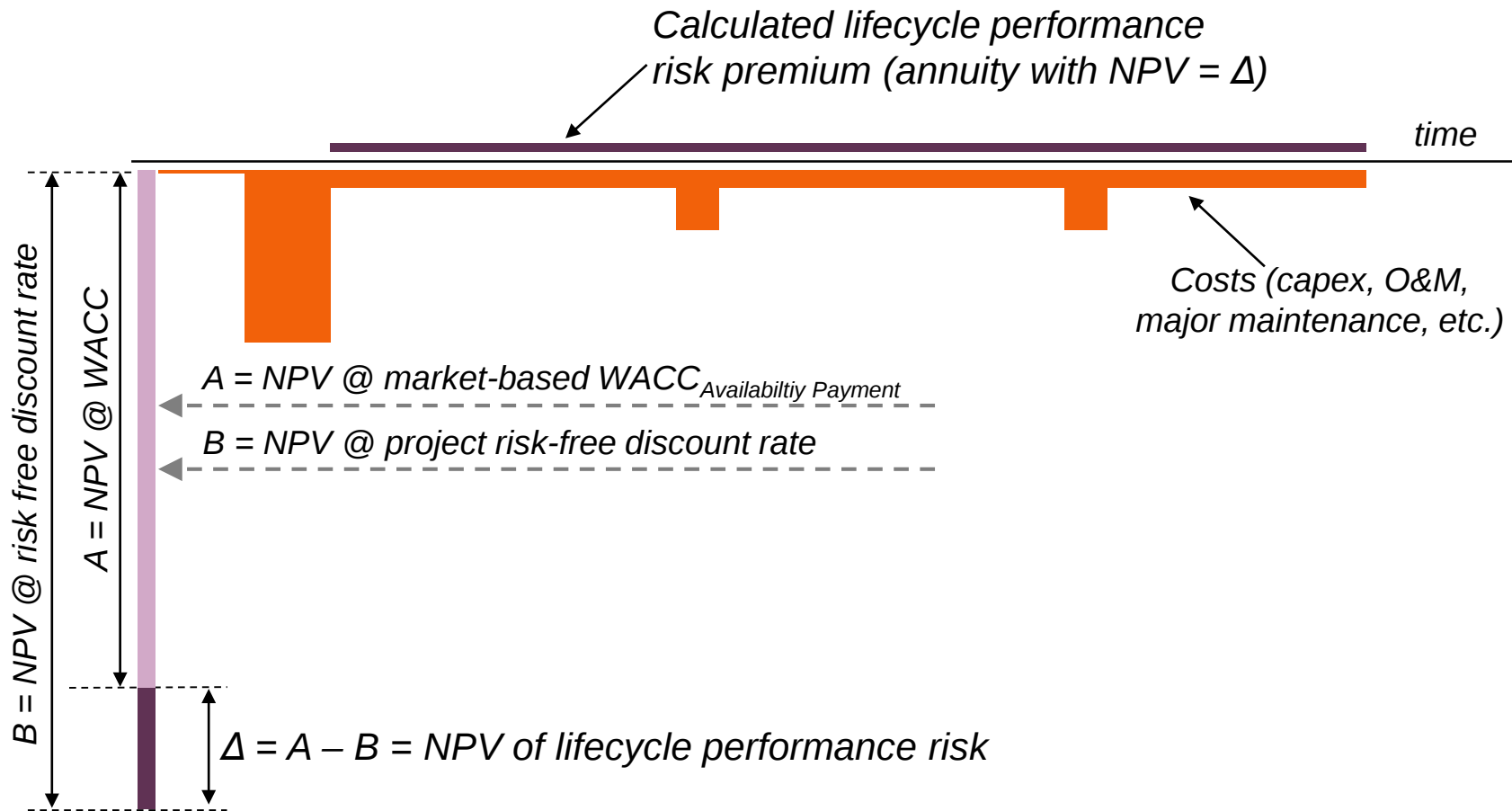
Valuing Lifecycle Performance Risks

Market-based valuation:

