Risk Management and Decision Analysis

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Overview

- Concepts of Risk Management & Decision Analysis
- General Project Risk Management Process

(15년 前 1994년 11월 26일 동아일보 뉴스)

PART I

CONCEPTS OF RISK MANAGEMENT & DECISION ANALYSIS

What is Risk?

- Think about at least **five risks** which people can confront in daily life.

What is Risk?

- **Risks in All Aspect of Our Life: Life is Full of Uncertainty!!!**
  - **Personal Risk**

Financial Risk	Physical Risk	Social Risk	Career Risk
✓Over spent ✓Stock investment ✓Bankruptcy	✓Health ✓Accident	✓Repeated failure ✓Loss of reputation ✓Social rejection	✓Satisfaction? ✓Success?

- **Decisions by government or business leader can result in risks for millions of people.**
- **The strategic decisions are often fraught with peril**
  - **ex. Leading company's loss of big market shares or bankruptcy because of poor decisions**

What is Risk?

- **Dictionary Definition**
  - To Expose to the Chance of Injury or Loss (Oxford English Dictionary, 2012)
  - Possibility of Undesirable Outcomes
- **Similar concepts:** bad consequence, loss, crisis, uncertainty?
- **Common Usage**
  - "Risk" is referring exclusively to negative effects
  - "Uncertainty" includes both upside and downside
- **Definition of PMBoK®** (*the Guide to the Project Management Body of Knowledge*, PMI, 4th Ed., 2008)

  "Project risk is an uncertain event or condition that, if it occurs, has a positive or a negative effect on a project objective … Project risk includes both threats to the project's objectives and opportunities on those objectives."

Why is Risk Analysis important?

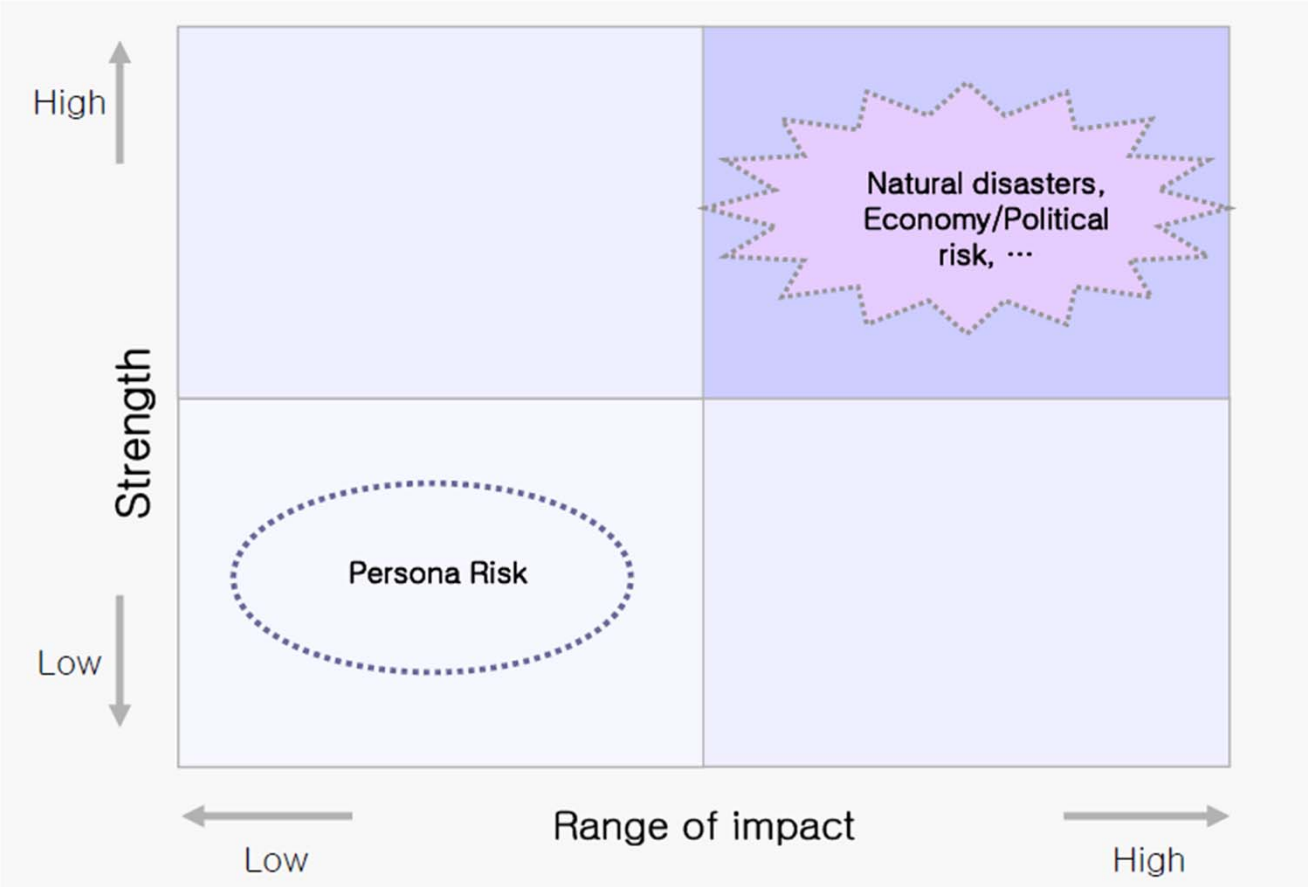
- **Example: Cause of Death**

  다음의 리스크 중 어느 경우 우연히 사망할 확률이 더 높다고 생각하는지?

  1) Fire?
  2) Auto Accident?
  3) Suicide?
  4) Murder?
  5) Tornado?
  6) Bee sting?
  7) Falling Down?
  8) Drowning?
  9) Earthquake?

Why is Risk Analysis important?

- **Degree of Strength and Scope of Impact**



Why is Risk Analysis important?

- **리스크 또는 미래에 닥칠 불확실한 사건에 대한 인간의 판단은 다음과 같은 인식적인 편견으로 인해 판단에 한계를 가진다고 함**
  - **Availability (**경험, 정보, **…)**
  - **Representativeness (S**건설, 공대생, **…)**
  - **Anchoring and Adjusting (**기준을 근거로 보정, 판매량, 케이블, **…)**
  - **Overconfidence (**일기예보원, 판매원, 수주실적, **…)**
  - **Wishful thinking**
  - **Loss aversion, ……..**

  지금까지 밝혀진 편견의 종류가 약 80여 종류에 달함

(Cognitive Psychology, Sternberg & Mio, 2008)

Why is Risk Analysis important?

- **Risk is an integral part of all Decisions made in the real world.**
  - 대부분의 의사결정 상황은 불확실한 리스크와 관계되어 일어나는데,
  - 이 때, 리스크에 대한 판단의 왜곡 현상이 생기게 되어 의사결정의 방향에 영향을 미침
  - 또한, 인간의 두뇌는 일정량 이상의 정보를 처리하는데 한계가 있음

  - 따라서, 좋은 의사결정을 하기 위해서는 판단의 왜곡현상을 줄이는 과정과
  - 의사결정 상황과 관련된 정보/조건들을 정리하는 과정이 필수적임

  - 이를 위해 **문제를 분해하고 구조화하는 과정이 요구**됨

Motivating Example #1

- **Case of Petro Corporation**
  - Petro Corporation is a company founded to wildcat in the Middle East oil fields.
  - Petro has a nontransferable short-term option to drill on a certain plot of land.
  - Two recent dry holes elsewhere have reduced Petro's net liquid assets to $130,000, and William Snyder, president and principal stockholder, must decide whether Petro should exercise its option or allow it to expire.
  - It will expire in four weeks if drilling is not commenced by then.
  - Snyder has three possible choices:
    1) Drill immediately
    2) Pay to have a seismic test run in the next few days, and then, depending on the result of the test, decide whether or not to drill
    3) Let the option expire

Motivating Example #2

- **Case of Multinational Products Inc.**
  - Multinational Products Inc. is conducting an investigation of the possibility of investment in the new market.
  - Decision situation: whether to invest alone or go in as a joint venture with ATC Inc. has not been resolved.
  - Decision objectives
    1) Maximizing ROI
    2) Minimizing entry risk
    3) Enhancing long-term relationships with business partners
    4) Stabilizing profits…

  Discuss how you can analyze the risky decision problem?

Why are Decisions Hard?

- Dynamic and Complex Process
- Uncertainty/Risk of Key Elements

- Multiple Options/Alternatives
- Multiple Objectives
- Decisions Linked to Other Decisions

- Different Perspectives/Stakeholders – Multiple decision makers
- Sensitivity/Instability

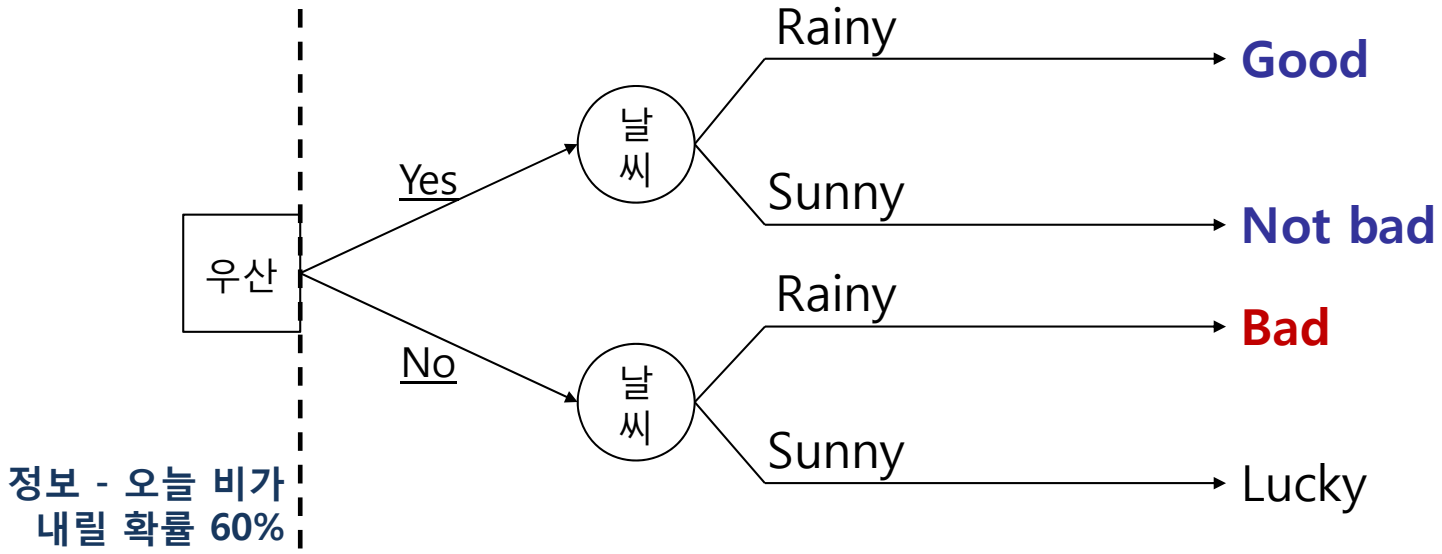
What is a Decision?

- **A Decision is**
  - A present action to achieve a future outcome
  - A process by which a person or group identifies a choice to be made, gathers and evaluates information about alternatives, and select from among the alternative (Carroll & Johnson, 1990)
  - An irrevocable allocation of resources, in the sense that it would take additional resources, perhaps prohibitive in amount, to change the allocation

- **A Decision Maker is**
  - An authority with power to allocate an organization’s resources

Decision Analysis and Risk Management

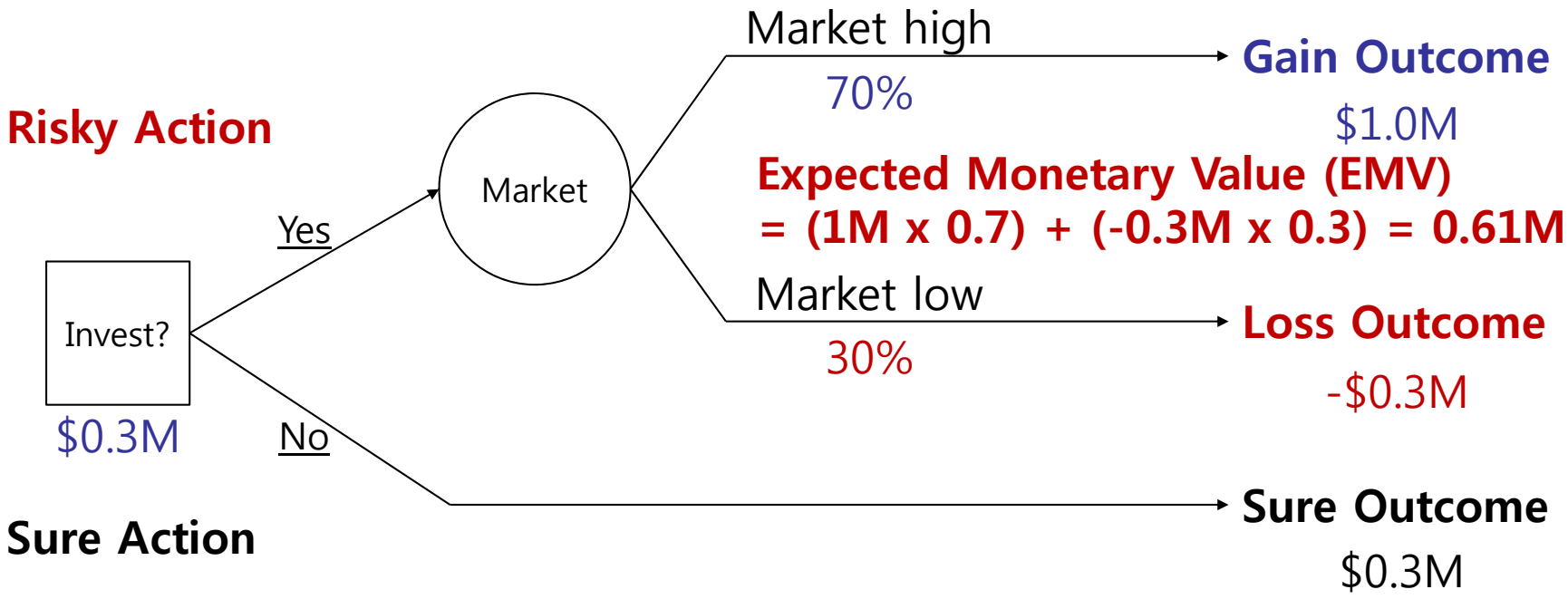
- **Ex: Weather Forecast & Umbrella**
  - 출근할 때 일기예보에서 비올 확률이 60%라고 한다면, 우산을 가져갈 것인가?



