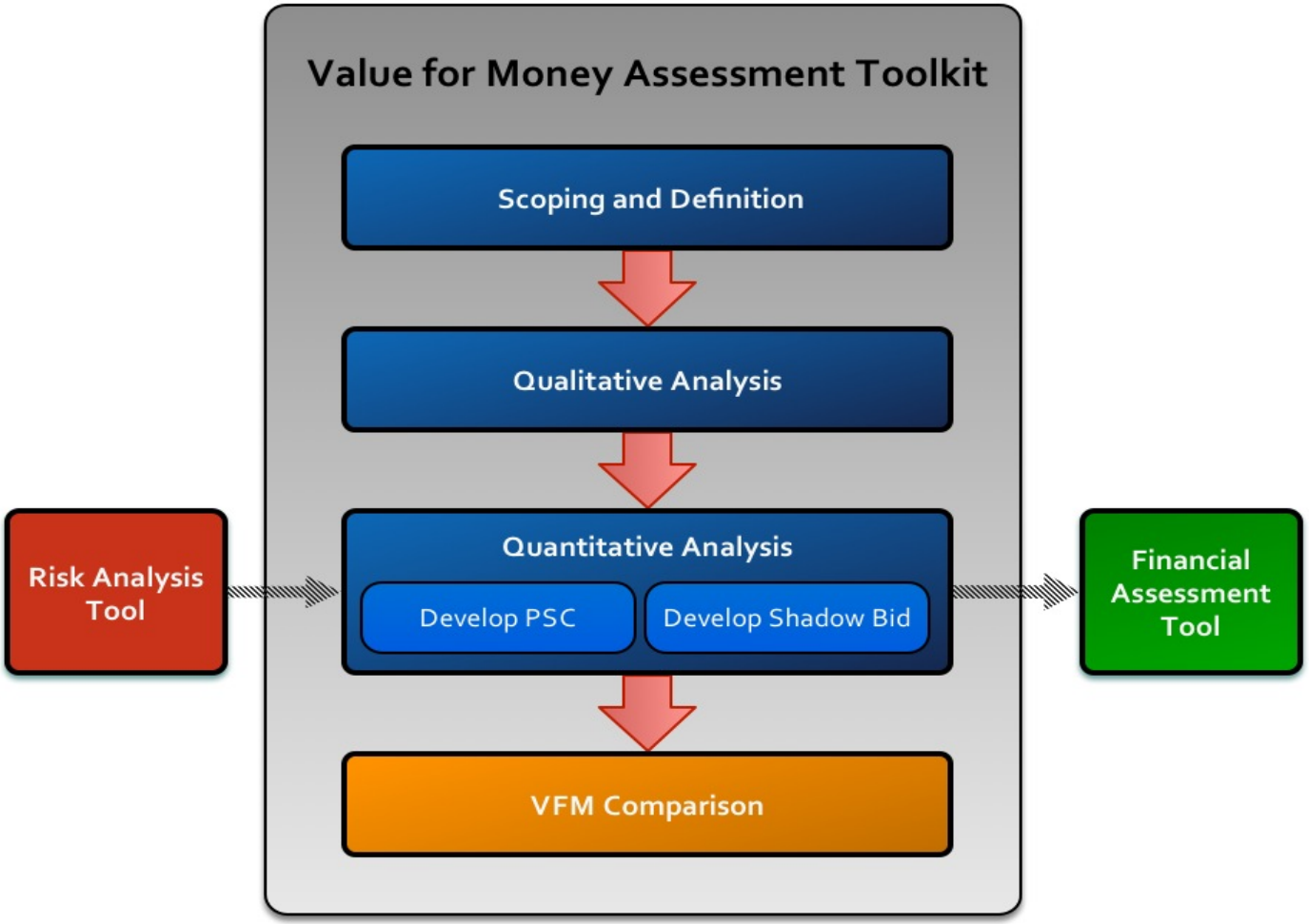
Risk Assessment for P3s

October 21, 2014

Maryland DOT -- P3 Workshop

Risk in the Context of VfM Assessment



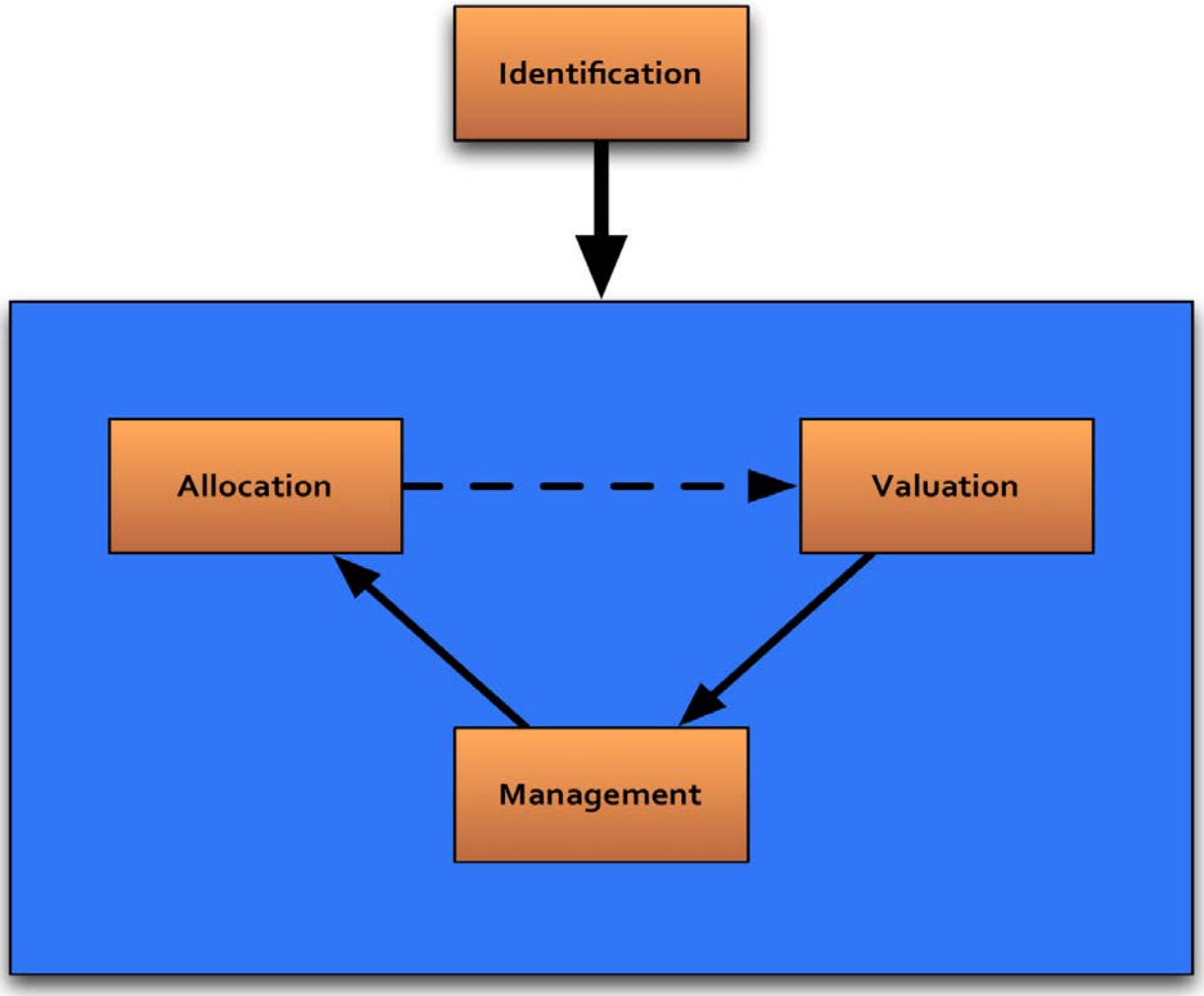
Session Objectives

- Gain the ability to:
  - Better explain the concepts of risk assessment and allocation
  - Coordinate and monitor a team of specialized advisors

Risk Assessment Objectives

- Within the larger purpose of project management, risk assessment has three different goals:
  - Realistic risk valuation as part of financial feasibility analysis and VfM assessment;
  - Effective risk management measures and strategies; and
  - Appropriate risk allocation to be used in structuring a contract.