- Calculate NPV of cost cash flows*, excluding financing:
 - A. Using a market-based weighted average cost of capital (WACC) that excludes revenue risk (Availability Payment WACC)
 - B. Using project risk-free discount rate
- Calculate difference in NPVs ($\Delta = A - B$)

**Use PSC cash flows for PSC lifecycle performance risk, and P3 cash flows for P3 lifecycle performance risk (used only in PDBCA and risk outputs)*

Lifecycle Performance Risk Valuation



Valuing Revenue Uncertainty

Ways to value revenue uncertainty

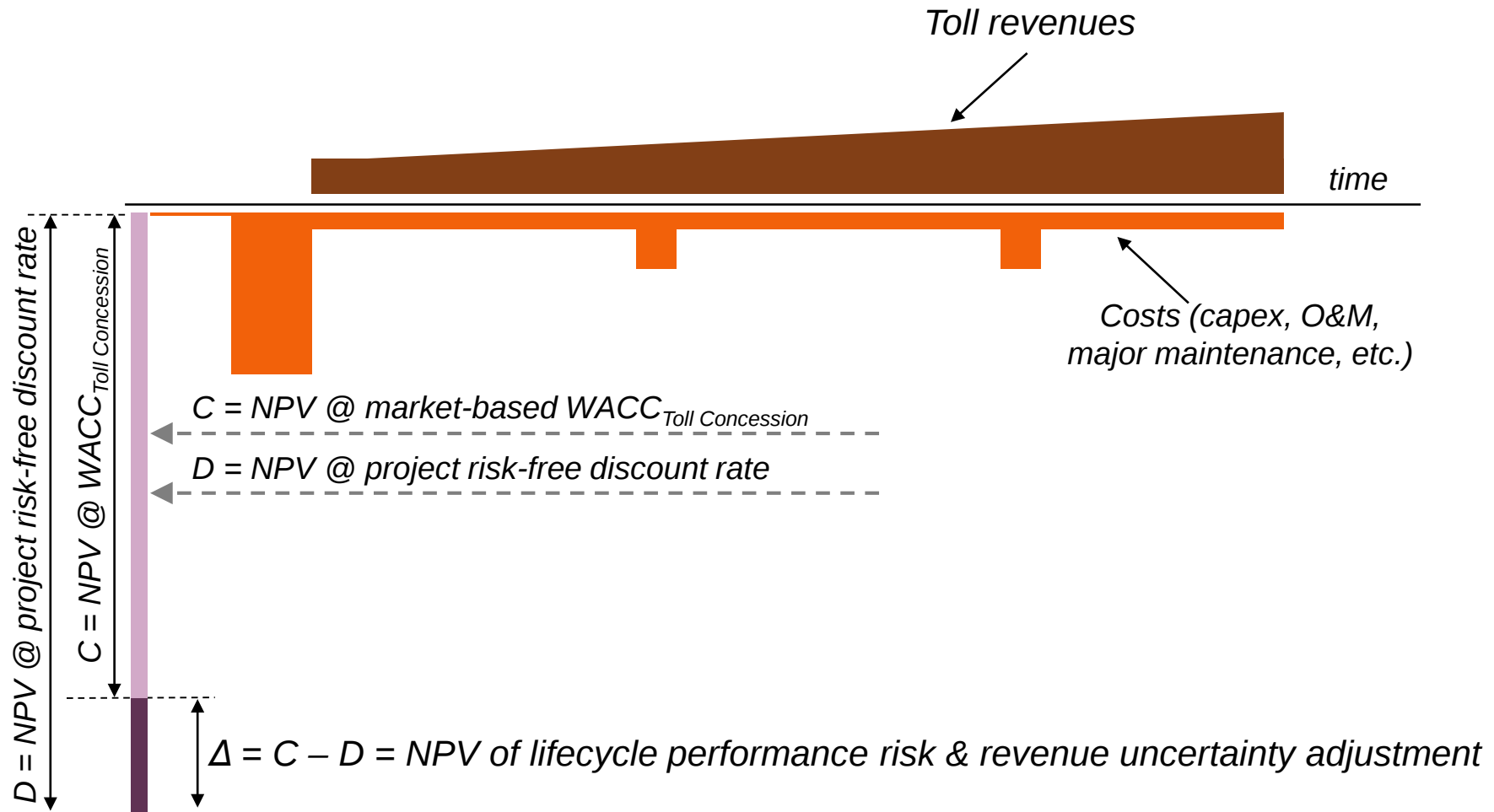
- Apply percentage haircut to P50 traffic/revenues
- Use market-based P3 financing conditions as a proxy to determine the value of revenue uncertainty