Decision Analysis and Risk Management

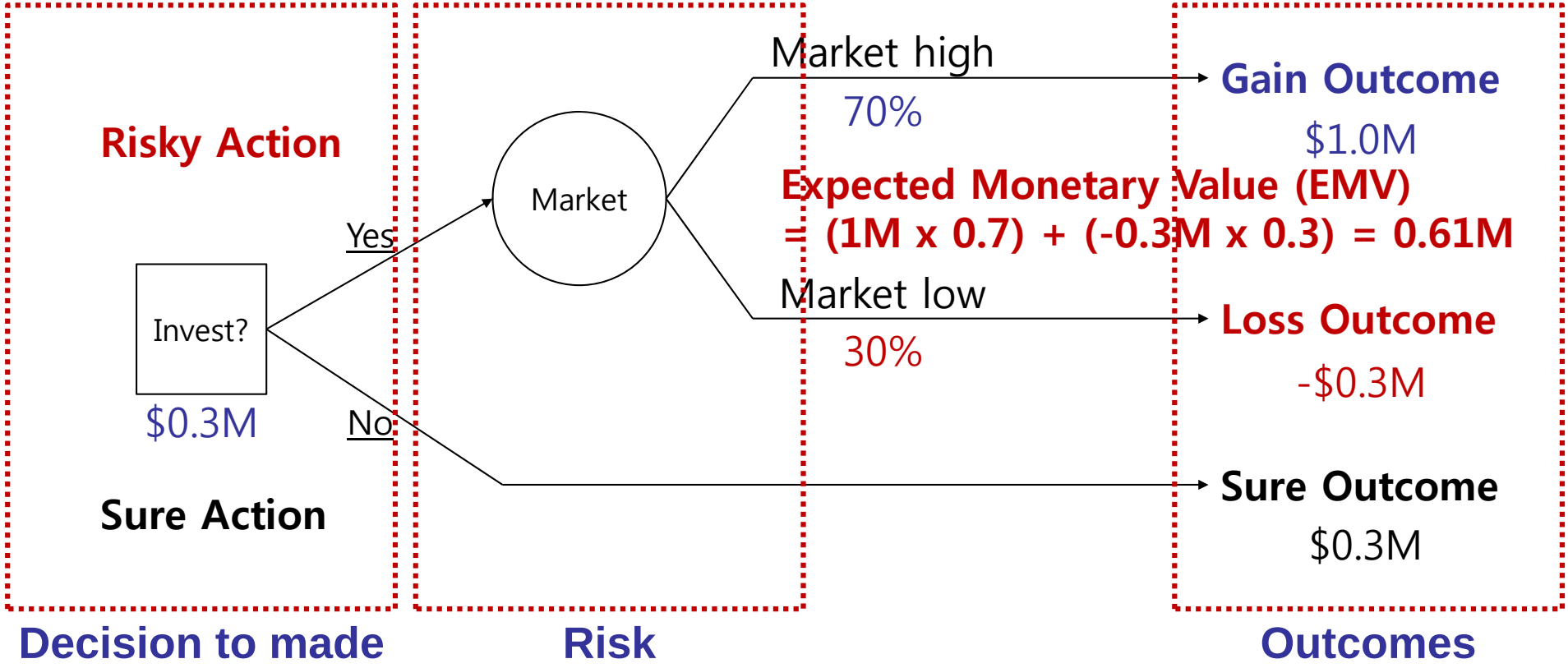
- **Ex: Investing in Stocks**

  - 주식시장에 투자를 고려할 경우의 상황



Element of Decision Problems

- **Inherently, Involving Risks**
- **3 Elements: Decision to made, Risks, Outcomes**



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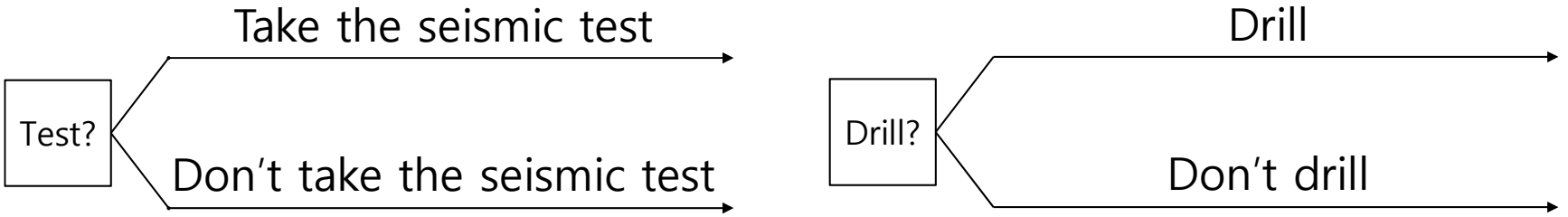
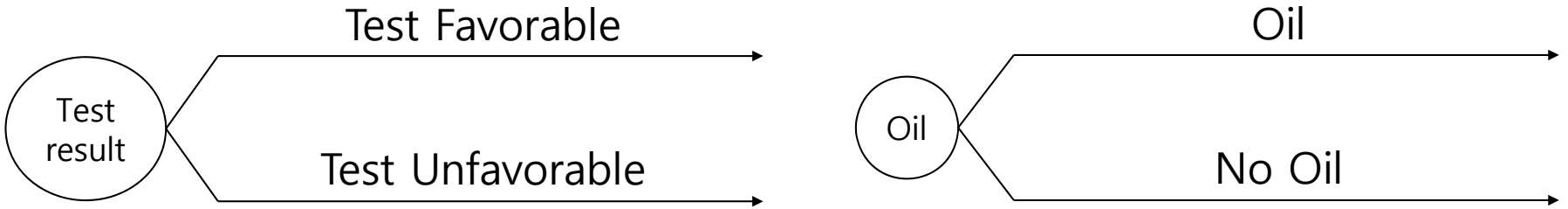
Motivating Example #1 (cont'd)

- **Case of Petro Corporation**
  - In order to decide which of the three choices he will make, Snyder must resolve the following two decisions:

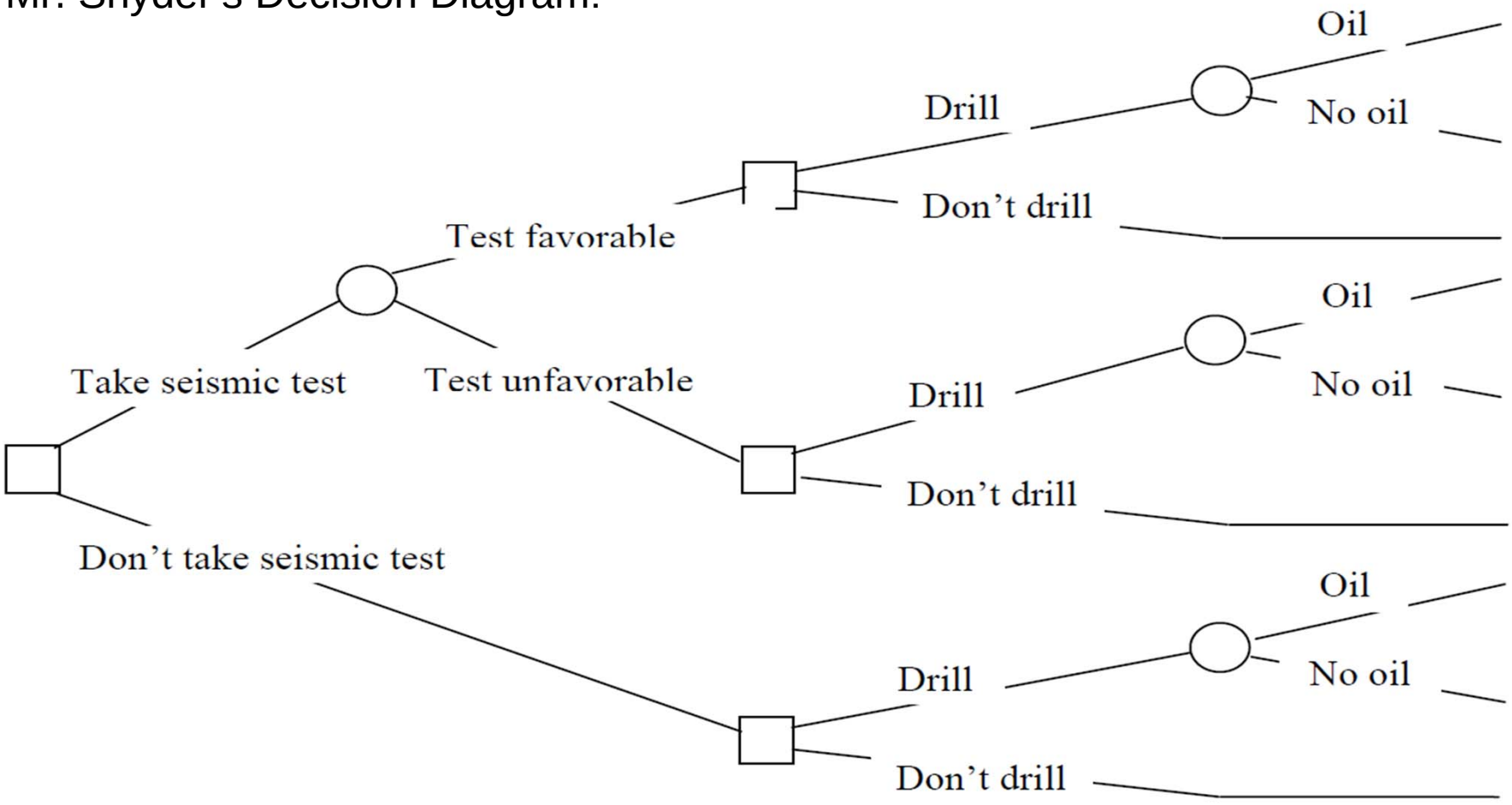


  - He also faces two uncertainties that will affect his choices; these are:



Motivating Example #1 (cont'd)

- **Case of Petro Corporation**
  - Mr. Snyder's Decision Diagram:



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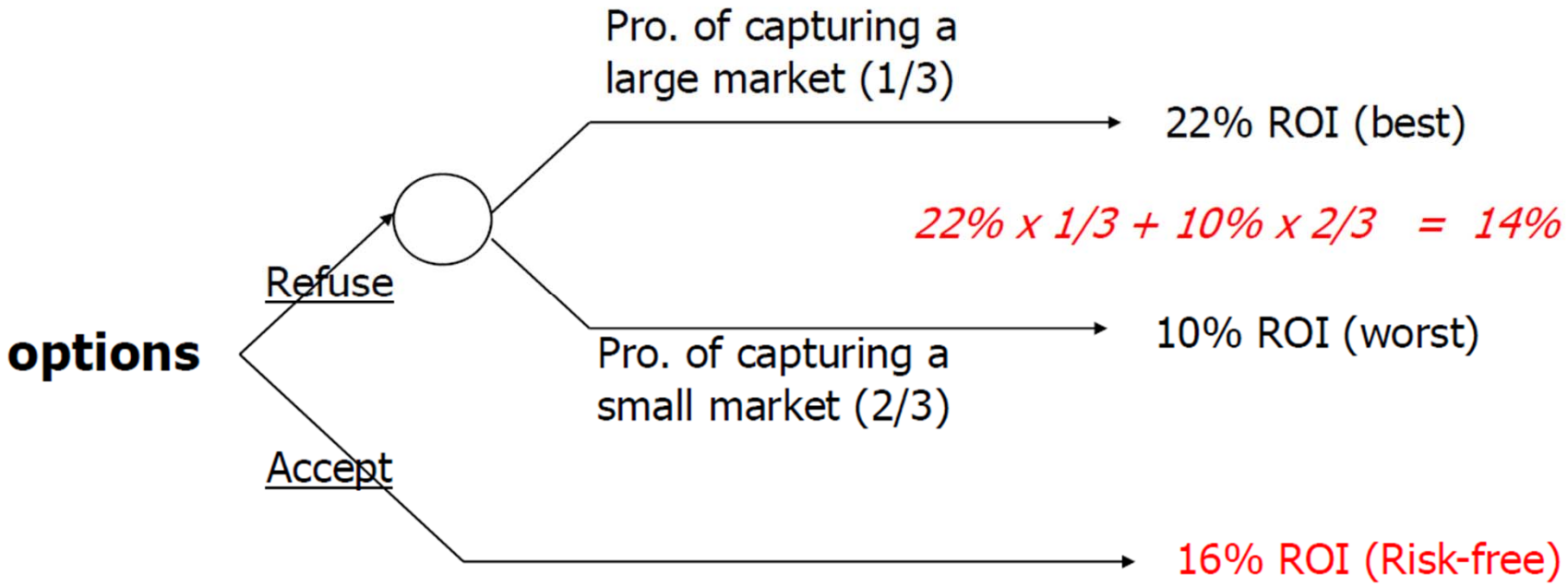
  Discuss how you can analyze the risky decision problem?

Motivating Example #2 (cont'd)

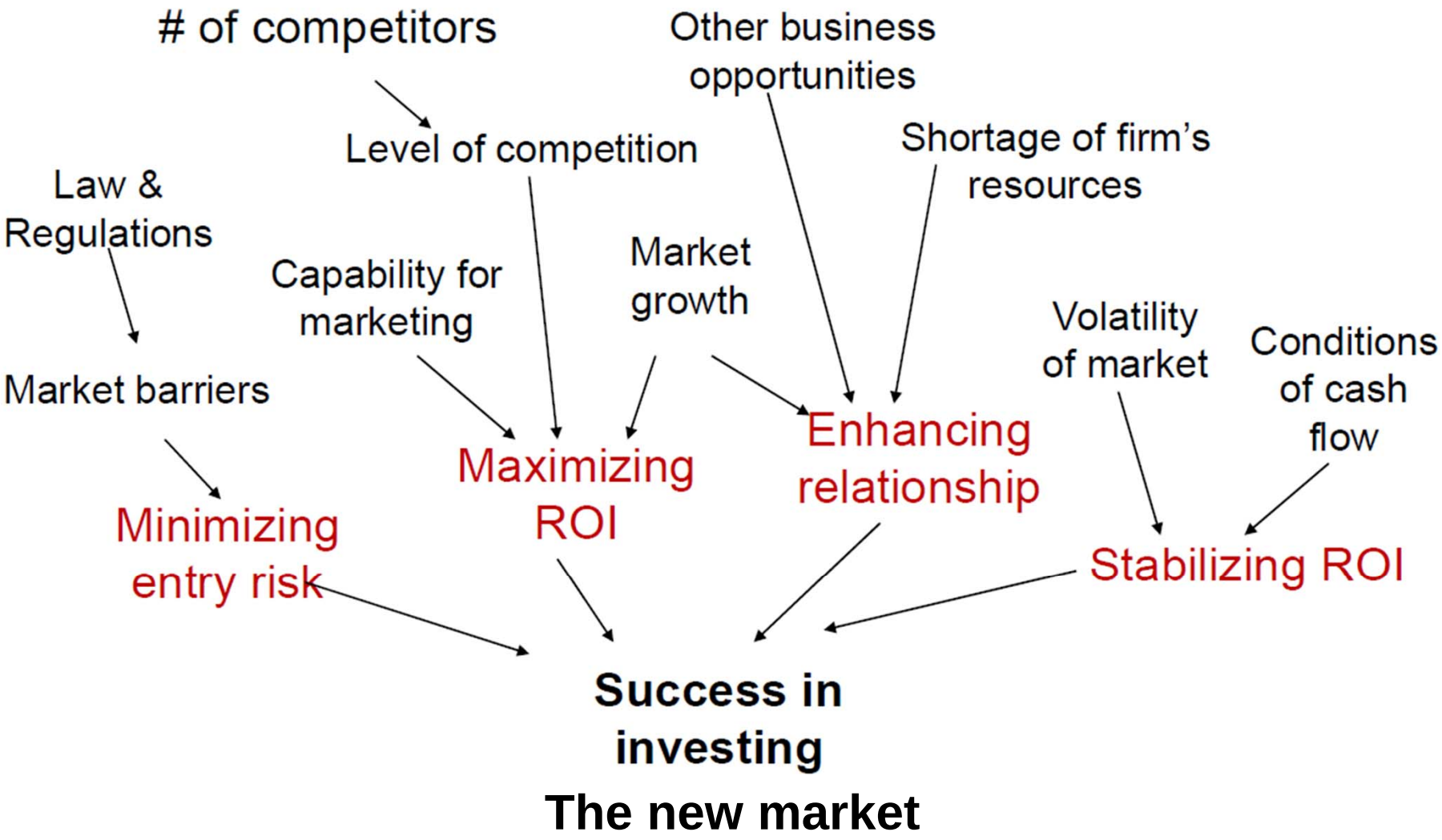
- Case of Multinational Products Inc.