Key Elements of Risk Assessment



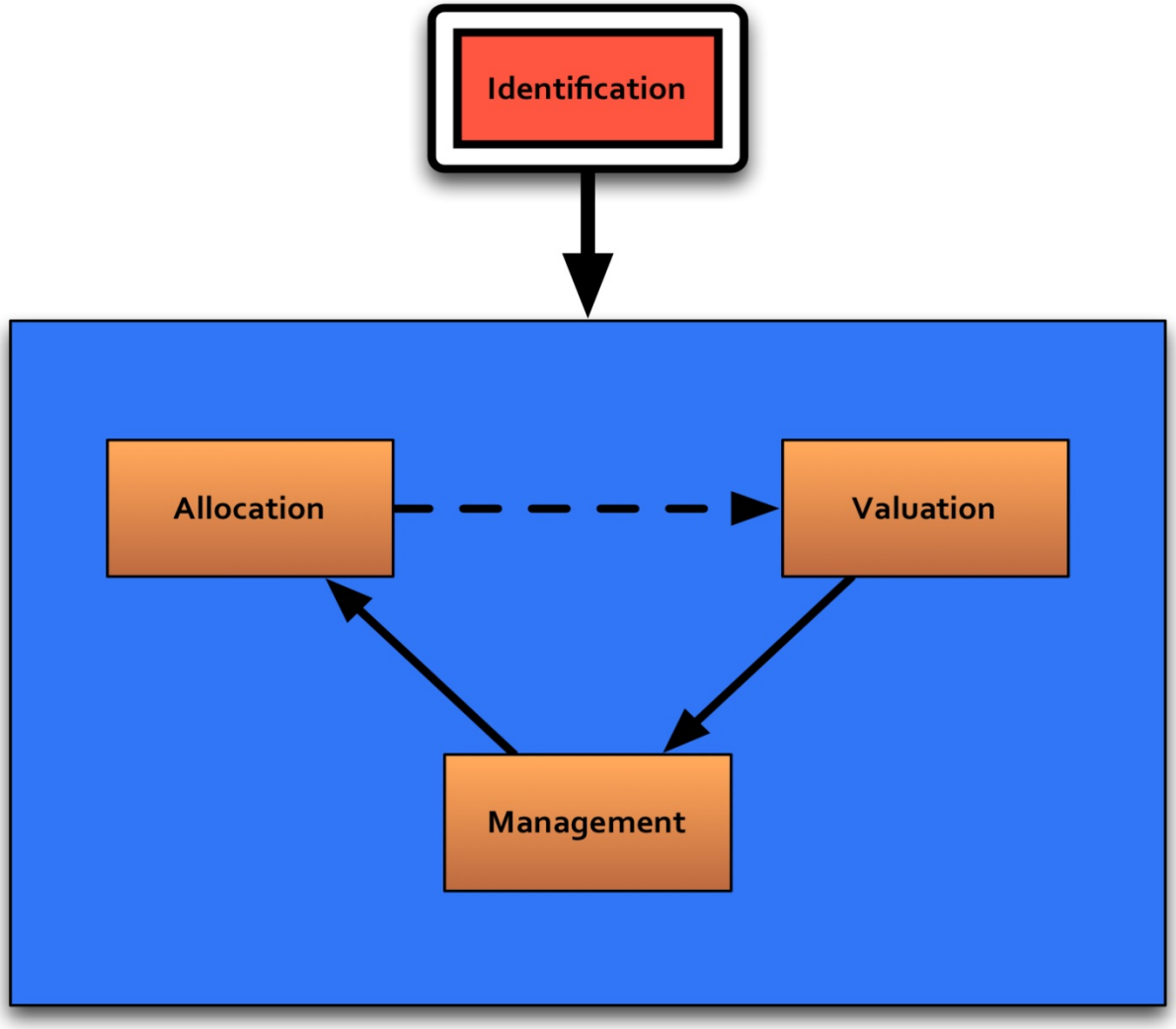
Session Outline

Part I	Risk Identification
Part II	Risk Management
Part III	Risk Allocation
Part IV	Risk Categorization
Part V	Risk Valuation

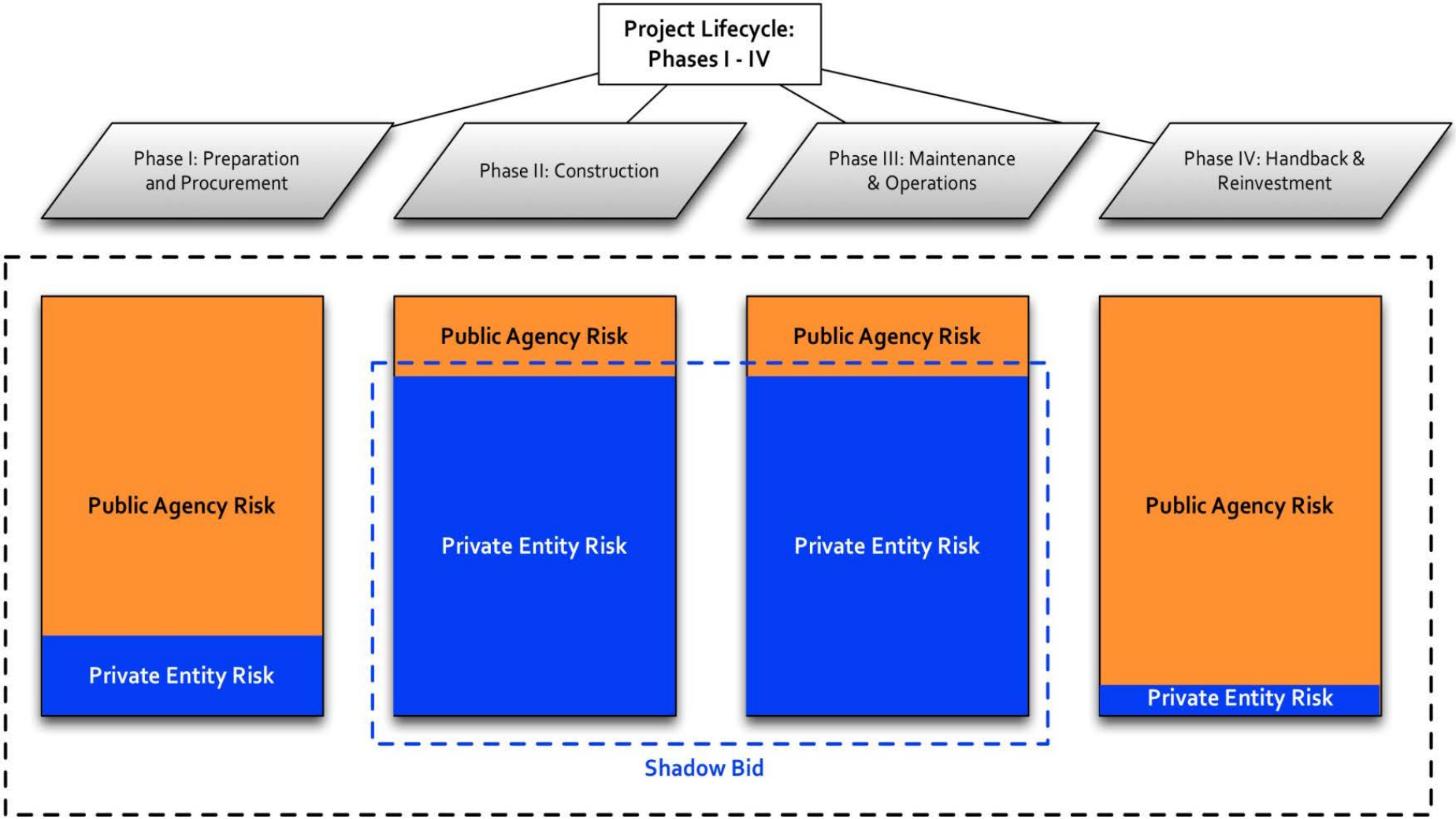
Part I

Risk Identification

Part I – Risk Identification



Scope Definition is the Starting Point



Identifying All Risks is the Challenge

Checklist #1: Issues:

✓Financial and economic
✓Legal
✓Permitting
✓Social and societal
✓Technical and technological
✓Organizational
✓Spatial and geographical
✓Demographical
✓Environmental and ecological
✓Political
✓Public safety

Checklist #2 Project phases:

- ✓ Commissioning
- ✓ Design
- ✓ Engineering
- ✓ Construction
- ✓ Operation
- ✓ Maintenance
- ✓ Major maintenance
- ✓ Handback

Checklist #3 P3 agreement:

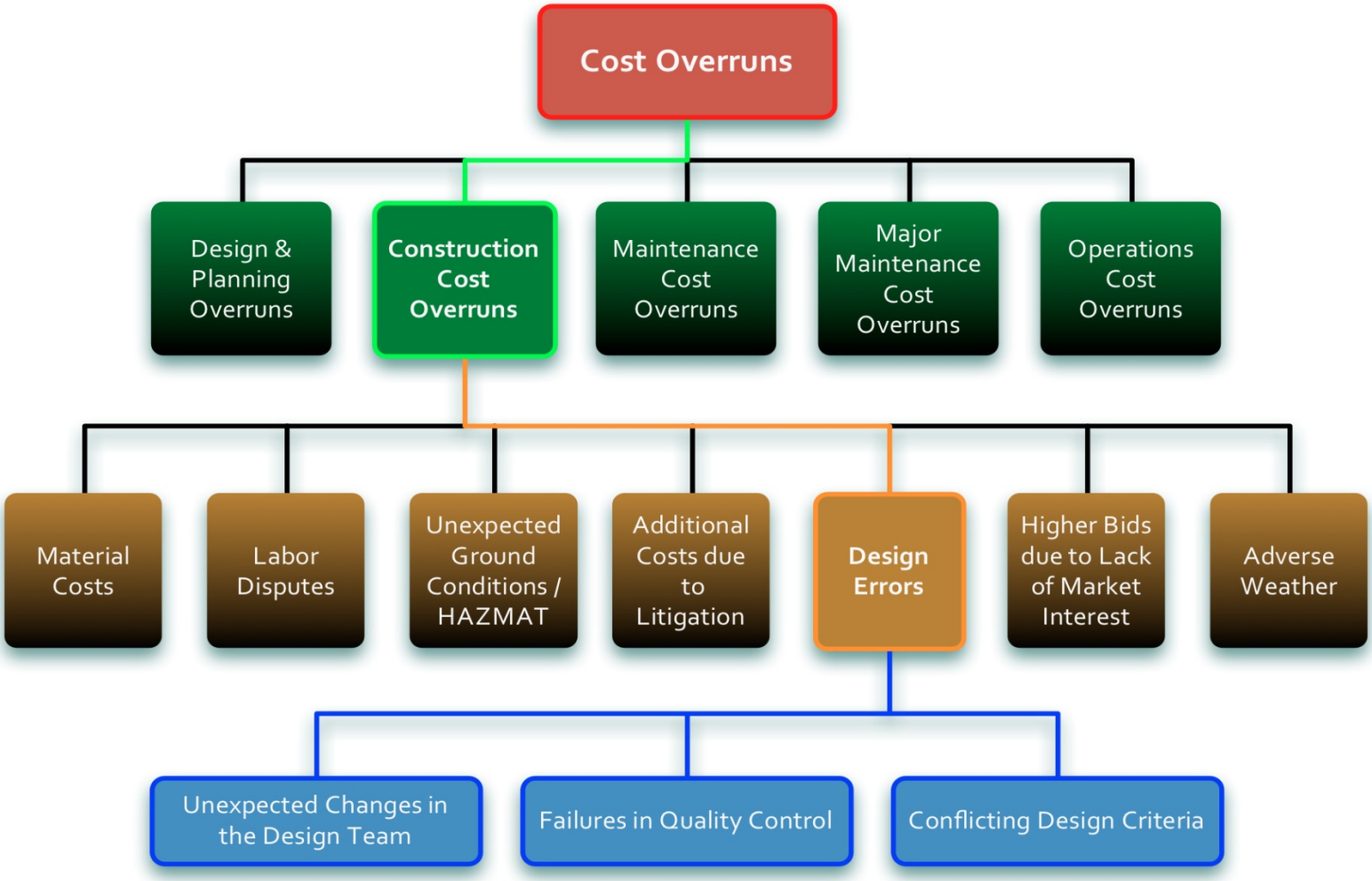
- ✓ Compensation event
- ✓ Delay event
- ✓ Force majeure

Prioritization is Key in Risk Management

			Cost Consequence				
			Greater than 25%	10% to 25%	3% to 10%	1% to 3%	Less than 1%
	Scale		5	4	3	2	1
Probability	Greater than 70%	5	Very High	High	High	Medium	Low
	40% to 70%	4	High	High	Medium	Medium	Low
	20% to 40%	3	High	Medium	Medium	Low	Low
	5% to 20%	2	Medium	Medium	Low	Low	Low
	0% to 5%	1	Low	Low	Low	Low	Very Low

Source: Virginia DOT's PPTA Risk Analysis Guidance, September 2011

Risk Relation Map Provides Structure



Exercise 1

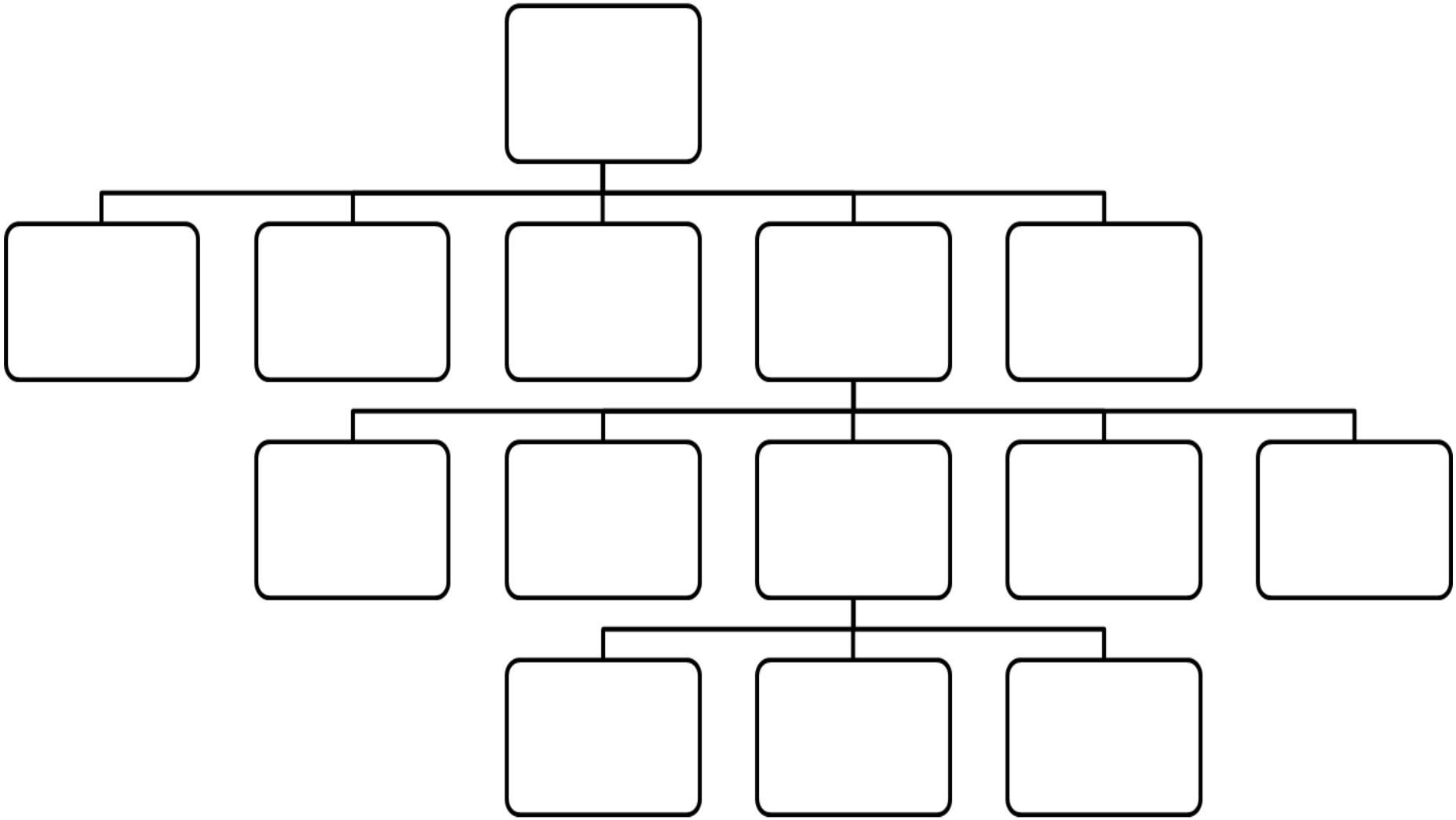
Risk Relation Map

Plan for Exercise 1: Risk Relationship Map

Diagram the hierarchical relations of a set of project risks through a Risk Relation Map.

1. Work in teams and select a project known to your team
2. Define sub-components of Completion Delays.
3. Diagram the relationships among these risks through a Risk Relation Map.