Valuing Revenue Uncertainty

Market-based valuation:

- Calculate NPV of revenue and cost cash flows, excluding financing:
 - C. Using a market-based weighted average cost of capital (WACC) that *includes* revenue risk
 - D. Using project risk-free discount rate
- Calculate difference in NPVs ($\Delta = C - D$), which equals the lifecycle performance risk and revenue uncertainty adjustment combined
- NPV of revenue risk is the difference between this Δ and the lifecycle performance risk calculated previously

Revenue Uncertainty Adjustment

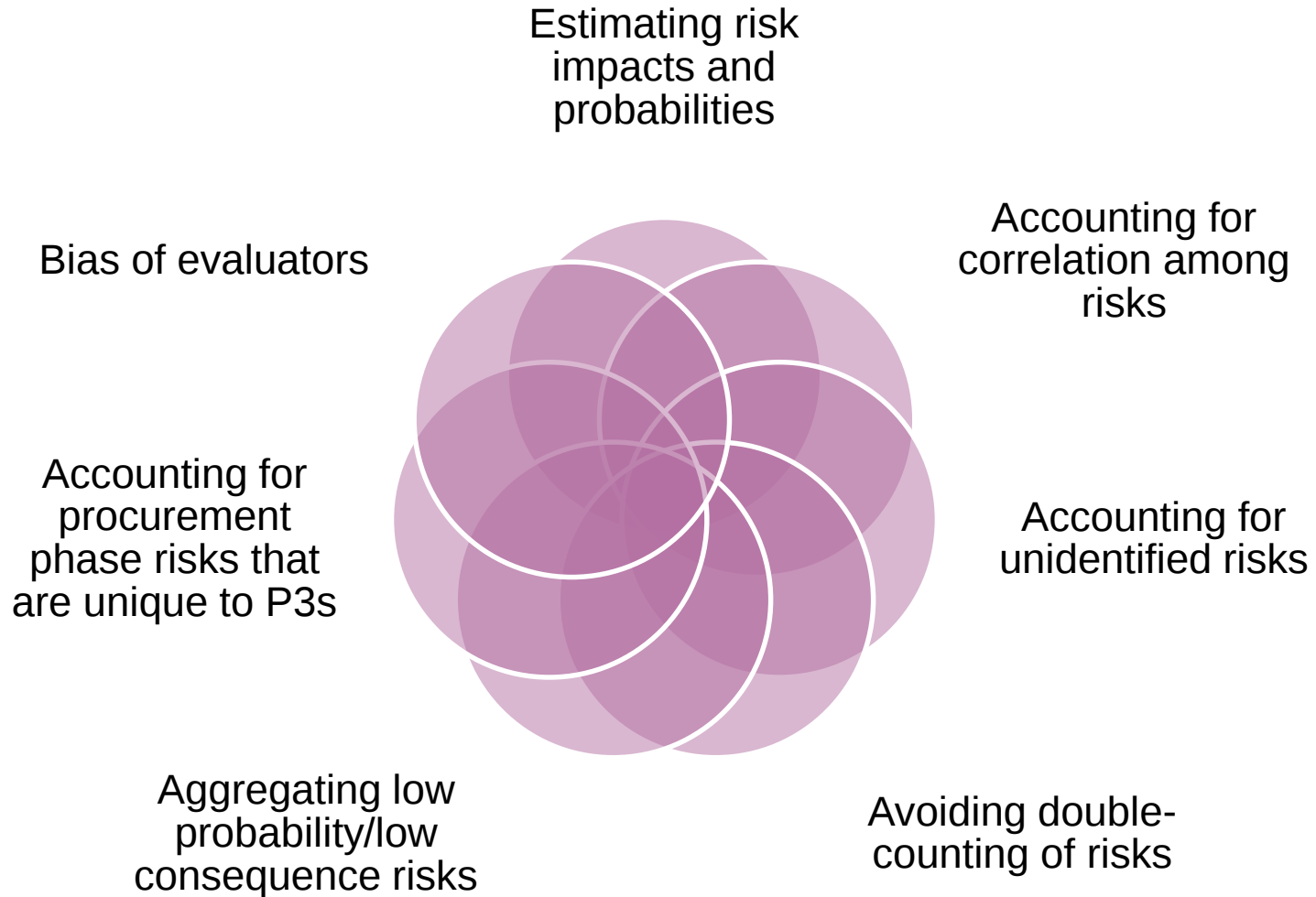




Accounting for Risk in P3-VALUE 2.0

Risk Type	VfM PSC	VfM P3	PDBCA PSC	PDBCA P3
Base variability	✓	✓	✓	✓
Pure risk	✓	✓	✓	✓
Lifecycle performance risk	✓		✓	✓
Revenue risk	✓			

Risk Analysis Challenges



Test Your Knowledge

True or False

- The WACC for a toll concession includes a risk premium that accounts for revenue risk as well as for lifecycle performance risks

Questions?

Submit a question using the chat box





Part 5

Risk Allocation

Risk Transfer by Delivery Type

Procurement Type	Design Risk	Construction Risk	Financial Risk	O&M Risk	T&R Risk
Design-Build (DB)	✓	✓			
Design-Build-Finance (DBF)	✓	✓	✓		
Design-Build-Finance-Operate-Maintain (DBFOM) with Availability Payment	✓	✓	✓	✓	