Do you believe this simplification?

- **To have more factors correlated each other**
- **To have more decision criteria**

Motivating Example #2 (cont'd)



Decision Analysis: Three contracting Approach

- **Normative Theory**
  - attempts to analyze decision tasks to present the optimal way to behave (What people should do to make a decision?). It proposes that decision makers follow a highly rational procedure for making decisions
- **Descriptive Theory**
  - to predict and explain the ways that people actually do behave when they make decisions
- **Prescriptive Theory**
  - to suggest the pragmatic guideline to help people make better decision such as multi-criteria decision making approach, which still concerned with the normative aspect of decision making

Decision Analysis and Risk Management

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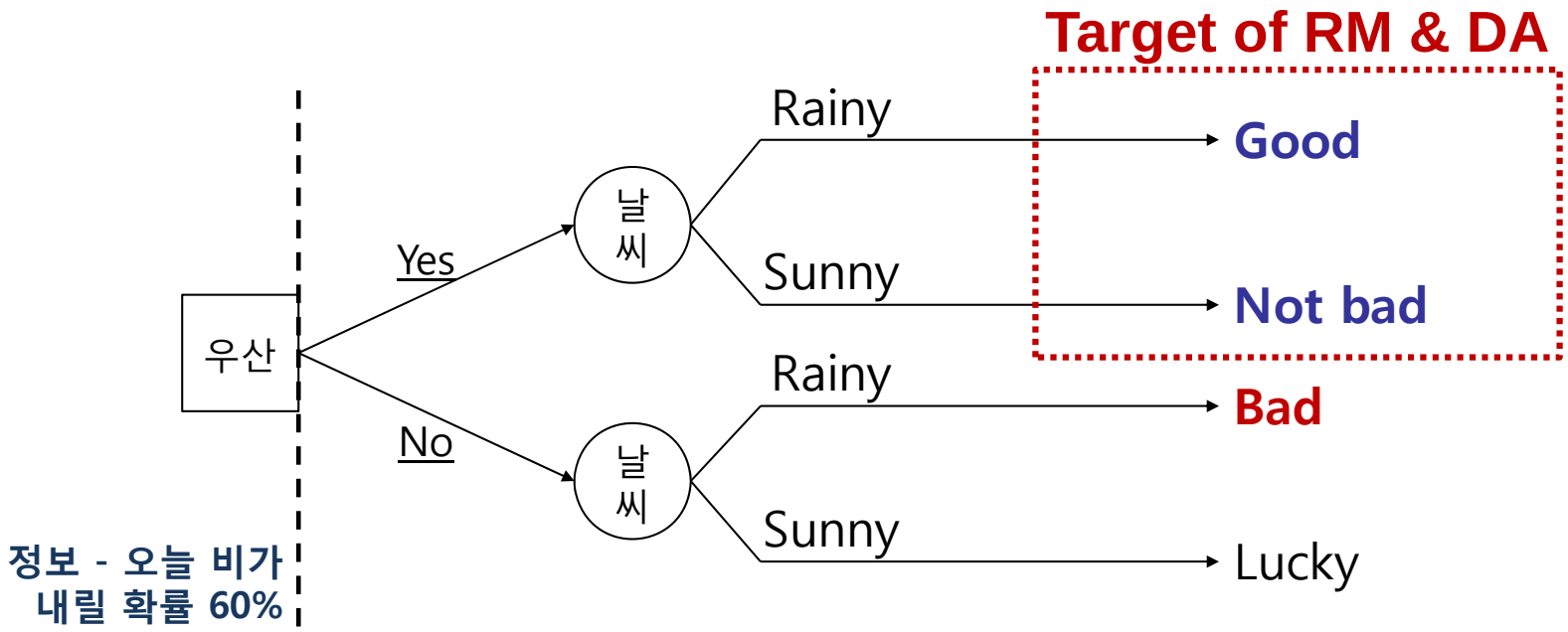
  - 출근할 때 일기예보에서 비올 확률이 60%라고 한다면, 우산을 가져갈 것인가?



Decision Analysis

- **Definition of Decision Analysis (DA)**
  - Prescriptive approach for people who want to think hard and systematically about decision problem
- **Comments on DA**
  - A DA is an information source: Should not replace the decision maker but support him/her
  - The main purpose of DA is to yield insights and understanding about the decision problem rather than to impose an ‘optimal’ solution
  - A DA does not only provide a solution, but also insight into: Situation; Uncertainty; Objectives; Tradeoffs
  - DA can only yield a recommended course of action

What is a good decision?

- Clarity
- Predictability via scientific approach
- Minimize Risks through effective strategies
- Minimize individual biases

Q & A

Please Feel Free to Contact Me at shchi@snu.ac.kr

PART II

GENERAL PROJECT RISK MANAGEMENT PROCESS

Risk Components & Determinants

- **Risk Components**
  1) Risk Event: What might happen to the detriment or in favor of the project
  2) Uncertainty of the event (Probability of Loss): How likely the event is to occur, i.e., *the chance of the event occurring*
  3) Potential loss/gain (Magnitude of Loss): It is necessary that there be some amount of loss or gain involved in occurring of the event, i.e., a consequence of the event happening

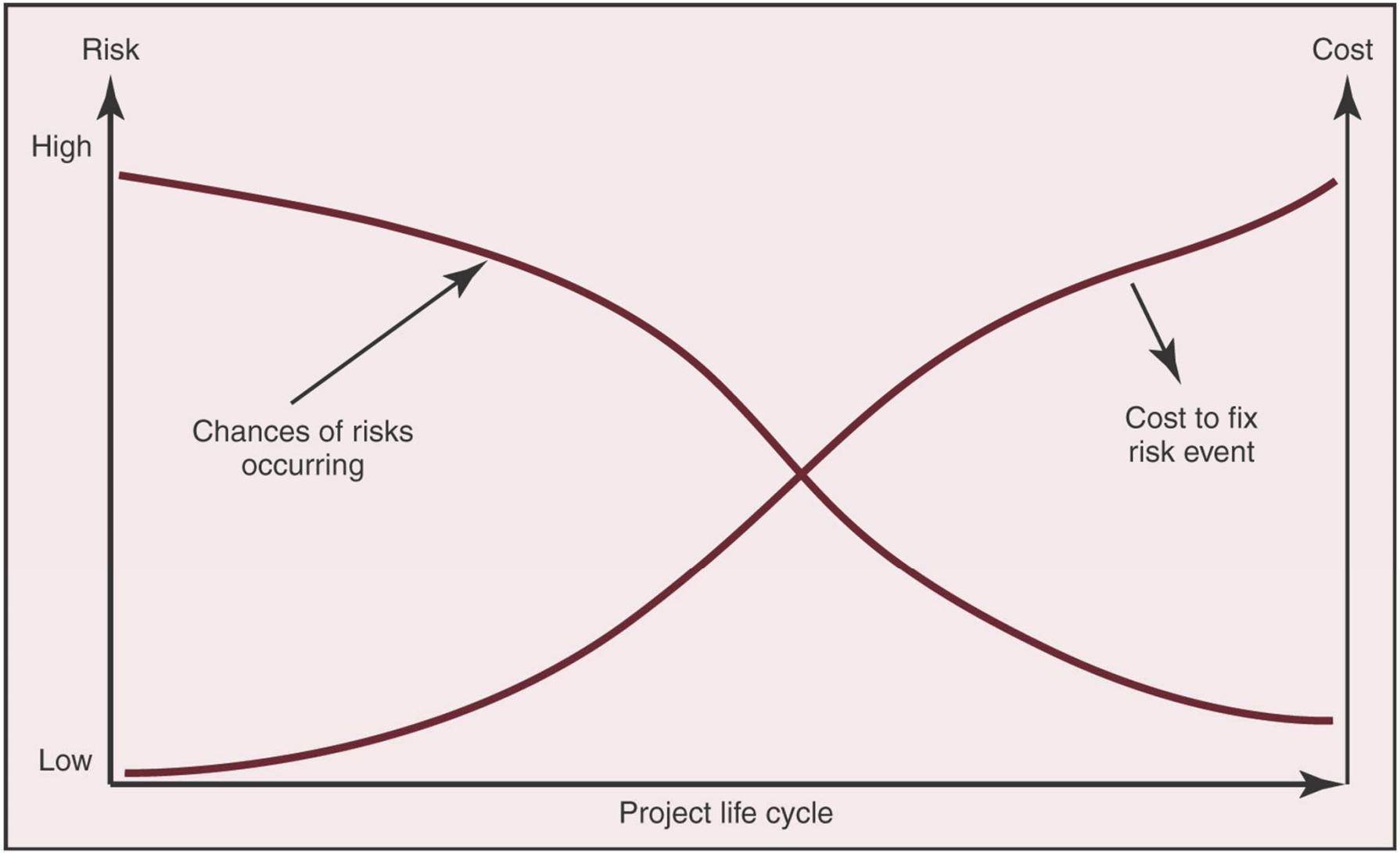
- **Risk Determinants**
  - Lack of Control, Time, and Information

Representing Risk

- **Based on Risk Factors**
  - Risk Event: What types of Risk to expose?
  - Risk Probability: Frequency of Risk occurrence
  - Risk Magnitude: Damage when Risk occurs

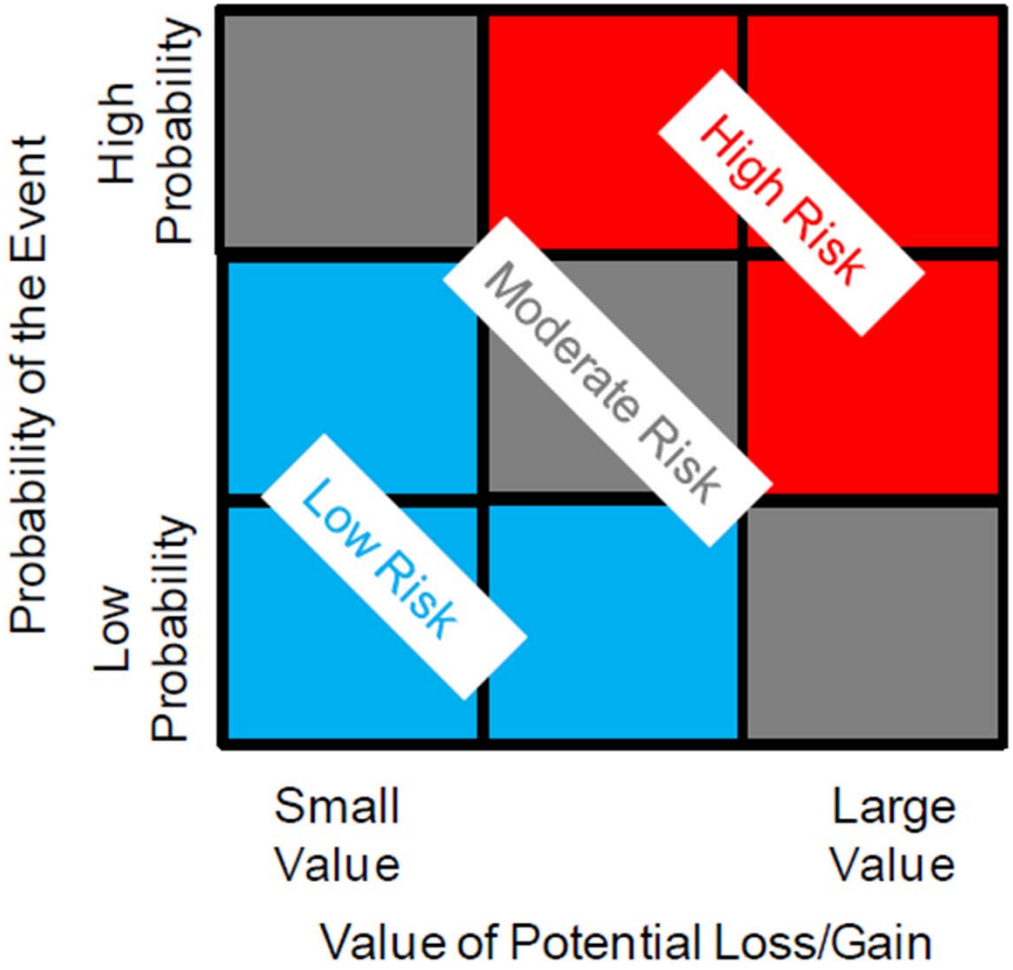
“Risk Consequence” = Probability x Impact

Risk in the Project Life Cycle



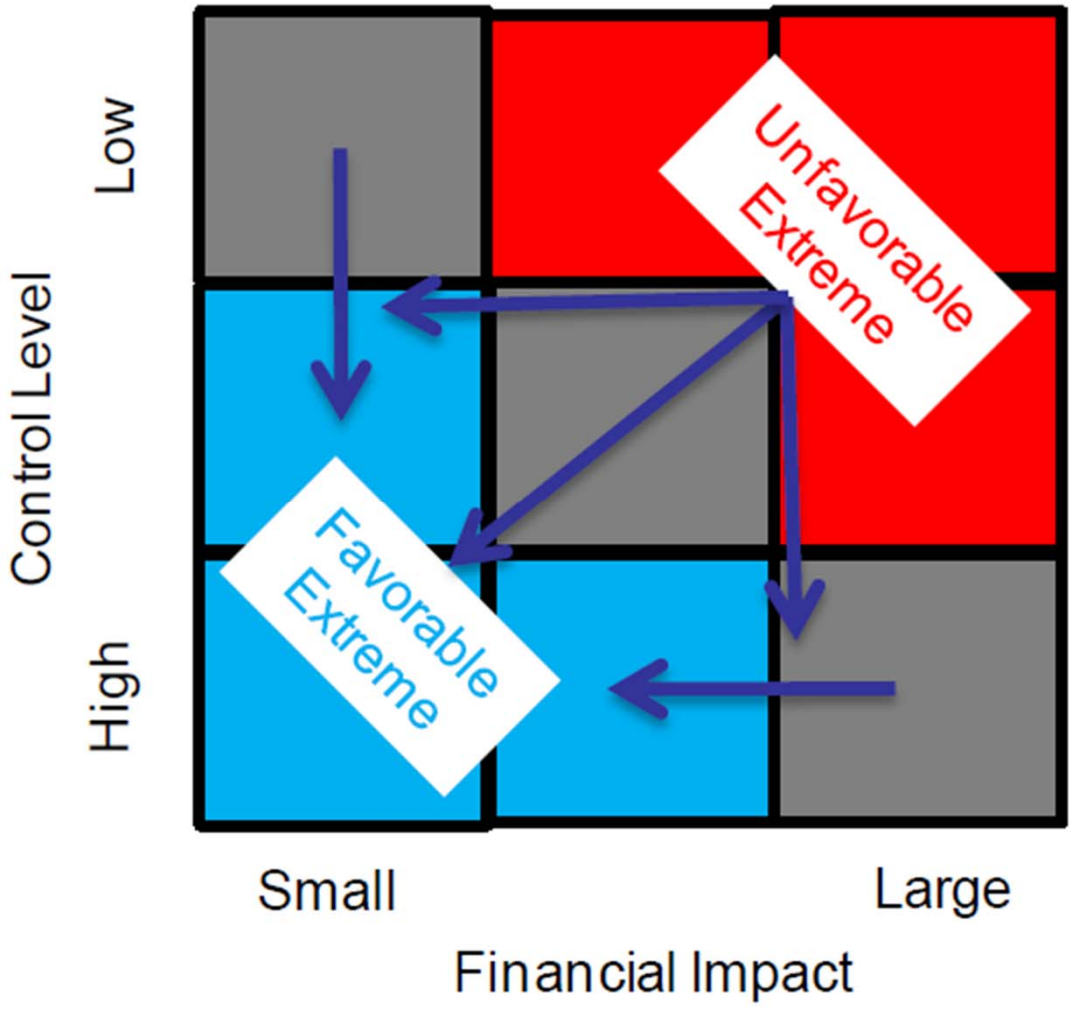
Two Dimensions of Risk

Risk = *f* (Probability of event, Value of Potential Loss/Gain)