Exercise 1: Risk Relation Map

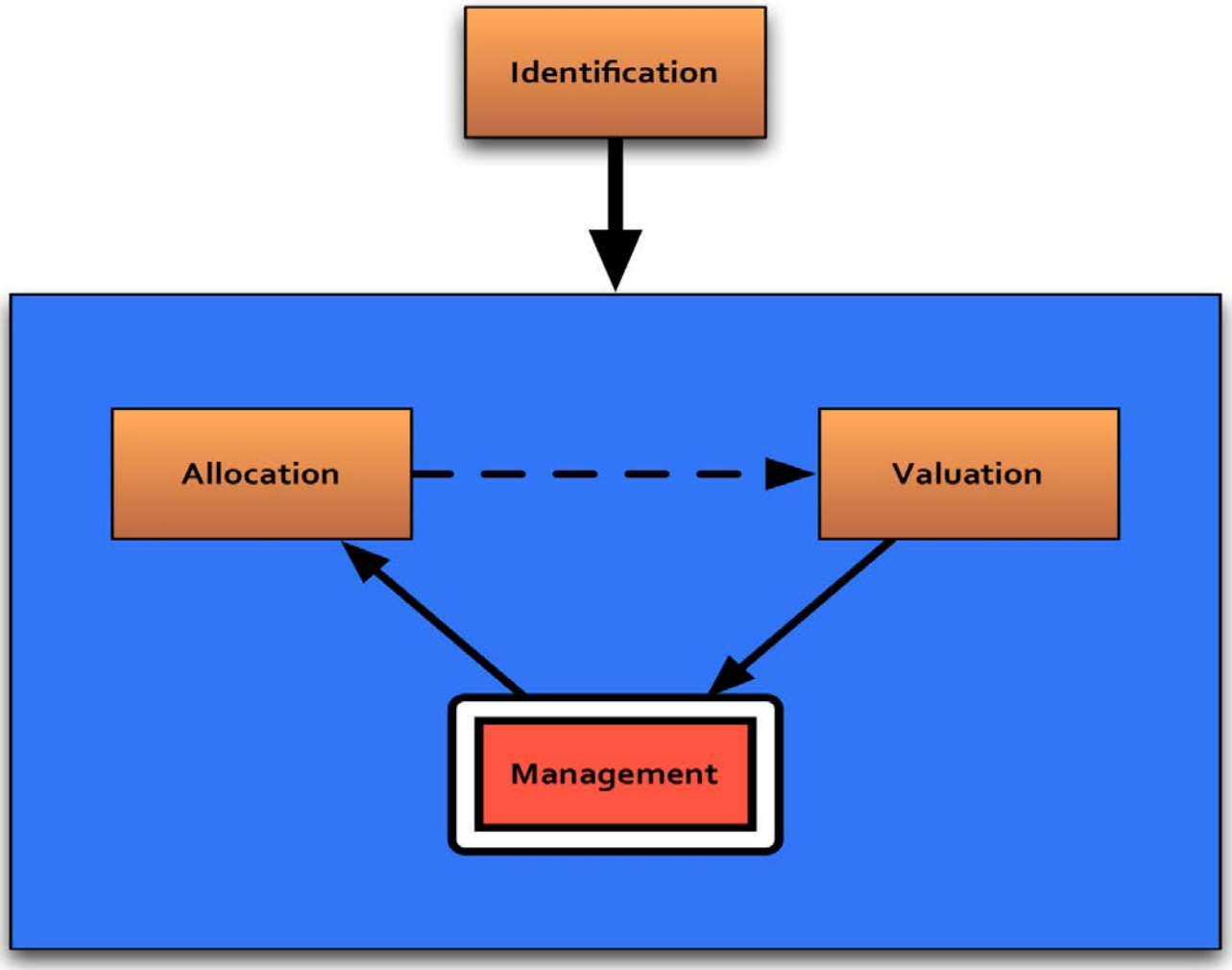


Discussion, Questions and Comments

Part II

Risk Management

Part II – Risk Management



Risk Management Steps

1. Decide on which risks to actively manage
2. Define risk management measures
3. Select and implement risk management measures

Exercise 2

Risk Management

Plan for Exercise 2: Risk Mitigation

1. Work in teams and select a project known to your team
2. Review the list of project risks on the next two slides.
3. Determine risk mitigation measures, and record your answers.

Exercise 2 Results: Risk Mitigation

No.	Description	Risk mitigation measure
1	Design errors	
2	Change in scope	
3	Interest rate risk	
4	Construction cost overruns	
5	HAZMAT discovered on acquired ROW	
6	Maintenance has to occur more often	
7	Competing facilities	

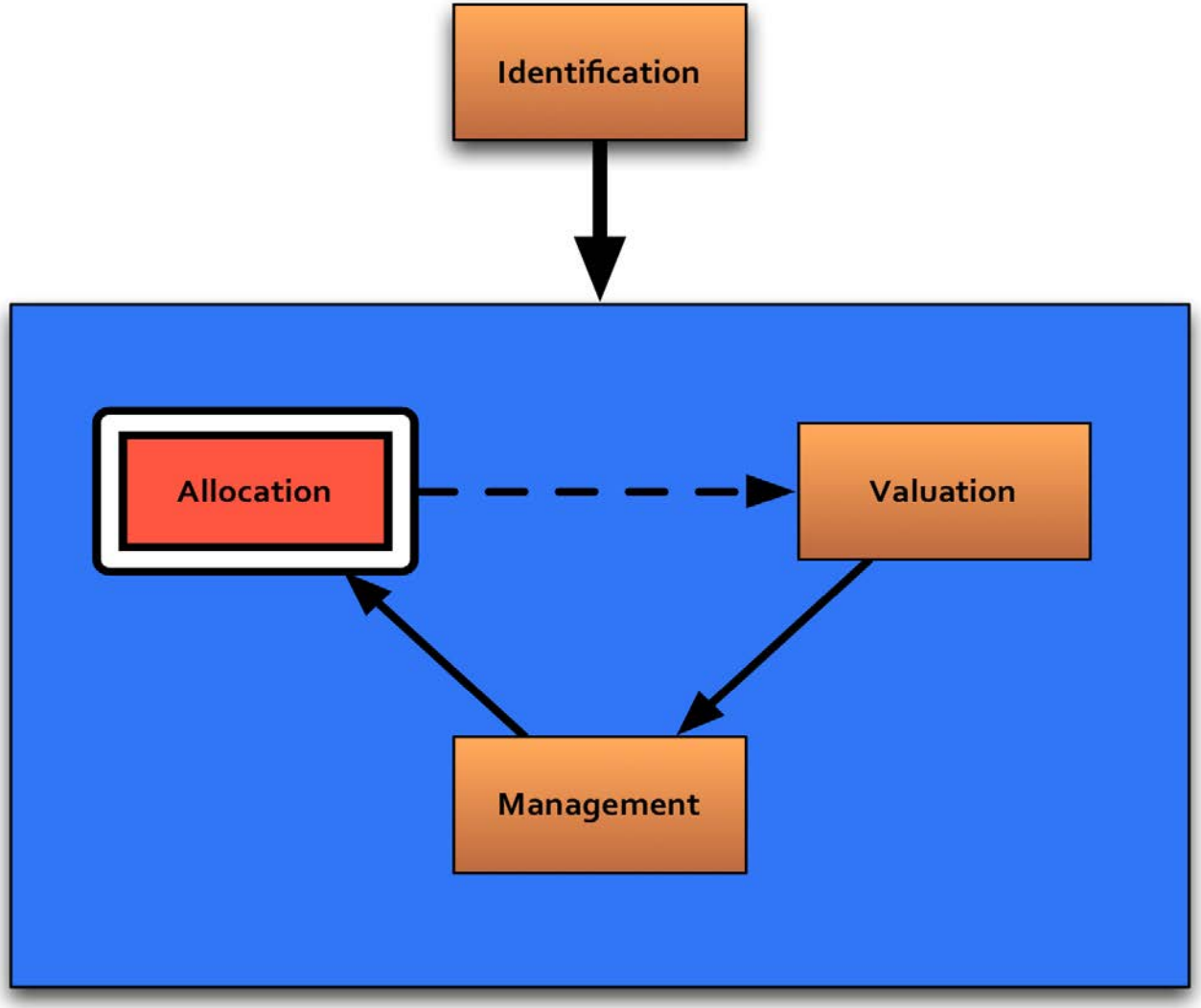
Exercise 2 Results: Risk Mitigation

No.	Description	Risk mitigation measure
8	Inflation higher than expected	
9	10 day unavailability road due to tornado	
10	Inaccurate reference information	
11	Insolvency of O&M contractor	
12	Different interpretation of contract terms	
13	Toll system breaks down	
14	Change in technology standards	

Part III

Risk Allocation

Part III – Risk Allocation



Risk Allocation Principles

Step 1 "likelihood"	Firstly, risk should be allocated to the party best able to control the likelihood of the risk occuring.
Step 2 "impact"	Secondly, risk should be allocated to the party best able to control the impact of the risk on project outcomes.
Step 3 "lowest cost"	Thirdly, risk should be allocated to the party best able to absorb the risk at lowest cost if the likelihood and impact cannot be controlled.