Design-Build-Finance-Operate-Maintain (DBFOM) with Toll Concession	✓	✓	✓	✓	✓

Typical DBFOM Risk Allocation

Risk	Design-Bid-Build	Availability Payment DBFOM	Toll Concession DBFOM
Design errors	Public	Contractor	Contractor
Change in scope	Public	Public	Public
Delay in permits	Public	Shared	Shared
Delay in right-of-way acquisition	Public	Public	Public
Construction cost overruns	Contractor	Contractor	Contractor
Construction risks	Contractor	Contractor	Contractor
Archeological findings	Public	Public	Public
Delay in relocation of cables & pipes	Public	Contractor	Contractor
Unknown ground conditions	Public	Contractor	Contractor
Hazardous materials	Public	Shared	Shared
Security	Public	Contractor	Contractor
Major maintenance cost overruns	Public	Contractor	Contractor
Snow & ice removal cost overruns	Public	Contractor	Contractor
Regular maintenance	Public	Contractor	Contractor
Traffic information systems	Public	Public	Public
Incident management	Public	Contractor	Contractor
Toll revenue risk	Public	Public	Contractor
Financing risks	Public	Contractor	Contractor
Force majeure	Public	Shared	Shared

Risk Allocation Steps

Step 1: Likelihood

- Which party is best able to control the likelihood of the risk occurring?