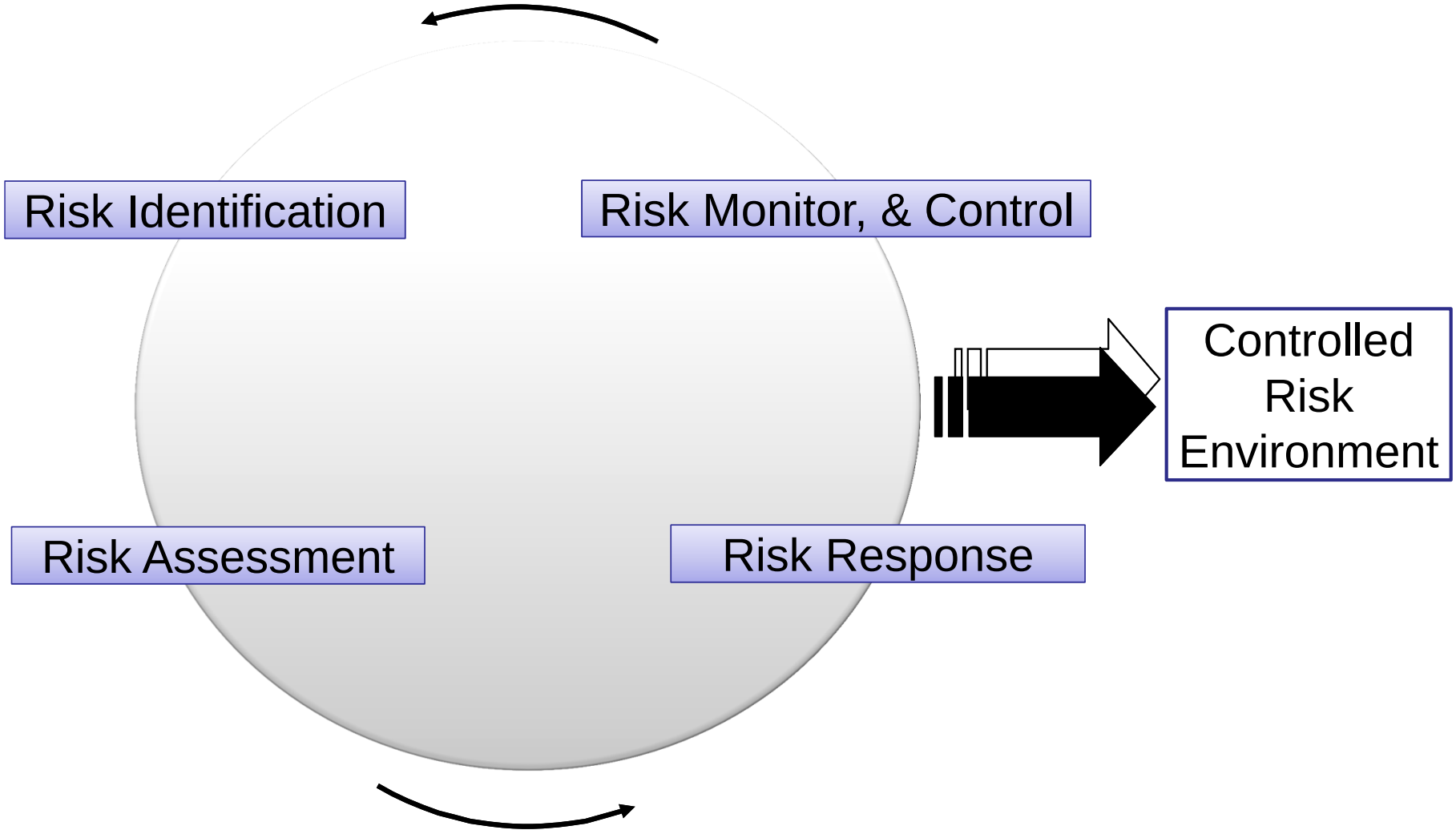


Fundamental Objective of Risk Management

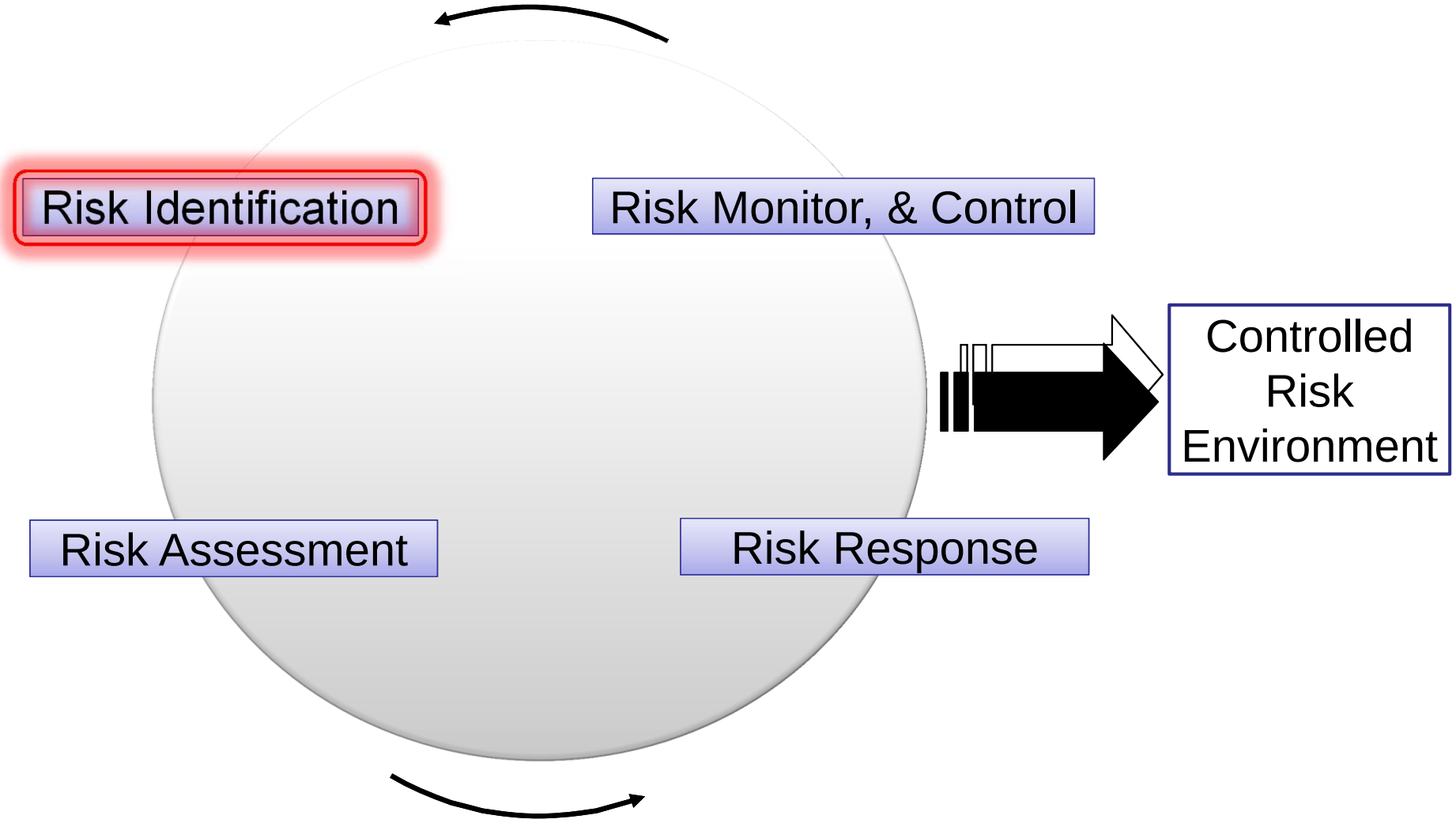
Risk = *f* (Probability of event, Value of Potential Loss/Gain)