Additional Risk Allocation Questions

- **Similar contracts:** Are there specific reasons to deviate from the risk allocation that has been chosen in earlier transactions and described in the model P3 contracts?
- **Marketability:** Are there any reasons to assume that the private sector will not accept the risk, or price the risk at an unreasonably high value?
- **Incentives:** Do any of the potential risk allocation mechanisms create unintended incentives for the private sector?
- **Holistic approach:** Do any of the potential risk allocation mechanisms create "gray areas" in terms of responsibility?

Typical Risk Allocation

Risk	Design - Bid - Build	Availability Payment P3	Toll Concession P3
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 and pipes	Public	Contractor	Contractor
Unknown ground conditions	Public	Contractor	Contractor
Hazmat	Public	Shared	Shared
Security	Public	Contractor	Contractor
Major maintenance cost overruns	Public	Contractor	Contractor
Snow and 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

Exercise 3

Risk Allocation

Plan for Exercise 3: Risk Allocation

1. Work in teams and select a project known to your team
2. Use the list of project risks on the next 2 slides to allocate them to the party best able to manage them, and record your answers:

- Step 1: Identify which party is better able to control the likelihood of the risk occurring:
  - If there is no difference, go to step 2
- Step 2: Identify which party is better able to manage the impact of the risk on project outcomes
  - If there is no difference, go to step 3
- Step 3: Identify which party is best able to absorb the risk at lowest cost if the likelihood and impact cannot be controlled.

Exercise 3 Results: Risk Allocation *

No.	Description	Public	Private	Shared
1	Design errors			
2	Change in scope			
3	Interest rate risk			
4	Construction cost overruns			
5	HAZMAT discovered on acquired ROW			
6	Maintenance has to occur more often			
7	Competing facilities			

** Mark with an "X" based on in to which party you think the risk should be allocated*

Exercise 3 Results: Risk Allocation *

No.	Description	Public	Private	Shared
8	Inflation higher than expected			
9	10 day unavailability road due to tornado			
10	Inaccurate reference information			
11	Insolvency of O&M contractor			
12	Different interpretation of contract terms			
13	Toll system breaks down			
14	Change in technology standards			

* ***Mark with an "X" based on in to which party you think the risk should be allocated***

Part IV

Risk Categorization

Categorization Supports Valuation

Exercise 4

Risk Categorization

Plan for Exercise 4: Categorize Risks

Review the list of risks in the Risk Register on next two slides, and categorize them:

- Decision uncertainties
- Systematic risks
- Pure risks
- Regular uncertainties

Exercise 4 Results: Risk Categorization *

No.	Description	Dec. Unc.	Syst. Unc.	Pure risks	Reg. Unc.
1	Design errors				
2	Change in scope				
3	Interest rate risk				
4	Construction cost overruns				
5	HAZMAT discovered on acquired ROW				
6	Maintenance has to occur more often				
7	Competing facilities				

* ***Mark with an "X" the risk categorization you believe is appropriate***

Exercise 4 Results: Risk Categorization *

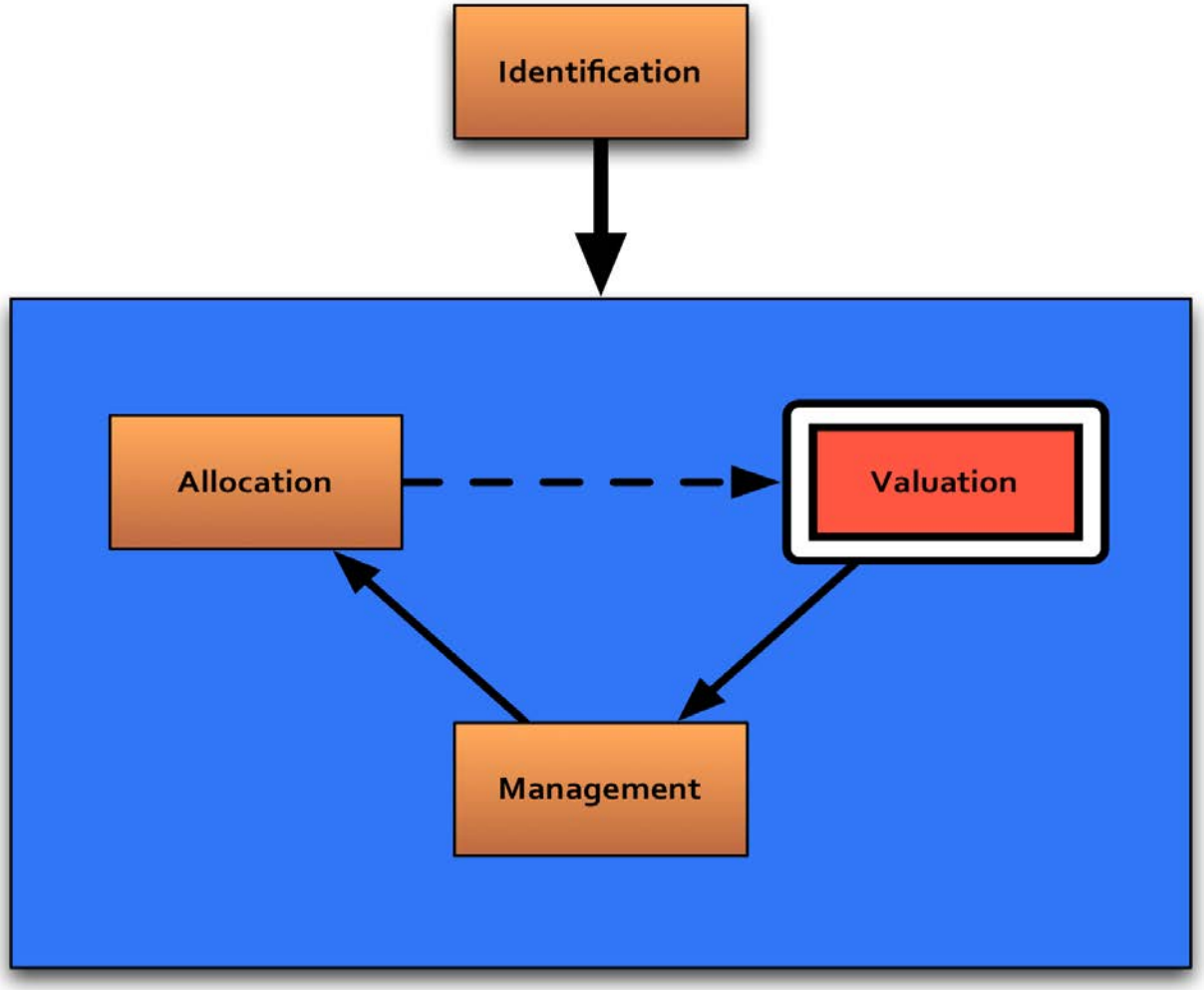
No.	Description	Dec. Unc.	Syst. Unc.	Pure risks	Reg. Unc.
8	Inflation higher than expected				
9	10 day unavailability road due to tornado				
10	Inaccurate reference information				
11	Insolvency of O&M contractor				
12	Different interpretation of contract terms				
13	Toll system breaks down				
14	Change in technology standards				