Step 2: Impact

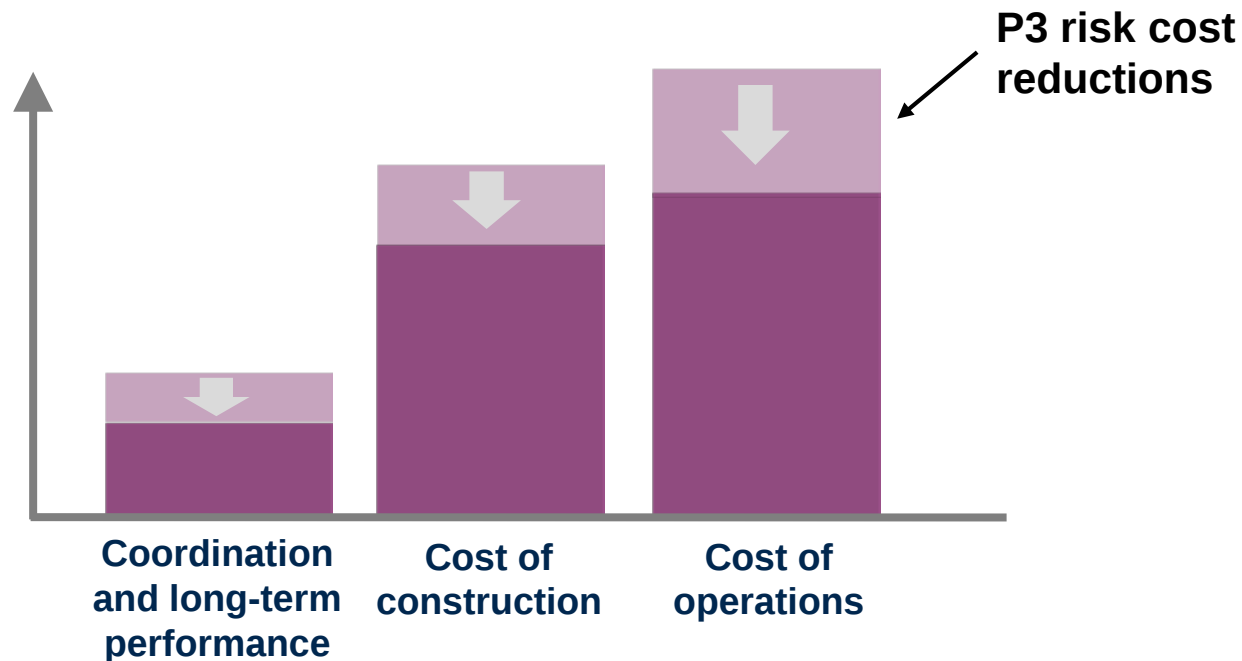
- Which party is best able to control the impact of the risk?

Step 3: Lowest Cost

- Which party is best able to absorb the risk at lowest cost if the likelihood and impact cannot be controlled?

Transferred Risks

- Transferred risks include risks pushed down to subcontractors
- Efficient P3 risk management may reduce overall risk valuation and contingencies



Example Tunnel Project

Risk Category	Risk Allocation		
	Public	Private	Shared
Political	✓		
Financial		✓	
Traffic and Revenue	✓		
Right of Way	✓		
Planning and Permitting			✓
Utilities			✓
Procurement	✓		
Construction		✓	
Operations and Maintenance		✓	
Hand-Back		✓	
Force Majeure			✓
Change in Law	✓		
Geotechnical			✓

Test Your Knowledge

True or False

- The public agency's goal in risk allocation should be to transfer all risks to the private partner in a P3.

Questions?