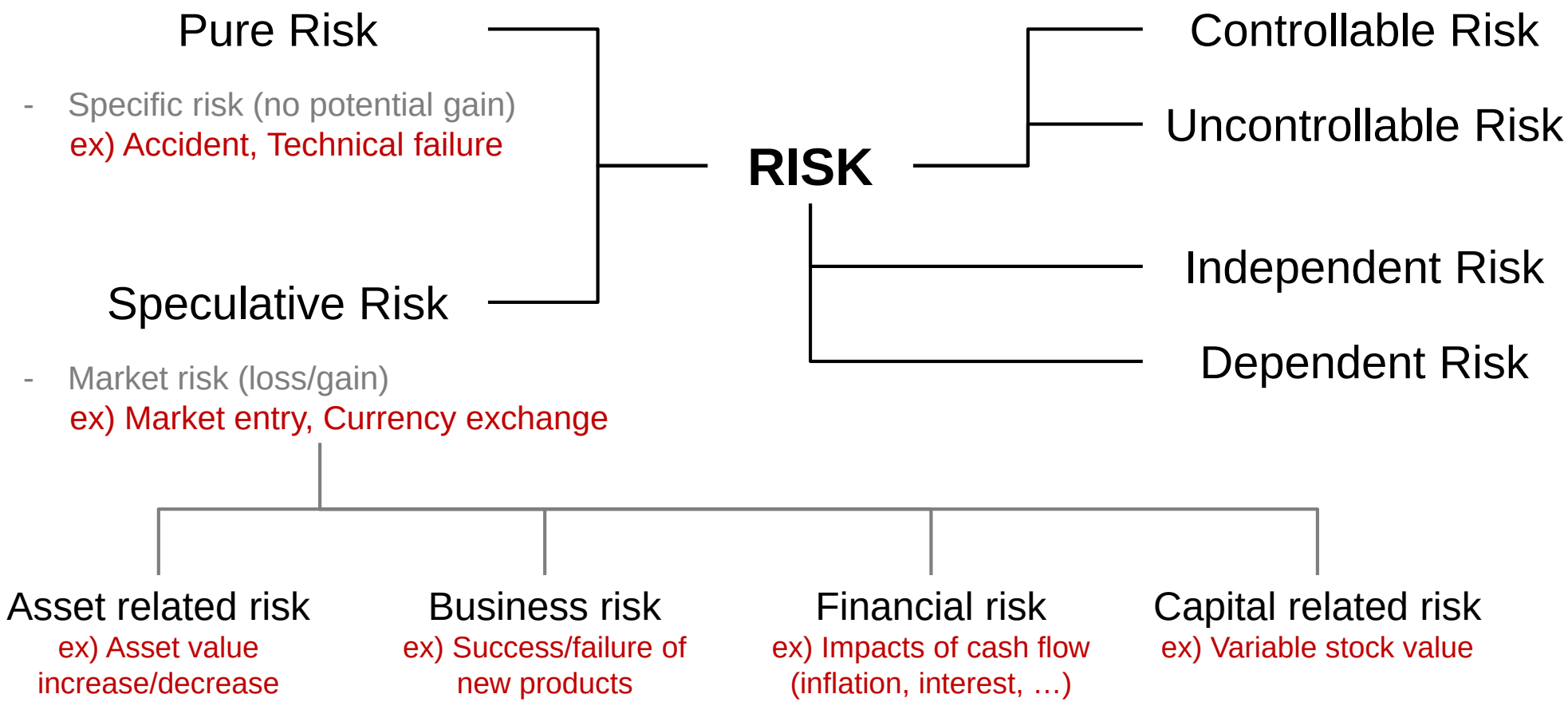
Risk Management Process



Risk Management Process

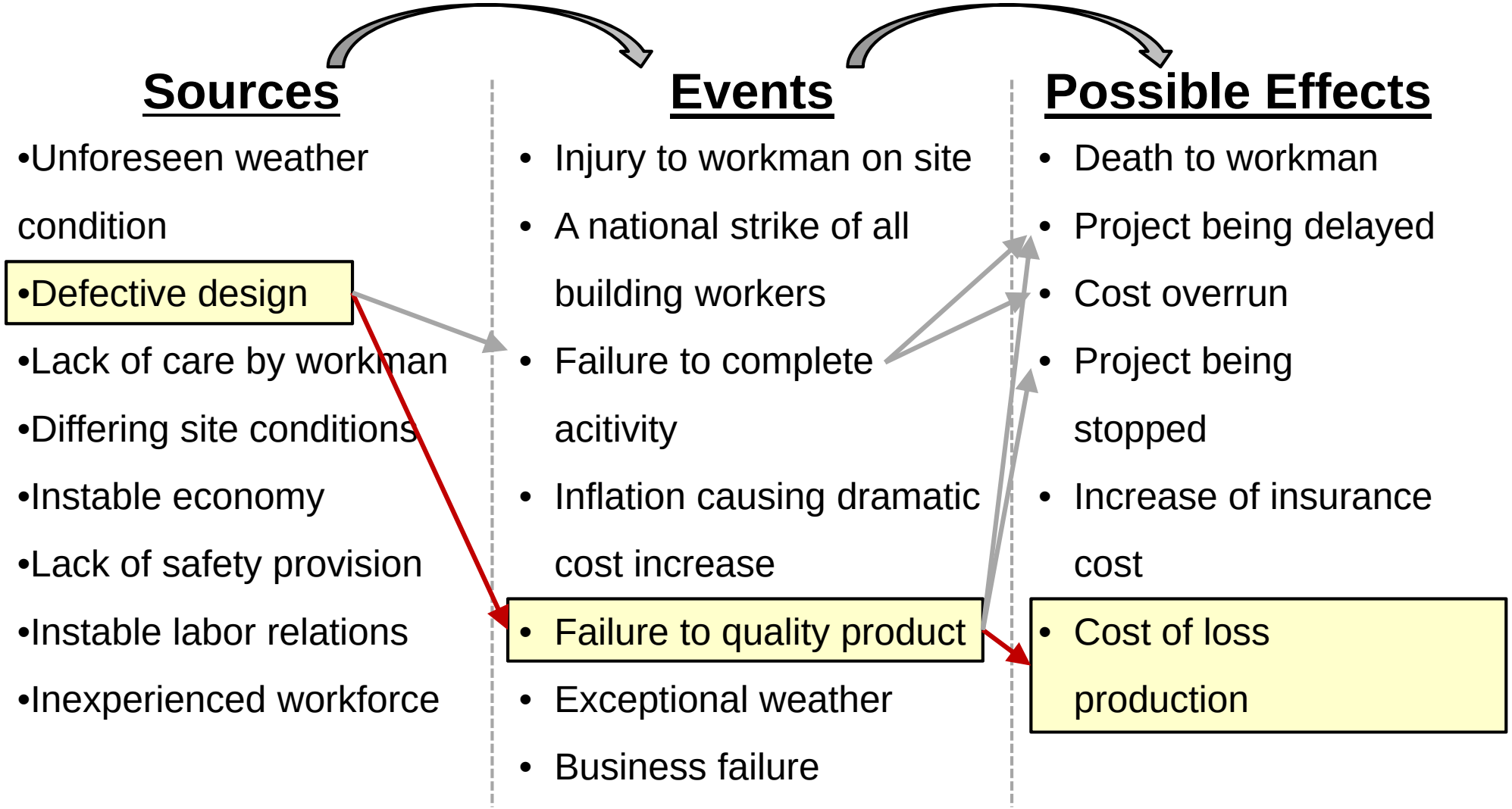


Risk Identification



Source: A. H. Mowbray (1969), Insurance

Risk Identification:
Example – SE/DV Checklist



Source: Han et al. (2008) FIRMS http://rms.icak.or.kr

Risk Identification: Example – SE/DV Checklist

- 진출국·발주처 여건

원인그룹(Source Group)				사건그룹(Event Group)			
코드	상위 요인	코드	하위요인	코드	상위요인	코드	하위요인
1	제도적 특성	1	건설관련 법규 및 제도의 불공정성	1	외국업체 차별		
				2	본국송금 규제		
		2	진입장벽	3	세금 과징		
				4	진입요건 충족요구	1	계약외적 요구사항
2	국가부패정도	3	부패한 관련 관공서	5	관공서의 부당한 접대요구		
				6	비효율적인 행정처리	2	각종 인허가 지연
						3	통관 행정처리 지연
		4	건설관행	7	담합/지하거래	4	수주 실패
						5	낙찰가 하락
				8	에이전트 의무화		
				9	지나친 Nego 및 재견적 요구		
				10	선수금 등 미지급 및 지연		
3	진출국 여건변동	5	정국 불안정	11	행정·인허가 지연		
				12	특정국 대상 거래 단기간 중지	6	주요 자원수급 차질
						7	통관 행정처리 지연
		6	관련 정책·규정 변경	13	설계기준 변경	8	변경요소 조사 및 준비 미흡
						9	교체·재시공
				14	행정상 요구사항 증가		
				15	관세부담 증가		
				16	공공요금 인상		
				17	자국 보호조치 증가	10	자원수급 비용증가
		7	시장경기 악화	18	자원수급 악화		
				19	현지 하도업체 도산		
		8	인플레이션	20	현지 투입비용 증가		
				21	금융조달 비용 발생		
4	발주자 특성	9	발주자 공사재원 부족	22	기성지급 지연		
		10	프로젝트 관리 능력 부족	23	발주자 업무처리 지연		
				24	참여업체간 비협조	11	연관업무·공정 지연
		11	발주자 공정성 부족	25	비협조적 태도	12	계약자에게 책임전가
				26	불합리한 요구	13	불합리한 접대요구
						14	지정업체 선정 요구
						15	계약외적 추가공사
						16	선호부분 선시공 요구

Source: Han et al. (2008) FIRMS http://rms.icak.or.kr

Risk Identification: Example – SE/DV Checklist

- 수주·입찰 정보

원인그룹(Source Group)				사건그룹(Event Group)			
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5	해외시장 여건	12	해외건설경기 악화	27	수주경쟁 심화	17	저가입찰
				28	해외건설 자금지원 축소		
		13	국제 원자재 가격 상승	29	자원수급 제한	18	자재 조달 지연
				30	물가변동 미반영	19	자재 구매 지연
						20	직접비 상승
		14	환율변동	31	지급통화 평가절하	21	금융비용 발생
				32	원자재 구매 비용 부담 증가		
		15	이자율 변동	33	금융비용 부담증가		
6	국내여건 변동	16	해외건설 정책변경	34	국가 지원금 축소		
		17	국내 경기 악화	35	국산 원자재 가격 상승	22	대체비용 발생
						23	자재 수급지연
				36	국내 하도업체 도산		
7	사전조사	18	과거 유사사례조사 부족	37	견적오류 발생		
		19	현장조사 부족	38	현장여건 미반영		
8	견적 및 입찰	20	견적·입찰 기간 부족	39	견적오류 발생		
		21	견적 기본자료 부정확	40	발주자 제공자료 부실	24	견적오류 발생
				41	과거 데이터 부정확	25	견적오류 발생
		22	부적절한 입찰방식	42	저가수주	26	부실공사
						27	수익률 저하
		23	정책적 수주	43	저가수주	28	부실공사
						29	수익률 저하
		24	견적능력 부족	44	기자재 비용예측 오류		
				45	파이낸싱 비용 미반영		
				46	예비비 규모 부적절	30	입찰가 상승에 의한 수주실패
						31	리스크 미반영

Source: Han et al. (2008) FIRMS http://rms.icak.or.kr

Risk Identification: Example – SE/DV Checklist

- 프로젝트 계약특성 및 환경

원인그룹(Source Group)				사건그룹(Event Group)			
코드	상위 요인	코드	하위요인	코드	상위요인	코드	하위요인
10	공사 특성 및 여건	34	불리한 현장 지리여건	69	운송비 증가		
				70	사고·위기 대응지체		
		35	불리한 작업환경	71	작업기피		
				72	작업 생산성 저하		
		36	불리한 기후조건	73	생산성 저하	56	실질 작업시간 감소
						57	장비 대기시간 증가
		37	인접 공사현장	74	자원수급 제한		
				75	공사 간섭현상	58	공사대기 및 간접영향
		38	빌딩·주거지 장애물	76	피해분쟁 소송 발생		
				77	주야간 공사시간 수시변경		
		39	전원·통신 인프라 시설 부족	78	시설 비용 추가발생		
				79	정보전달 오류 및 장시간 소요		
		40	용수·연료 공급부족	80	안정적 수급 불균형		
				81	시설 비용 추가발생		
		41	지반조건 불량	82	지반침하 발생		
				83	지장물 발생		
		42	사회적 합의 부족	84	민원발생		
				85	환경단체 시위		
		43	시공난이도	86	익숙하지 않은 프로세스 발생	59	교체/재시공
11	불가항력	44	전쟁/내란	87	보험인수조건 부재		
				88	기존 구축시설 피해발생		
				89	공정지연		
				90	시설복구 비용 발생		
		45	자연재해	91	보험인수조건 부재		
				92	기존 구축시설 피해발생		
				93	공정지연		
				94	시설복구 비용 발생		

Source: Han et al. (2008) FIRMS http://rms.icak.or.kr

Risk Identification:
Example – SE/DV Checklist

- **Risk "path" are defined by relating risk sources to their subsequent events**
- **These sources are further decomposed into "relatively determined" or "variable" risks**
  - "**Determined risk**" is one that can be mitigated or avoided by the preliminary investigation with due precaution or the contractor's experience from previous similar projects (i.e., instability of law and regulation, degree of corruption of the host county, owner's financing capability and quality, relationship with owner, and firm's current ability to perform a project).
  - "**Variable risk**" highly fluctuates depending on the characteristics of a project condition and its environment surrounding a project (such as currency exchange risk, interest rate, differing site conditions, and material supply condition …).

Kinds of Risks
- Foreseeable vs. Non-foreseeable

Uncertain events

- Unpredictable
- Predictable and subject to known laws of chance
- Predictable and subject to estimated laws of chance
- Controllable(partially or totally) by the decision maker

- **Known risk (foreseeable)**
  - We can know the probability of occurrence and its likely outcome (ex. Minor variations in productivity and swings in material cost)
- **Known + Unknown risk (partially foreseeable)**
  - Its occurrence is predictable, but its likely effect is not known (ex. speculative uncertainty – inflation, interest, exchange rate, ….)
- **Unknown + Unknown risk (non-foreseeable)**
  - Both probability and effect are not foreseeable (force majeure, Act of God, Bird flu)

Typical Project Risks (PMBoK®, 2008)

- **Contract type**
  - Lump Sum, Unit Price, Reimbursable
- **Unfair contract clauses**
  - Differing site condition, damage for delay, force majeure loss, quantity variation
- **Area factors**
  - Geography, altitude, government stability, local attitude, communications, infrastructure
- **Site factors**
  - Access, congestion, hazard for safety & health, availability of utilities, security
- **Weather**
  - Potential for extremes
- **Monetary**
  - Escalation, exchange rate, cost and award, payment float, retention, overhead cost, penalties

Typical Project Risks (PMBoK®, 2008)

- **Ability to perform**
  - Familiarity with type work, qualification of key personnel, quality of design, requirement of new technology, knowledge of area, need for work
- **Time factors**
  - Deadline and milestones, available work days, potential for stoppage
- **Regulatory factors**
  - Permits, environmental violation
- **Labor factors**
  - Availability, skill, productivity, wage scale, potential for adverse activity
- **Client factors**
  - Financial stability, interference, change management policy, quality expectations, interpretation of contract

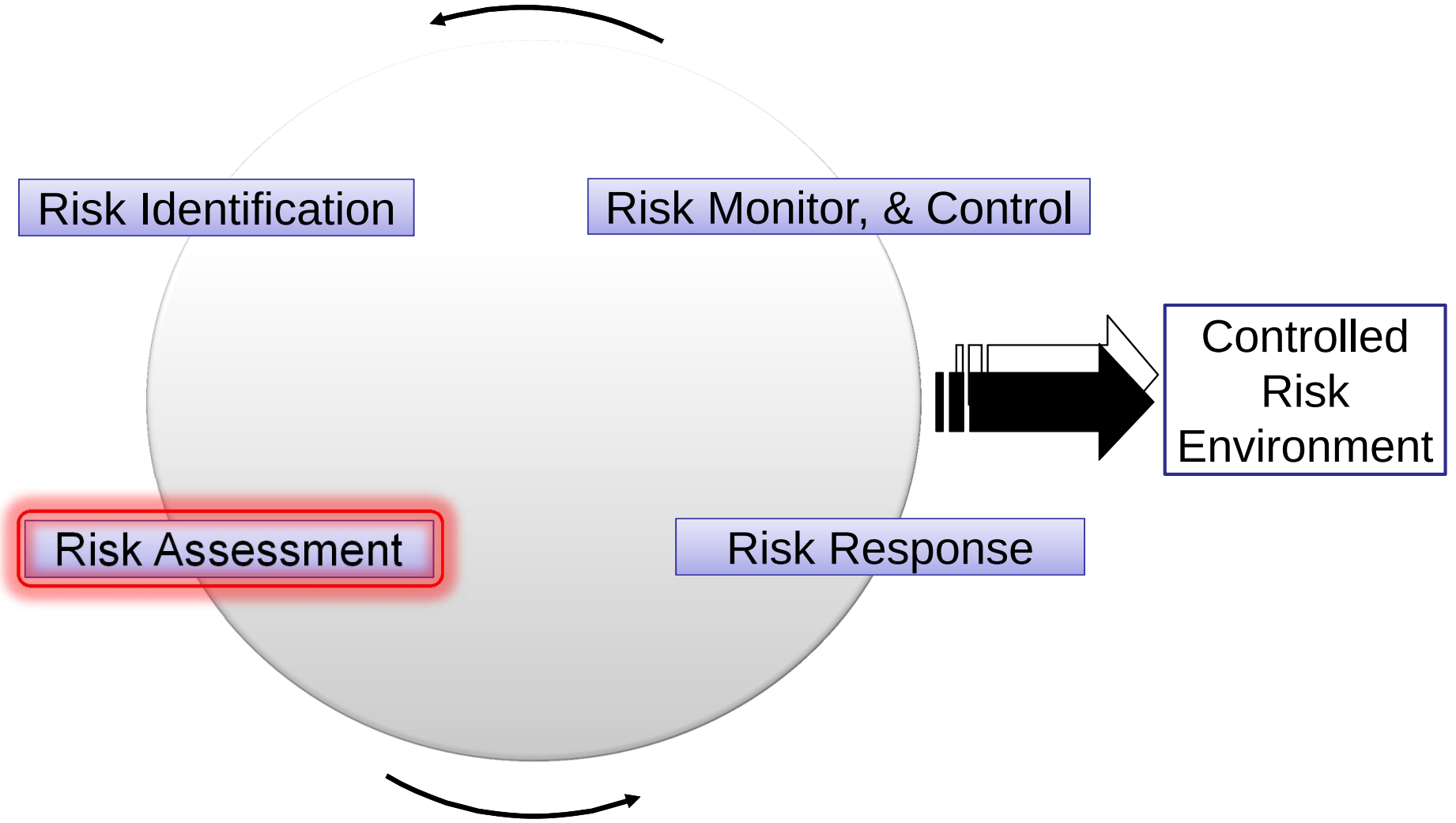
Typical Project Risks (PMBoK®, 2008)

- **Material factors**
  - Quantity variation, quality, price, availability, delivery uncertainty, waste in use, potential for theft/damage
- **Equipment factors**
  - Availability, cost, loss or damage
- **Subcontractor/vendor factors**
  - Technical qualification, financial stability, reliability
- **Special exposures**
  - Insurance deductibles, client claim, third party litigation, warrantee & guarantee