* ***Mark with an "X" the risk categorization you believe is appropriate***

Part V

Risk Valuation

Part V – Risk Valuation



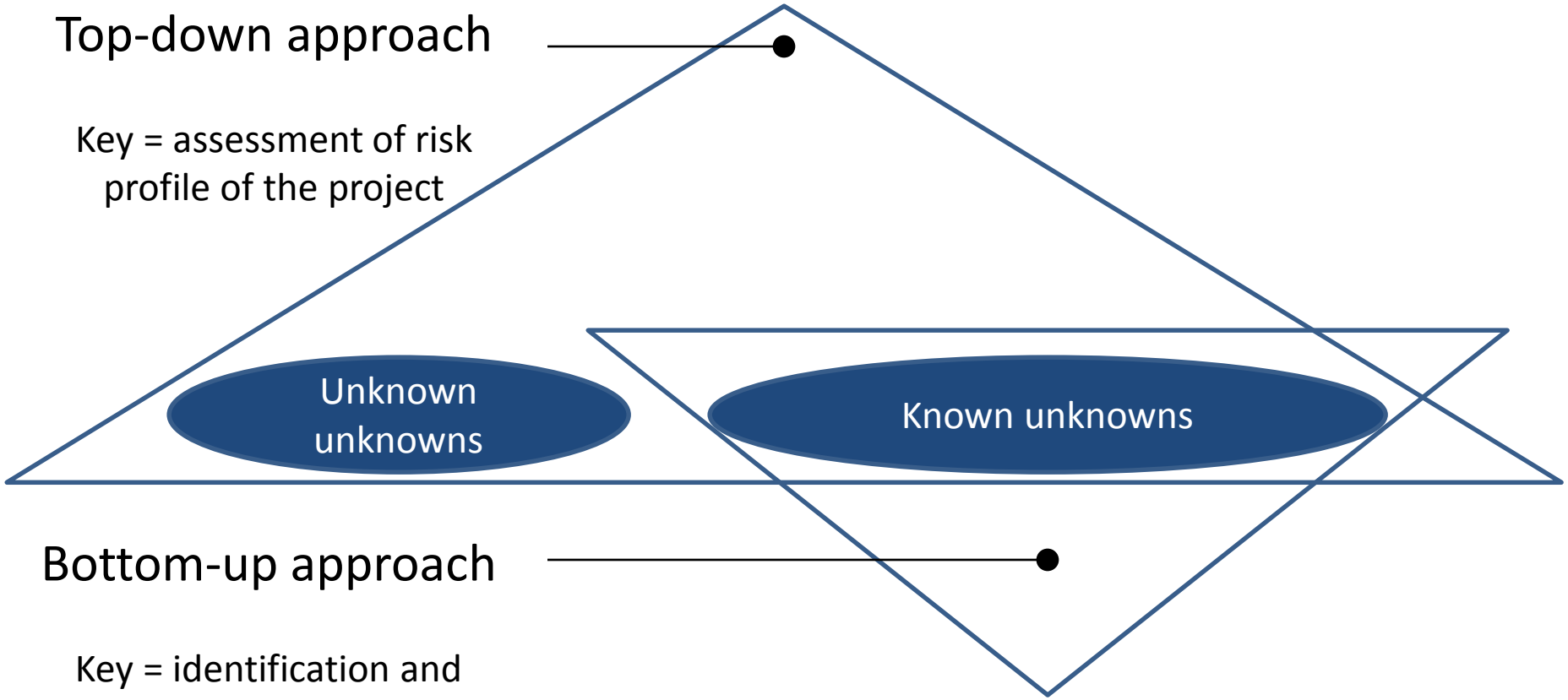
Categorization Supports Valuation

Category	Theoretical Method	Market-based Method
Decision Uncertainties	• No valuation, just multiple scenario analysis	• Not Applicable
Process risks	• No valuation, just multiple scenario analysis	• Not Applicable
Systematic uncertainties	• Beta analysis on the basis of CAPM • Probability distribution (Monte Carlo) and realistic confidence level on market related cost and revenue estimates	• Market-based risk premium in the discount rate on the basis of the WACC (weighted average cost of capital)
Pure risks	• Probability x damage • Typical contingency in cost estimate • Probability distribution (Monte Carlo) and realistic confidence level on pure risks	• Insurance premiums • Cost estimate risk mitigation measures • Market-based mark-up for risk profile
Regular uncertainties	• Probability distribution (Monte Carlo) and realistic confidence level on cost and revenue estimates • Typical allowance in cost estimate	• Market-based mark-up for uncertainties

Top-Down in Addition to Bottom-Up

Top-down approach

Key = assessment of risk profile of the project

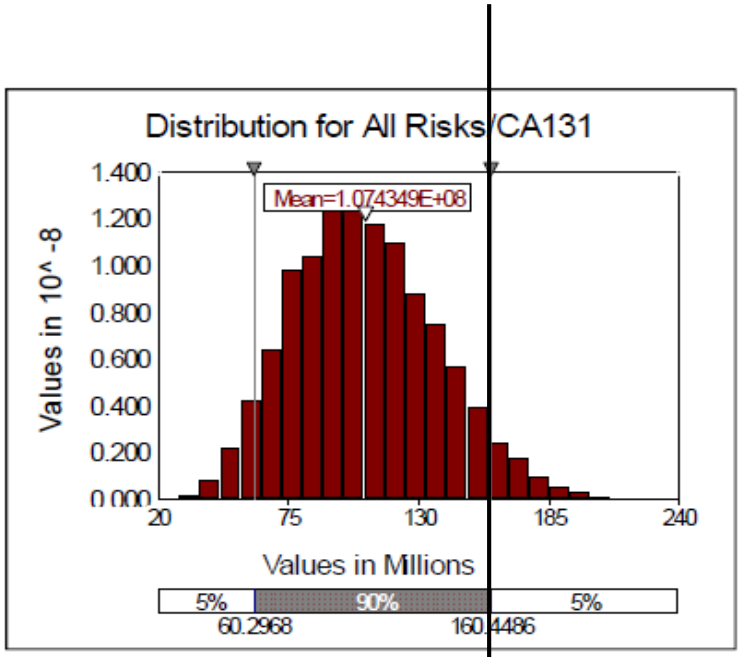


Bottom-up approach

Key = identification and assessment of individual risks

Probability Analysis

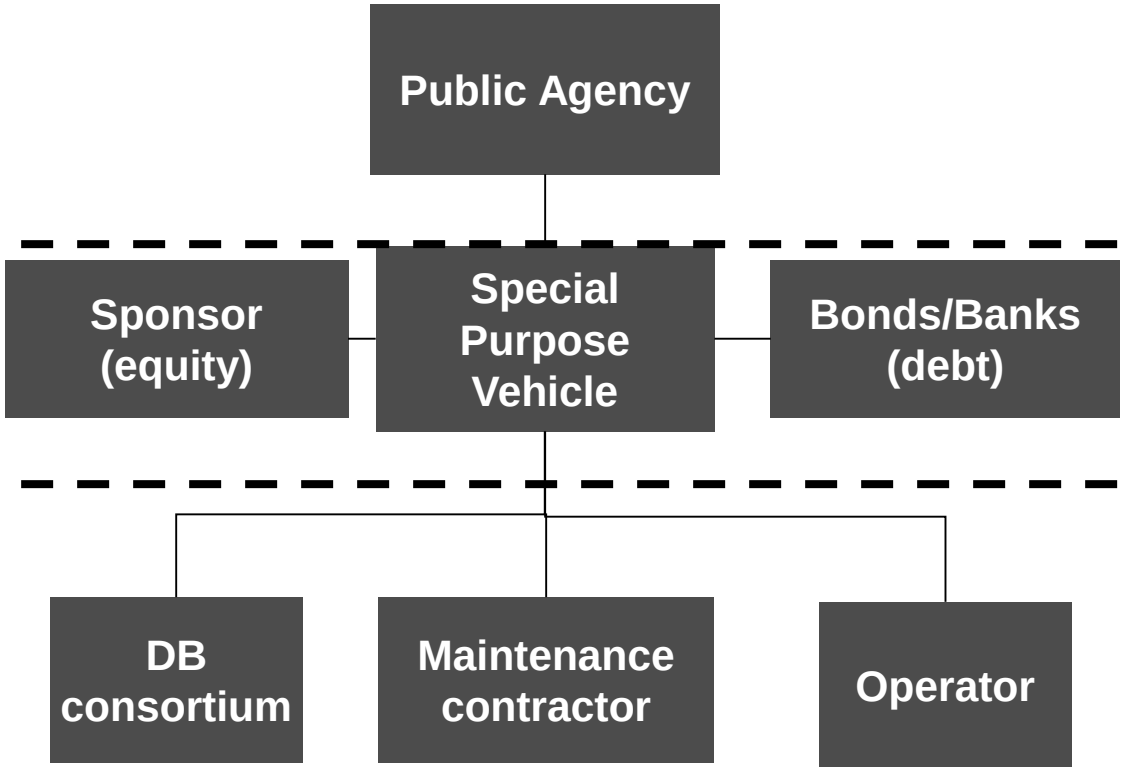
1. Select distribution type (normal, lognormal, triangular, flat or discrete);
2. Determine the impact levels (most likely, minimum, maximum);
3. Determine correlations between risks;
4. Run simulation by using risk software;
5. Determine confidence levels for risk valuation.