Submit a question using the chat box

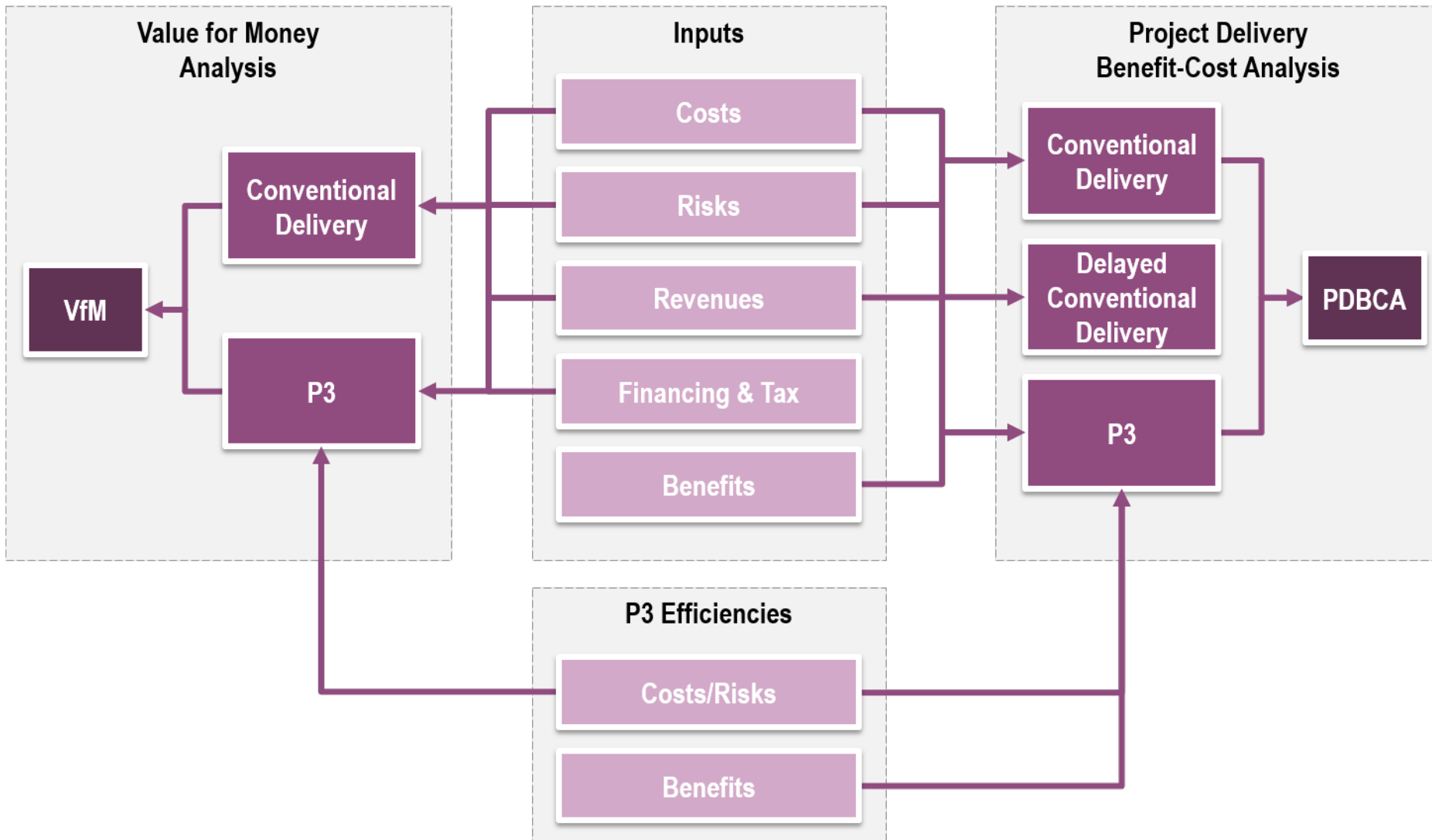




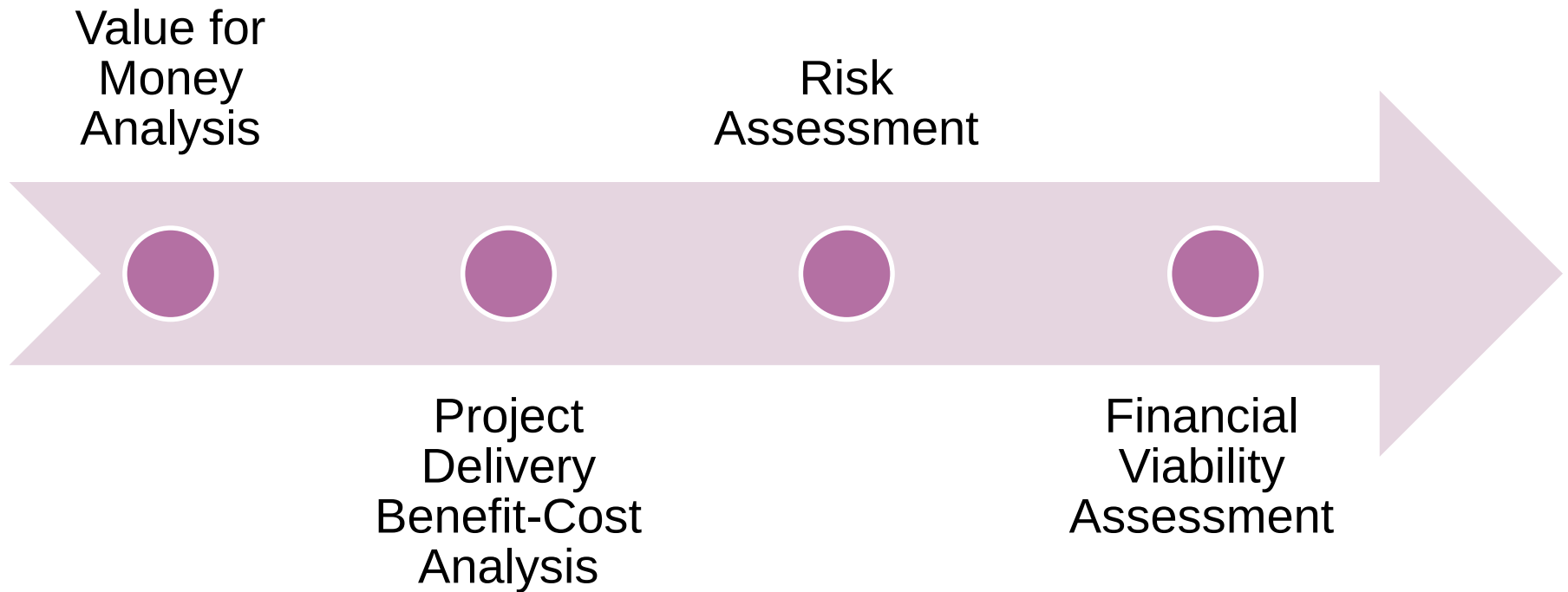
Part 6

Using P3-VALUE 2.0 for Risk Assessment

FHWA's P3-VALUE 2.0



Training Modules



Training Navigator User Interface

Training Navigator

Welcome

Welcome to the P3-VALUE 2.0 Training Navigator!
Please select one of the four training modules below.

If you would like to access the full P3-VALUE 2.0 model,
click the "Go to Model Navigator" button on the right.

Go to
Model Navigator

Training Module Selection

Module 1
Value-for-Money Analysis

Module 2
Project Delivery
Benefit-Cost Analysis

Module 3
Risk Assessment

Module 4
Financial Viability
Assessment

Inputs

InpTiming&Cost: Project timing and cost inputs
InpSeries: Construction, ramp-up and milestone payments time series inputs
InpFin: Financial inputs
InpRisk: Risk inputs

Outputs

Risk Output for VfM: Risk outputs related to VfM
Risk Output for PDBCA: Risk outputs related to PDBCA

Training Module selection

Input sheet selection

Output sheet selection



Demonstration of Risk Module

Please stand by as we open the Excel file

Questions?

Submit a question using the chat box