Risk Identification Methodology

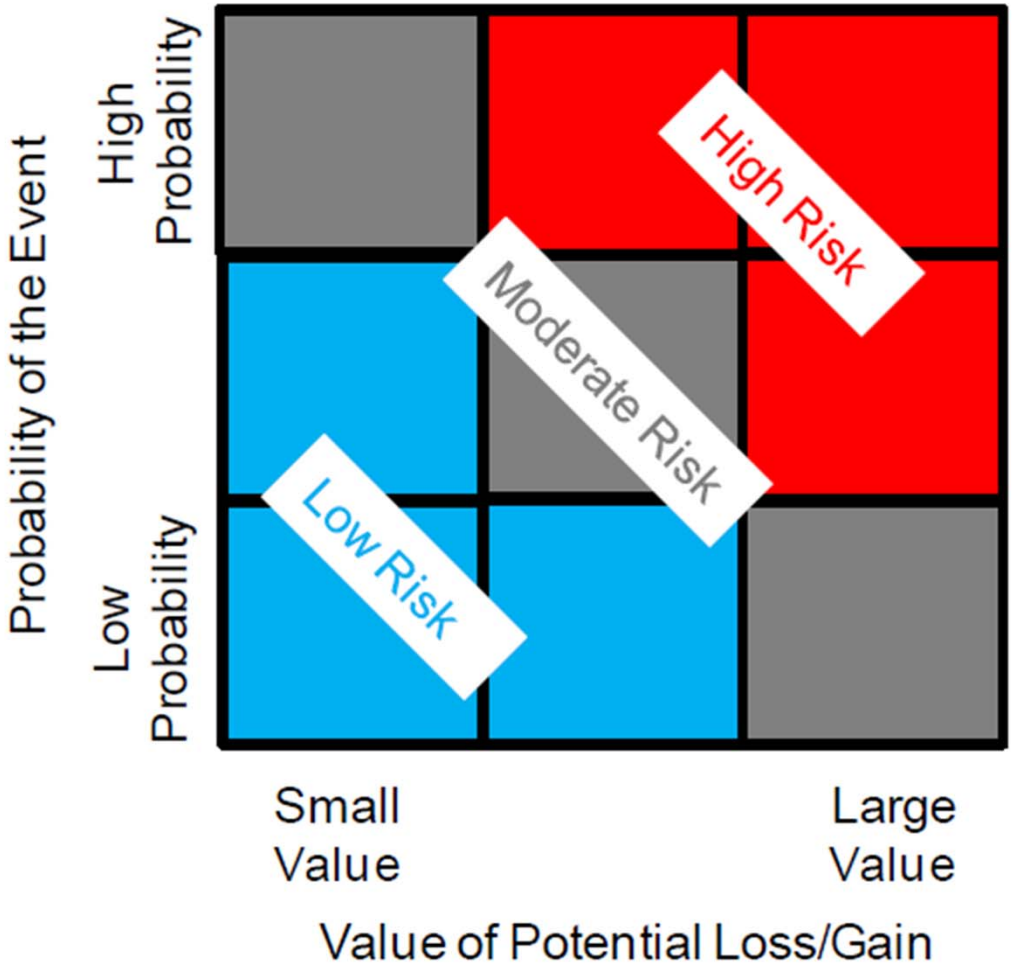
- This is essentially a brainstorm, by a team led by an experienced person, and conducted as follows
  - Structured to cover: Concepts, Processes, Systems, & Components
  - No criticism by fellow team members
  - The more ideas the better
  - Encouragement to build upon one another's ideas
  - Refine the list to 10-15% of the total
- The Delphi method is an appropriate methodology in risk identification process
  - It was developed by the Rand Corporation to make predictions
  - The method is based on using *a panel of experts* to provide opinions, but managing the process to optimise the confidence which can be placed on the outcome

Risk Management Process

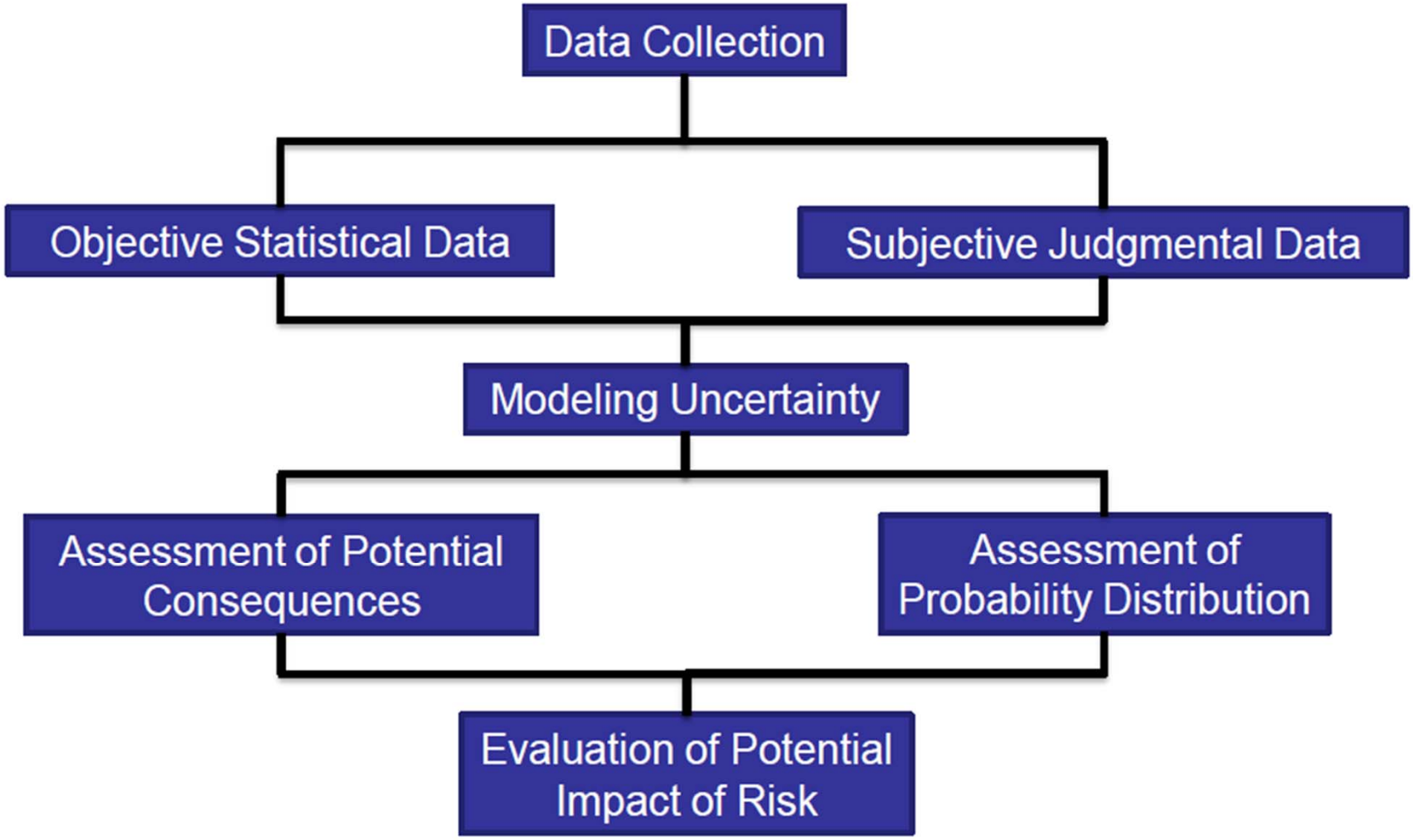


Risk Assessment

Risk = *f* (Probability of event, Value of Potential Loss/Gain)



Risk Assessment Process Framework



Likelihood of occurrence: Probability
Potential impact: Financial monetary

Risk Identification and Assessment

- **Objective Function**
  - What would be a more strategic, structured way for criteria and weights setting and assessing risks?
  - Become the basis for decision making
  - Explain what we are trying to achieve better

  - Formula-based support: Outcomes + Decision Criteria
  - Outcomes: What are the consequences of decisions and related events? (advantages and disadvantages)
  - Decision criteria: What are the measures of goodness or preference

Objective Function Practice (1)

- **Modularization/Preassembly (off-site manufacturing) → GO or NO GO**

Objective Function Practice (1)

- **Possible Objective Function**
  - Potential Total Value to Owner =

    (1) Potential Project Net Savings +

    (2) Potential Gross Revenue from Early Completion and Sales

Objective Function Practice (2)

- **Son-La dam construction in Vietnam: Go/No Go**
  - Vietnam is experiencing a more rapid rise in demand for electricity than economic growth
  - Vietnam’s energy demand heavily relies on coal fired generating plant
  - Vietnam government is deciding whether or not to do the great hydro expansion
  - Son-La Dam will be the biggest project in this hydro expansion

Objective Function Practice (2)

- **Son-La dam construction in Vietnam: Go/No Go**

Decisions need to be made?

The Son-La Dam project: Go/No Go

Decision Maker? A Vietnam government agency

Objective Function Practice (2)

- **Son-La dam construction in Vietnam: Go/No Go**

Normal Water Level	265 m
Dam Height	177 m
Volume of Reservoir	25.4 billion m^3
Surface of Reservoir	440 km^2
Installment Capacity	3,600 MW
Energy Production	14,124 GWh/year
Project Estimated Cost	$2.3 billion
Project Life Cycle	100 years

Objective Function Practice (2)

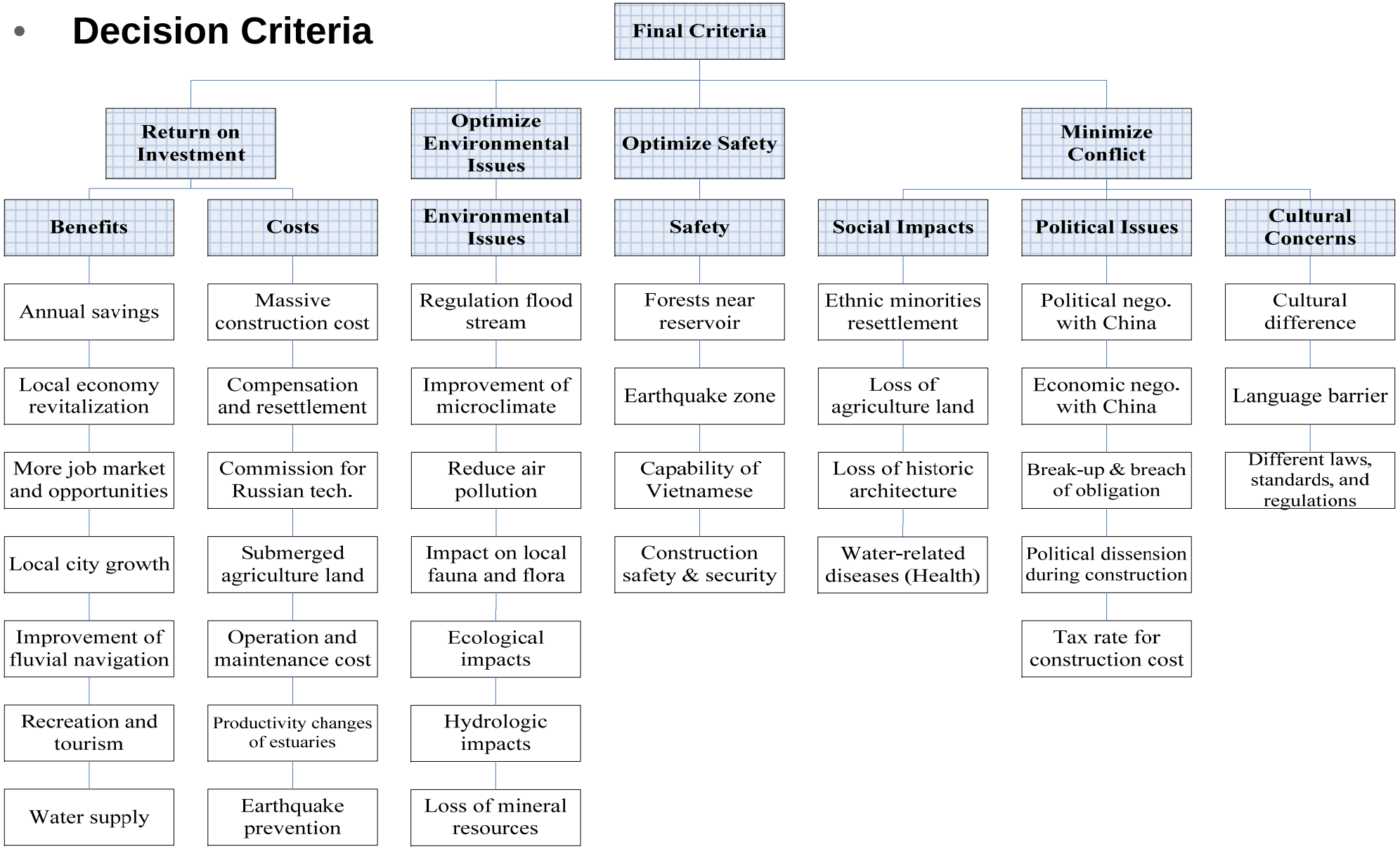
- **Positive Impacts**

Objective Function Practice (2)

- **Negative Impacts**

Objective Function Practice (2)

- **Decision Criteria**



Objective Function Practice (2)

- **Weighting Four Major Criteria**
  - Analytic Hierarchy Process (AHP)

  - Compare the major categories in pair-wise fashion, ranking each pair on a scale of 1 to 5 according to the criteria:

    1: The two factors contribute equally

    2: One factor is slightly favored over the other

    3: One factor is moderately favored over the other

    4: One factor is strongly favored over the other

    5: One factor dominates

Objective Function Practice (2)

- **Weighting Four Major Criteria**
  - Analytic Hierarchy Process (AHP)

A \ B	Return on Investment	Optimize Safety	Minimize Conflicts	Optimize Environment
Return on Investment	1 (contribute equally)	2 (A slightly favored over B)	2	3 (moderately favored)
Optimize Safety	0.5	1	1.2	2
Minimize Conflicts	0.5	0.83	1	2
Optimize Environment	0.33	0.5	0.5	1
Sum	2.33	4.3	4.7	8

Objective Function Practice (2)

- **Normalized Weighting Four Major Criteria**
  - Analytic Hierarchy Process (AHP)

B

A

	Return on Investment	Optimize Safety	Minimize Conflicts	Optimize Environment	Row Sum	Average
Return on Investment	0.43 (1/2.33)	0.47	0.43	0.38	**1.69**	**0.42**
Optimize Safety	0.21 (0.5/2.33)	0.23	0.26	0.25	**0.95**	**0.24**
Minimize Conflicts	0.21 (0.5/2.33)	0.19	0.21	0.25	**0.86**	**0.22**
Optimize Environment	0.14 (0.33/2.33)	0.12	0.11	0.13	**0.49**	**0.12**
Sum	1	1	1	1	**4**	**1**

Objective Function

*= 0.42*Return on Investment + 0.24*Optimize Safety*
*+ 0.22*Minimize Conflicts + 0.12*Optimize Environmental Issues*

Objective Function Practice (2)