Discount Rate

	Excluding inflation	Including inflation
Risk free	Real risk free rate	Nominal risk free rate
Including standardized risk premium	Real rate including risk	Nominal rate including risk
Including project-specific risk premium	Real rate including project-specific estimation of systematic uncertainty	Nominal rate including project-specific estimation of systematic uncertainty

Where do these Risks Belong?



Design errors

Change in scope

Interest rate risk

Construction cost overruns

HAZMAT discovered on acquired ROW

Maintenance has to occur more often

Competing facilities

Inflation higher than expected

10 day unavailability road due to tornado

Inaccurate reference information

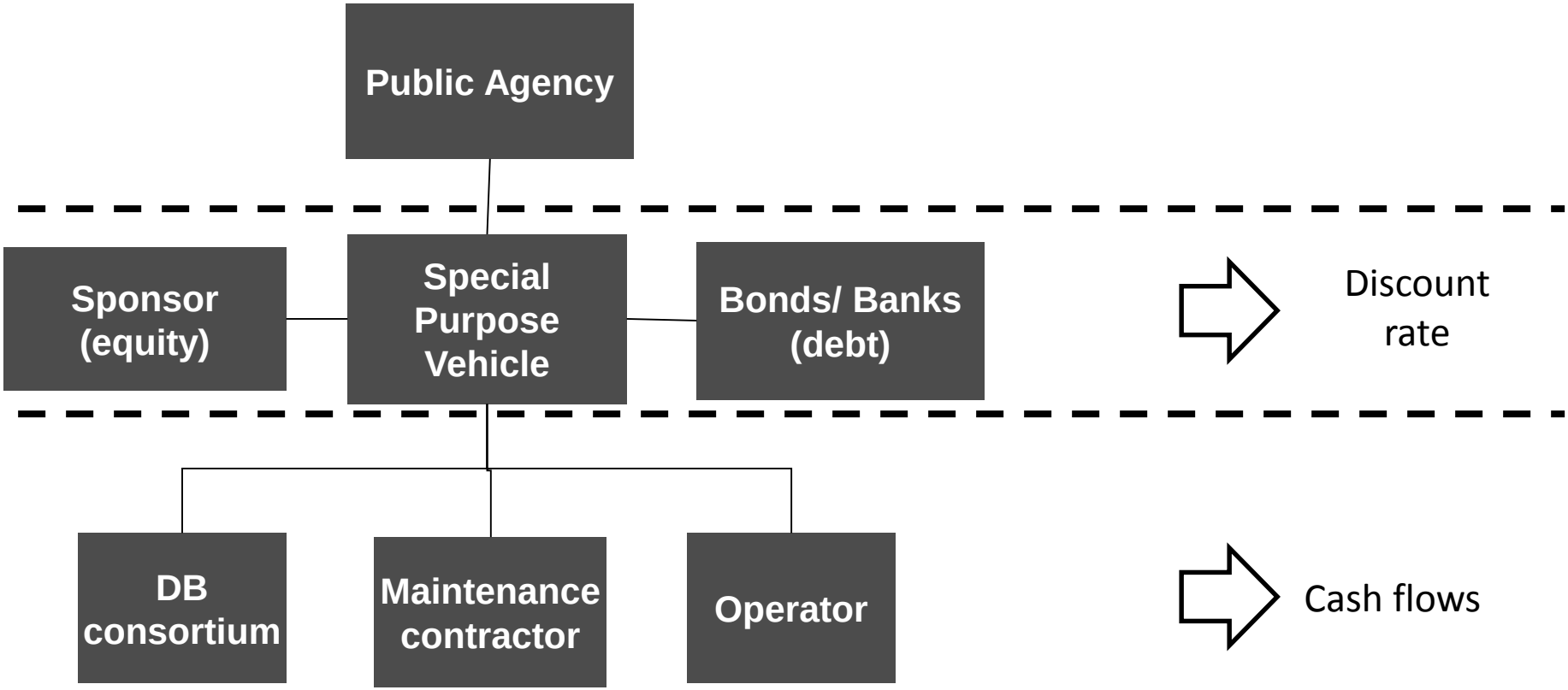
Insolvency of O&M contractor

Different interpretation of contract terms

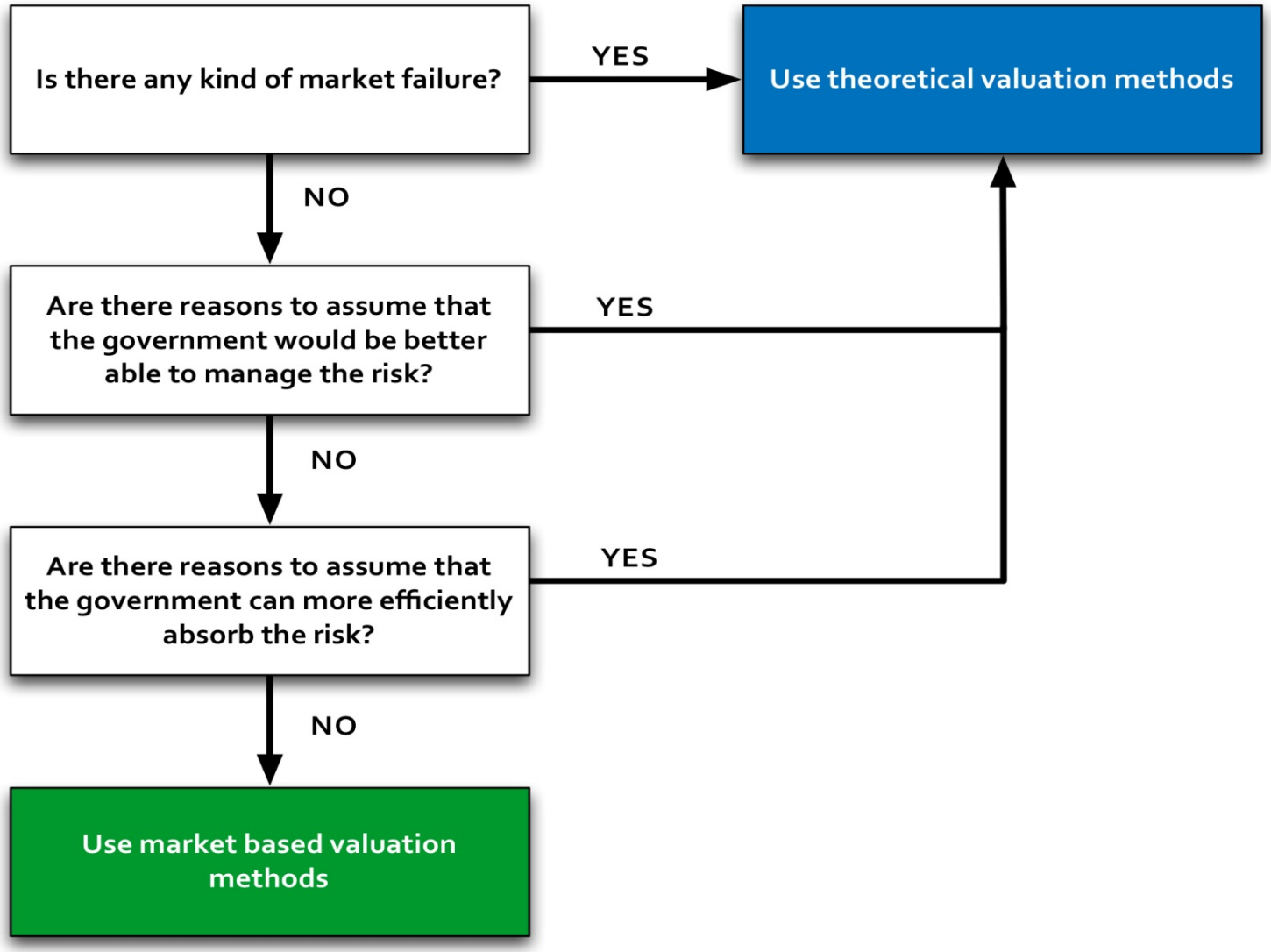
Toll system breaks down

Change in technology standards

Market-Based Risk Valuation



Use of Market Prices



Guidance Choosing Valuation Method

1. Use all information available and if possible use different approaches to develop the most robust understanding of the risks;
2. Use market prices, unless there is a clear market failure or there are convincing reasons to expect that the government is better able to manage a risk; and,
3. Benchmark to similar projects; this is an important source of information for the assessment of the risks.

Exercise 5

Risk Valuation

Plan for Exercise 5: Valuation Methods

1. Work in teams and select a project known to your team
2. Review the list of risks in the Risk Register on the next 2 slides, and record your answers:
   - Determine appropriate valuation methods for all the risks.