Webinar Summary



Webinar Recap

- Part 1 Categorizing Risk
- Part 2 Risk Management Process
- Part 3 Pure Risk Assessment
- Part 4 Lifecycle Performance and Revenue
Uncertainty Risk Assessment
- Part 5 Risk Allocation
- Part 6 Using P3-VALUE 2.0 for Risk Assessment

Tool and References

P3-VALUE 2.0 Excel
Spreadsheet

User Guide

Risk Assessment
Primer &
Guidebooks



Upcoming P3-VALUE Training

- **Exercise review – March 14 at 12:30pm EST**
- **March 21** Financial Viability Assessment
- Exercise instructions may be downloaded from the web room
- Technical assistance options:
 - E-mail questions to: patrick.decorla-souza@dot.gov
 - Or call (202)-366-4076
 - Participate in “Exercise Review” webinar

To access the Exercise Review webinar, please use the following link and telephone number:

- ***Link: <https://connectdot.connectsolutions.com/p3>***
- ***Telephone: 1-888-363-4749, Passcode: 6139168#***



Resources

FHWA's Office of Innovative Program Delivery Website:

<http://www.fhwa.dot.gov/ipd/>

P3 Website:

<http://www.fhwa.dot.gov/ipd/p3/>

Questions?

Submit a question using the chat box





Contact Information

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