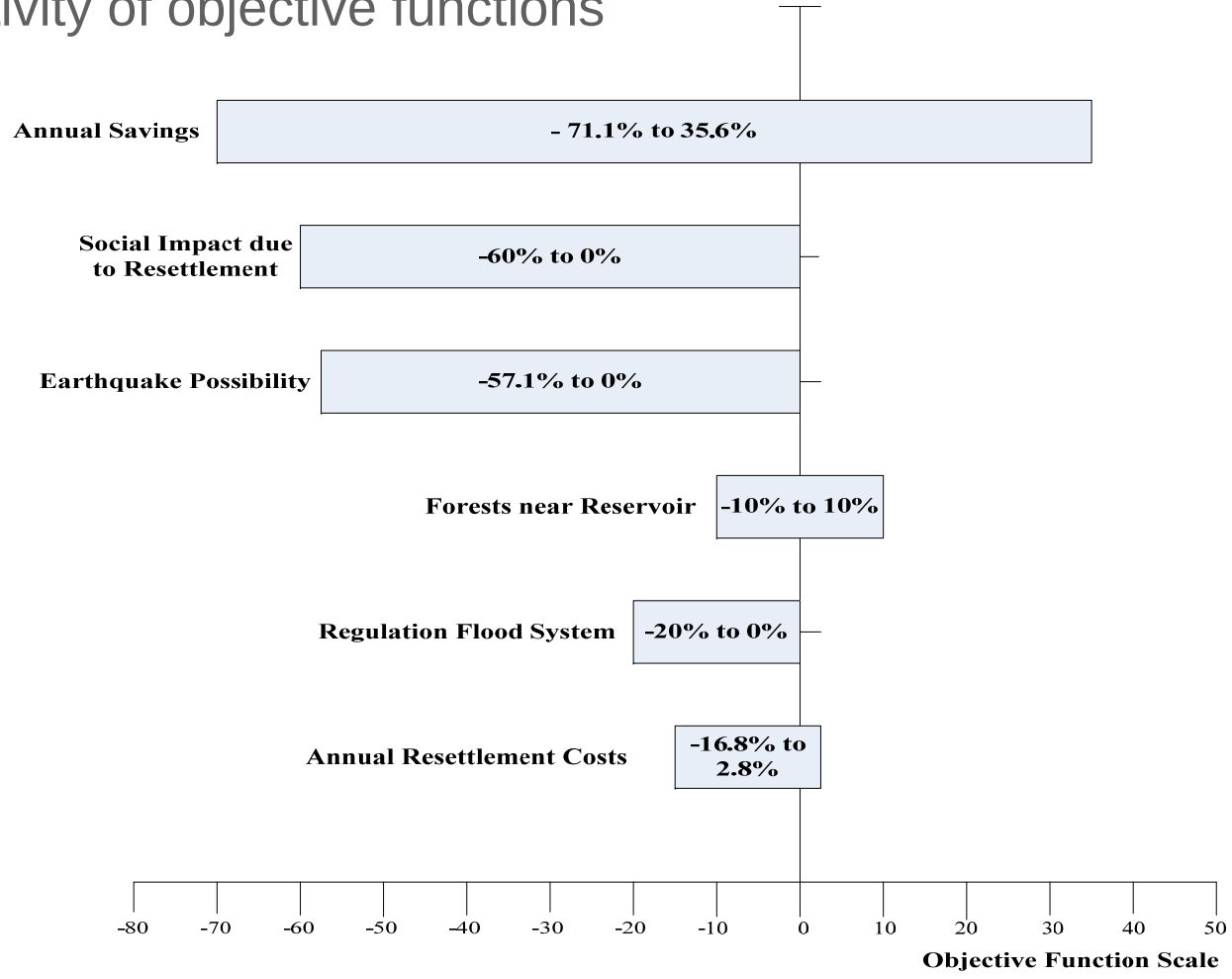
Objective Function

*= 0.42*Return on Investment + 0.24*Optimize Safety*
*+ 0.22*Minimize Conflicts + 0.12*Optimize Environmental Issues*

Ref. #	Variable or Data Element	Variable Type	Best Unit of Measure	Variable Value(s) or Range	Best Source(s) of Information	Current Reliability of Information/ Source	Need to Modify Data?
1	Go / No Go Decision	Decision					
2	Return on Investment	Calculated	$		Benefits & costs comparison		
3	Benefits	Calculated	$		Sub-criteria data		
4	Annual Savings	Calculated	$	$500 million (+10%,-20%)	Consultant firm & design firm	Reliable	
5	Local Economy Revitalization	State	H/M/L	H/M	Economist & consultant firm	Moderate	
6	More Job Market and Opportunities	State	H/M/L	H/M	Economist & consultant firm	Moderate	
7	Local City Growth	State	H/M/L	H/M	Economist & consultant firm	Moderate	
8	Improvement of Fluvial Navigation	State	H/M/L	M/L	Environmentalists & geologists	Low	
9	Opportunity for Recreation and Tourism	State	H/M/L	H/M	Economist & consultant firm	Moderate	
10	Water Supply	State	m3	25.4 billion m3	Design firm	Reliable	
11	Costs	Calculated	$	$4 billion (+-10%)	Sub-criteria data	Reliable	
12	Massive Construction Cost	Nominal	$	$2.3 billion (+-10%)	Design firm	Reliable	
13	Compensation and Resettlement Cost	Nominal	$	$700 million (+30%,-5%)	Owner & consultant firm	Reliable	
14	Commission for Russian Technologies	Nominal	$		Design firm & Russian contractor	Low	

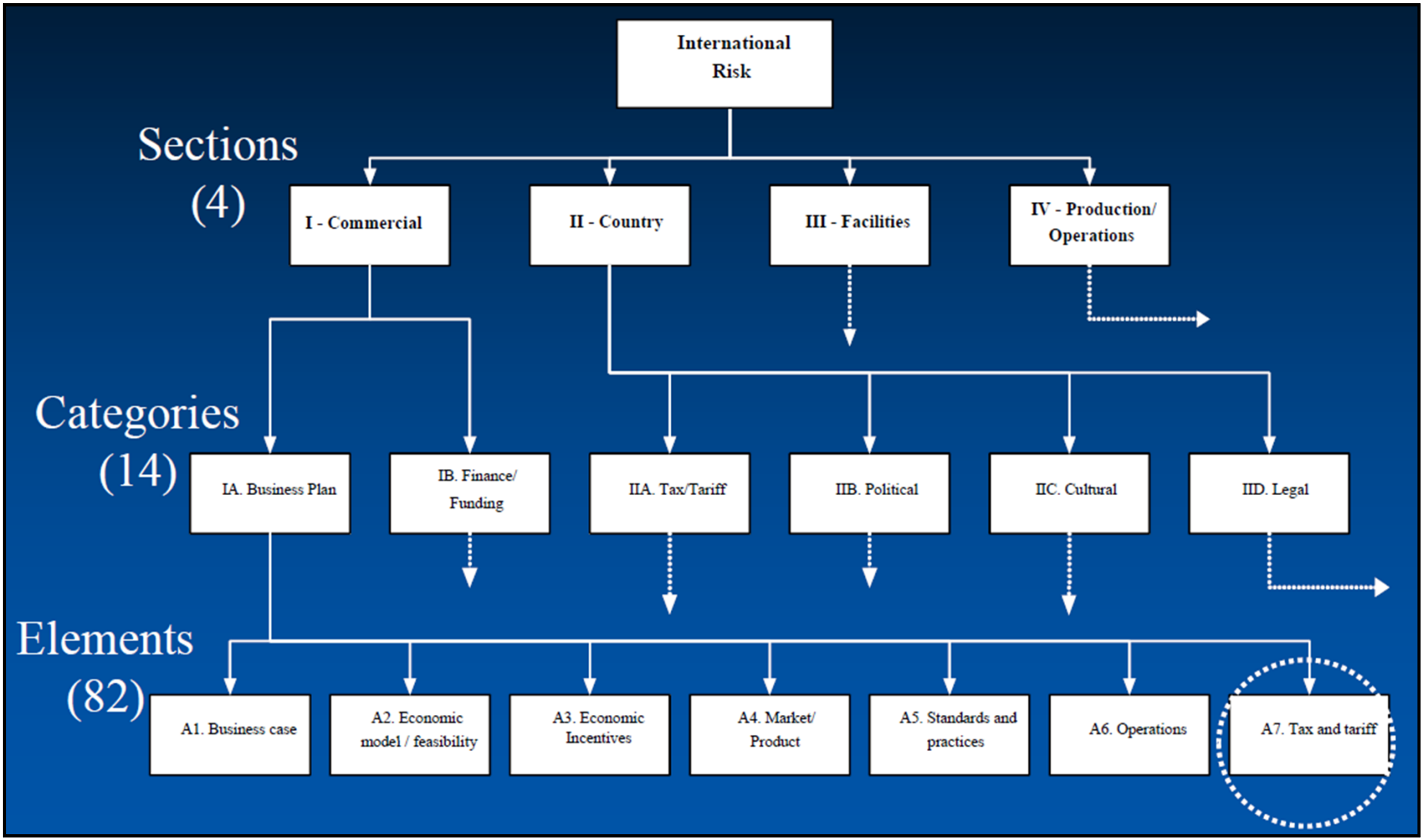
Objective Function Practice (2)

- **Sensitivity Analysis: Tornado Diagram**
  - Consider base, upper, and lower value of each variable and see sensitivity of objective functions



Risk Identification & Assessment Tool: IPRA

- **International Project Risk Assessment (IPRA)** – Construction Industry Institute (CII), U.S. 2003



Risk Identification & Assessment Tool: IPRA

- **Section I – Commercial**
  - I.A Business Plan
  - I.B Finance/Funding
- **Section II – Country**
  - II.A Tax/Tariff
  - II.B Political
  - II.C Cultural
  - II.D Legal
- **Section III – Facilities**
  - III.A Product Scope
  - III.B Sourcing and Supply
  - III.C Design/Engineering
  - III.D Construction
  - III.E Start-Up
- **Section IV – Production/Operations**
  - IV.A People
  - IV.B Legal
  - IV.C Technical

Risk Identification & Assessment Tool: IPRA

- **Section I – Commercial**
  - I.A Business Plan
    - I.A.1 Business case
    - I.A.2 Economic model/feasibility
    - I.A.3 Economic incentives/barriers
    - I.A.4 Market
    - I.A.5 Standards and practices
    - I.A.6 Operations
    - I.A.7 Tax and tariff (세금/관세)

Risk Identification & Assessment Tool: IPRA

I.A7. Tax and Tariff

Host country taxes and tariffs impact projects and early identification of their repercussions is critical considering the entire life cycle of the venture. Most taxes and tariffs arise under statutes that are administered by government agencies and can provide for serious sanctions in case of violation. Calculation, administration, and reporting requirements related to foreign taxes and tariffs are functions where in-country expertise is often required (see Category C, Section II for a more detailed treatment of tax and tariff). Taxes and import duties need to be understood for investment, construction, and ongoing facility operation. Items to consider include:

- ❑ Basis and rate of charges
- ❑ Volatility for changes
- ❑ Registration and applications
- ❑ Nature of enforcement
- ❑ Type of tax (income, business, VAT, corporate, technology, etc.)
- ❑ Application of tax and duty laws and their specificity
- ❑ Miscellaneous fees, levies, import duties, etc.
- ❑ Other

Risk Identification & Assessment Tool: IPRA

CATEGORY	NA	Likelihood of Occurrence (L) Very Low → Very High					Relative Impact (I) Negligible → Extreme					Baseline	Coordinate L, I	Comments
		1	2	3	4	5	A	B	C	D	E			
II.A BUSINESS PLAN														
II.A.1 Business case												E		
II.A.2 Economic model/ feasibility												D		
II.A.3 Economic incentives/ barriers												E		
II.A.4 Market/product												D		
II.A.5 Standards and practices												D		
II.A.6 Operations												D		
II.A.7 Tax and tariff												D		

Legend

Likelihood of Occurrence

NA = Not applicable to this project
1 = Very low probability and occurs in only exceptional circumstances (<10% chance)
2 = Low chance and unlikely to occur in most circumstances (10% chance <35%)
3 = Medium chance and will occur in most circumstances (35% chance <65%)
4 = High chance and will probably occur in most circumstances (65% chance <90%)
5 = Very high chance and almost certain and expected to occur (90% or greater chance of occurrence)

Relative Impact

A = Negligible and routine procedures sufficient to deal with the consequences
B = Minor and would threaten an element of the function
C = Moderate and would necessitate significant adjustment to the overall function
D = Significant and would threaten goals and objectives; requires close management
E = Extreme and would stop achievement of functional goals and objectives

Risk Identification & Assessment Tool: IPRA

Risk Assessment Sheet--SECTION II--COUNTRY

CATEGORY	NA	Likelihood of Occurrence (L) Very Low → Very High					Relative Impact (I) Negligible → Extreme					Baseline	Coordinate L, I	Comments
		1	2	3	4	5	A	B	C	D	E			
II.C Cultural														
II.C.1 Traditions and business practices						✓					✓	E	5, E	
II.C.2 Public opinion			✓						✓			D	2, C	
II.C.3 Religious differences			✓					✓				E	2, B	