Exercise 5 Results: Risk Valuation

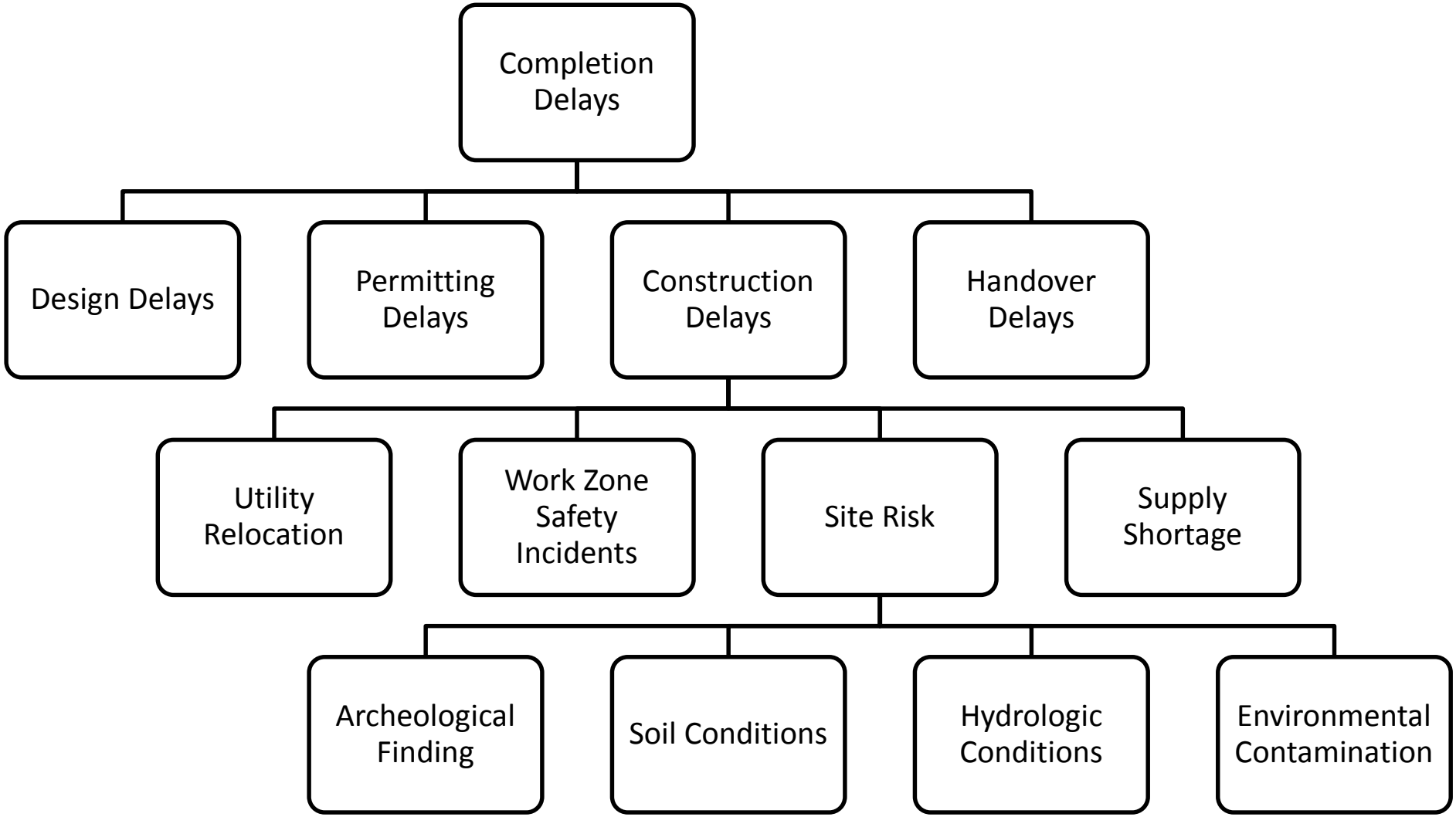
No.	Description	Risk valuation method
1	Design errors	
2	Change in scope	
3	Interest rate risk	
4	Construction cost overruns	
5	HAZMAT discovered on acquired ROW	
6	Maintenance has to occur more often	
7	Competing facilities	

Exercise 5 Results: Risk Valuation

No.	Description	Risk valuation method
8	Inflation higher than expected	
9	10 day unavailability road due to tornado	
10	Inaccurate reference information	
11	Insolvency of O&M contractor	
12	Different interpretation of contract terms	
13	Toll system breaks down	
14	Change in technology standards	

Exercise Results

Exercise 1 Results: Risk Relation Map



Exercise 2 Results: Risk Mitigation

No.	Description	Risk mitigation measure
1	Design errors	Quality assurance procedures
2	Change in scope	Thorough project preparation
3	Interest rate risk	Interest Rate Swap Fixed rate financing solution
4	Construction cost overruns	Elaborated design Allowances in cost estimates Subcontracting
5	HAZMAT discovered on acquired ROW	Research
6	Maintenance has to occur more often	Develop long term maintenance plan Allowances in cost estimates Subcontracting

Exercise 2 Results: Risk Mitigation

No.	Description	Risk mitigation measure
7	Competing facilities	Use pricing to optimize revenues Deliver good services Don't allow competing facilities Compensate for loss of revenues
8	Inflation higher than expected	Inflation hedge
9	10 day unavailability road due to tornado	Robust design
10	Inaccurate reference information	Technical due diligence Additional research Warrantee by information provider
11	Insolvency of O&M contractor	Selection criteria for O&M contractor Replacing O&M contractor Performance bond / Escrow account

Exercise 2 Results: Risk Mitigation

No.	Description	Risk mitigation measure
12	Different interpretation of contract terms	Good dialogue about contract terms Standardization Clarification before contract close
13	Toll system breaks down	Robust system Good maintenance Manufacturer warrantee
14	Change in technology standards	Use adaptable equipment

Exercise 3 Results: Risk Allocation

No.	Description	Public	Private	Shared
1	Design errors		X	
2	Change in scope	X		
3	Interest rate risk		X	
4	Construction cost overruns		X	
5	HAZMAT discovered on acquired ROW		X	
6	Maintenance has to occur more often		X	
7	Competing facilities	X		

Exercise 3 Results: Risk Allocation

No.	Description	Public	Private	Shared
8	Inflation higher than expected		X	
9	10 day unavailability road due to tornado		X	X
10	Inaccurate reference information	X	X	
11	Insolvency of O&M contractor		X	
12	Different interpretation of contract terms			X
13	Toll system breaks down		X	
14	Change in technology standards	X		

* ***Mark with an "X" based on in to which party you think the risk should be allocated***

Exercise 4 Results: Risk Categorization

No.	Description	Dec. Unc.	Syst. Unc.	Pure risks	Reg. Unc.
1	Design errors			X	
2	Change in scope	X			
3	Interest rate risk		X		
4	Construction cost overruns				X
5	HAZMAT discovered on acquired ROW			X	
6	Maintenance has to occur more often				X
7	Competing facilities	X			

Exercise 4 Results: Risk Categorization

No.	Description	Dec. Unc.	Syst. Unc.	Pure risks	Reg. Unc.
8	Inflation higher than expected		X		
9	10 day unavailability road due to tornado			X	
10	Inaccurate reference information			X	
11	Insolvency of O&M contractor			X	
12	Different interpretation of contract terms			X	
13	Toll system breaks down			X	
14	Change in technology standards	X			

Exercise 5 Results: Risk Valuation

No.	Description	Risk valuation method
1	Design errors	Probability x Damage Contingency difference DBB and DB PI Insurance premium
2	Change in scope	Scenarios on the basis of potential scope changes
3	Interest rate risk	Allowance Probability distribution (Monte Carlo) and realistic P-level (P70)
4	Construction cost overruns	Probability x Damage
5	HAZMAT discovered on acquired ROW	Probability distribution (Monte Carlo) and realistic P-level (P70)
6	Maintenance has to occur more often	Probability distribution (Monte Carlo) and realistic P-level (P70)
7	Competing facilities	Scenarios on the basis of potential scope changes

Exercise 5 Results: Risk Valuation

No.	Description	Risk valuation method
8	Inflation higher than expected	Inflation hedge
9	10 day unavailability road due to tornado	Probability x Damage
10	Inaccurate reference information	Probability x Damage Typical contingency in cost estimate
11	Insolvency of O&M contractor	Included in SPV risks as reflected in WACC
12	Different interpretation of contract terms	
13	Toll system breaks down	Probability x Damage
14	Change in technology standards	Probability x Damage