Legend

Likelihood of Occurrence

NA = Not applicable to this project
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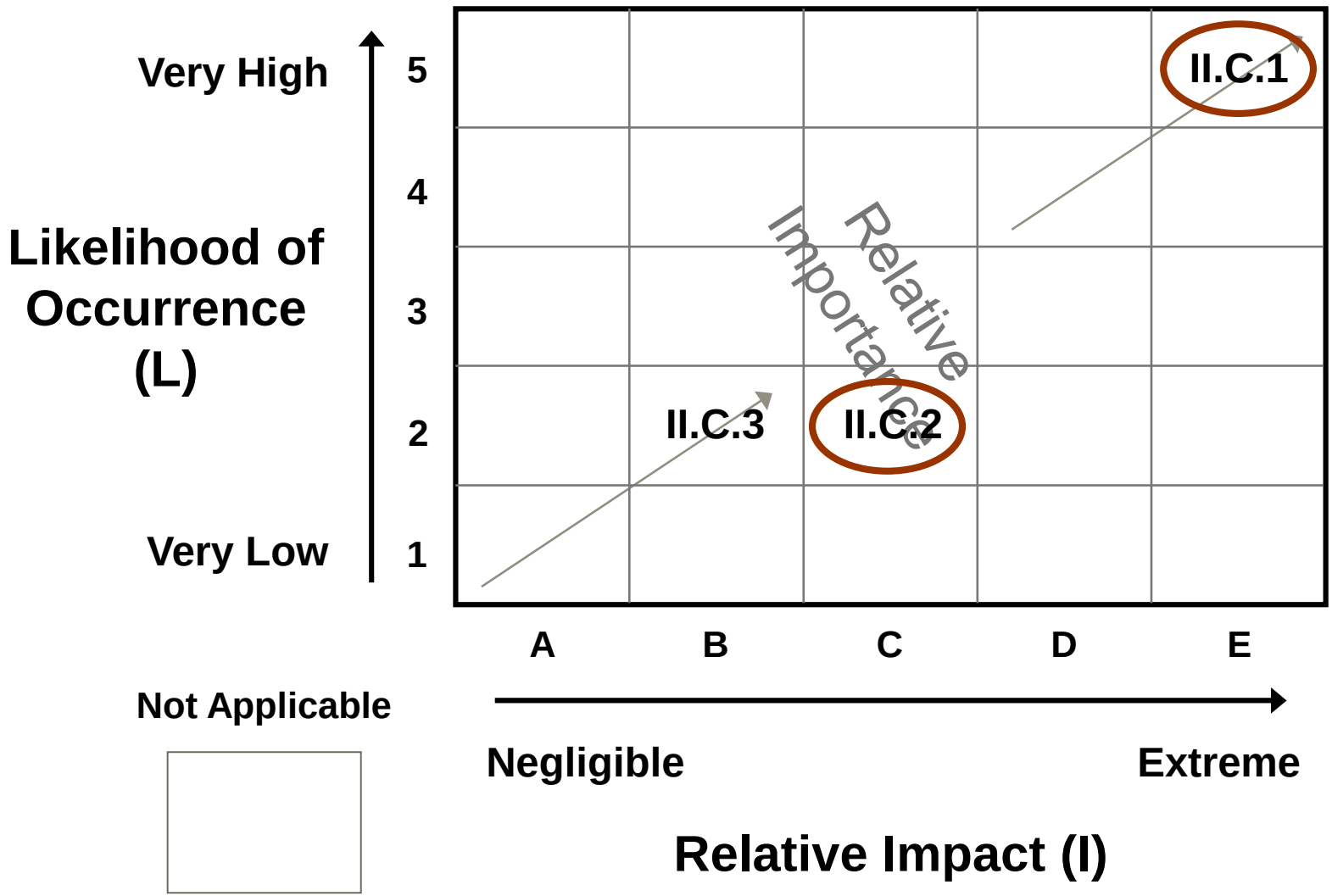
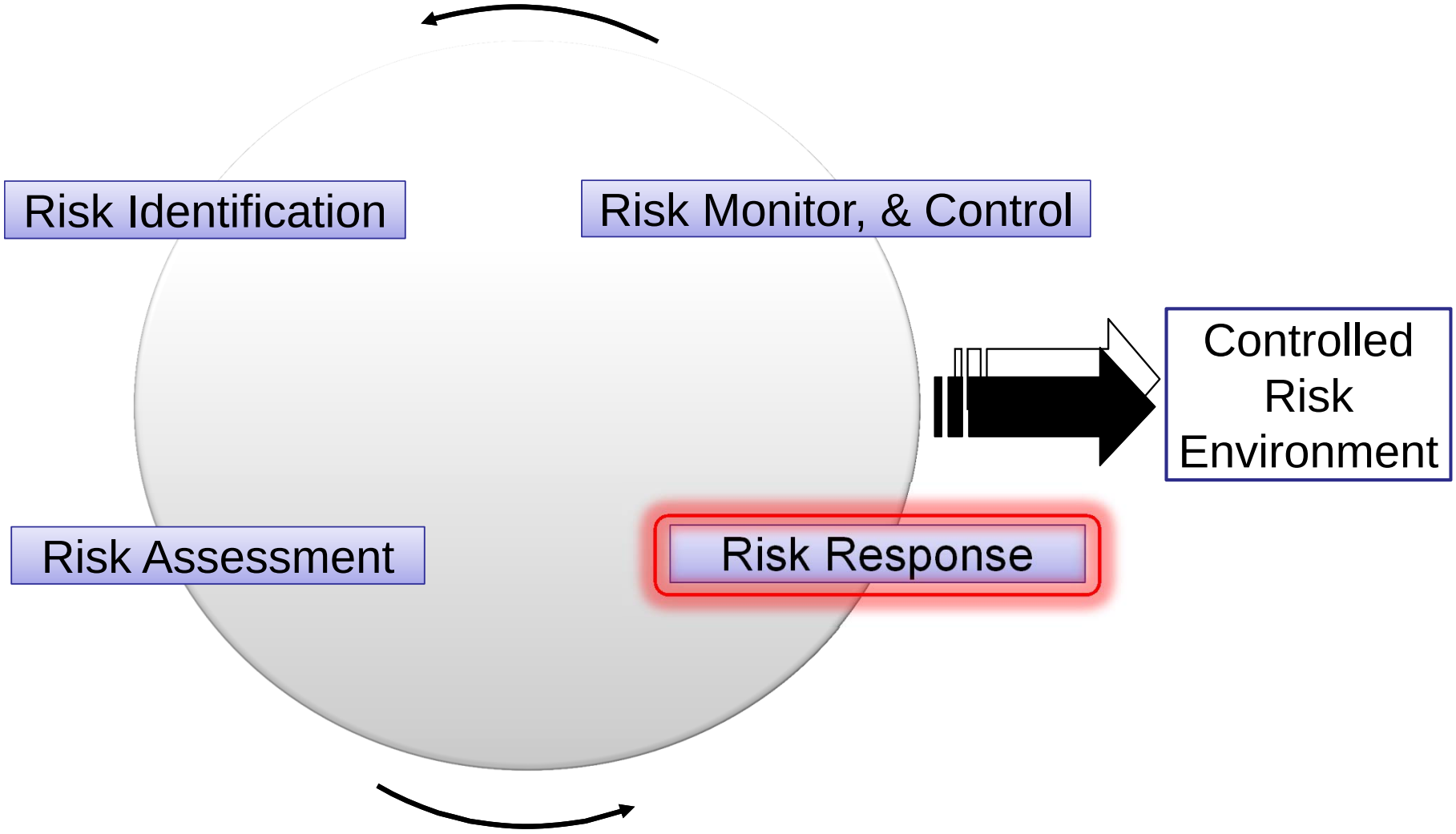
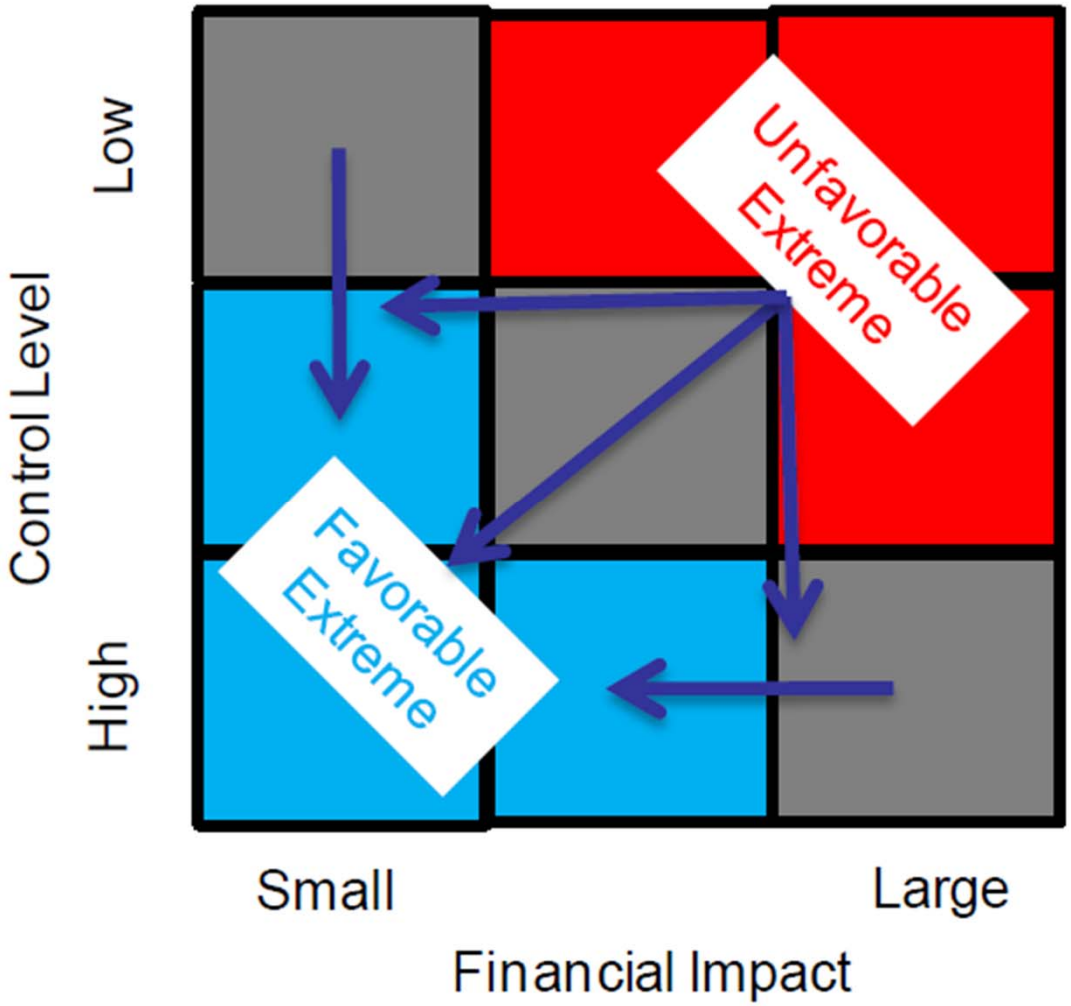
Risk Identification & Assessment Tool: IPRA



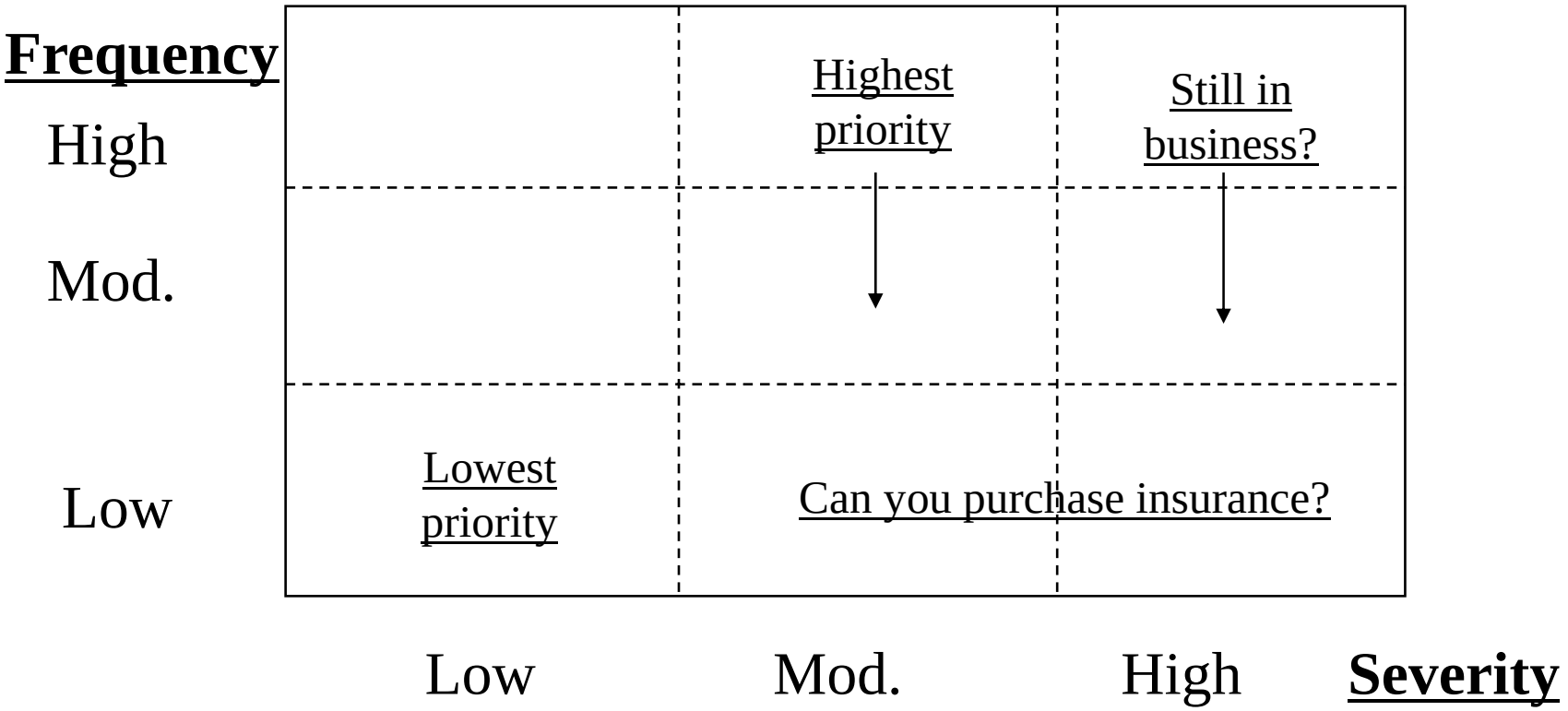
Risk Management Process



Objective of Risk Response



Objective of Risk Response



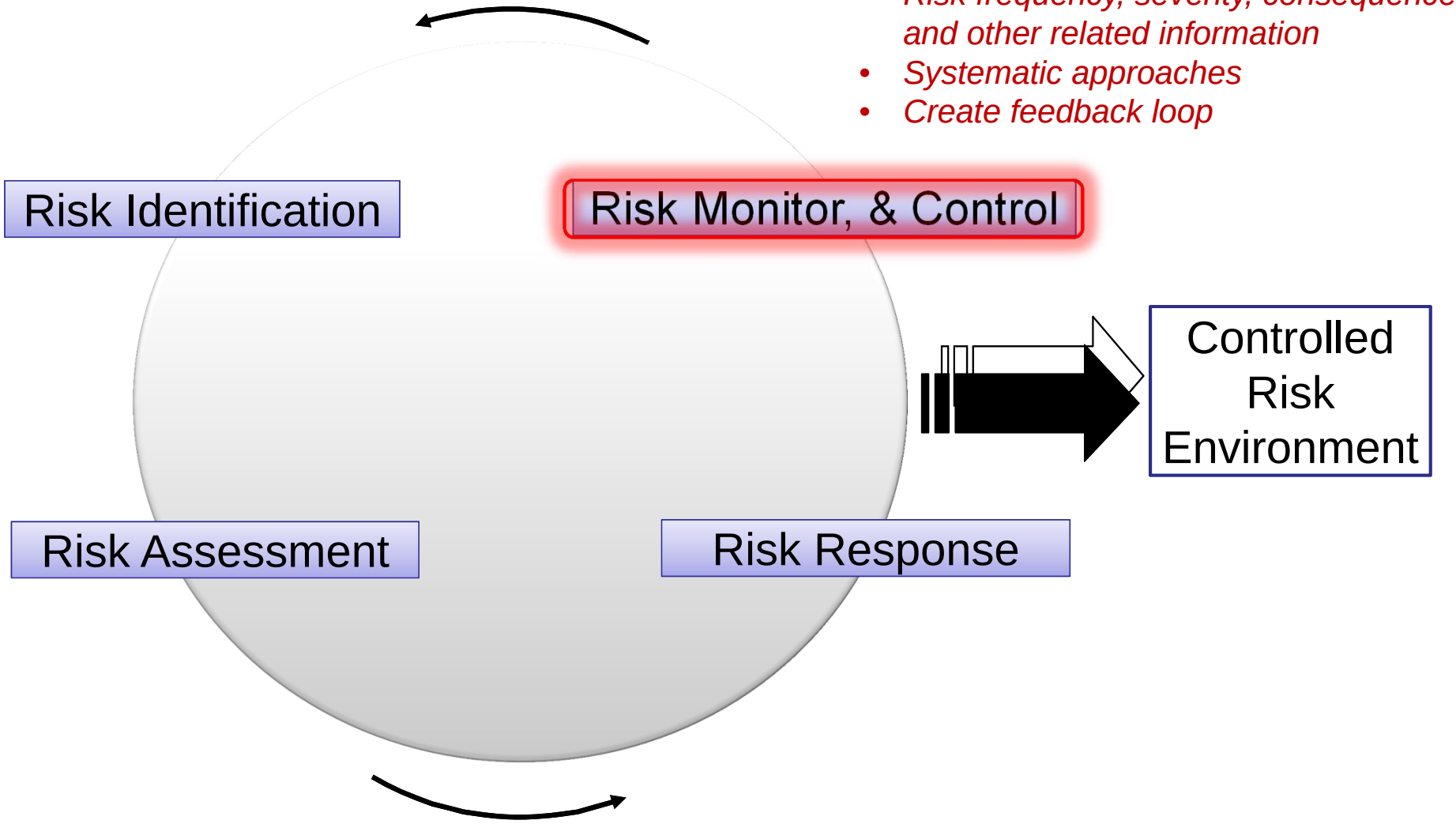
Risk Response

- **Proactive Prevention**
  - Focus is on prevention, Preferred, most cost-effective approach
  - Plan, then implement now

- **4Ts**
  - Transfer: **risk sharing** via contracts(negotiation), joint venture, incentives, insurance, bonds, liquidated damages, warranties, working day contract(disaster, severe weather), …
  - Treat: **risk reduction** via training, constructability, antitheft devices, sprinkler systems, ...
  - Take: **risk acceptance** with contingency, …
  - Terminate: **risk avoidance**: don’t participate(problems of hazardous waste, political, financial, etc.), use only proven technologies, …

Risk Management Process

- *Keep tracking risk register*
- *Risk frequency, severity, consequences, and other related information*
- *Systematic approaches*
- *Create feedback loop*



Texagon Management Inc.
Project Management
Dr. G. Edward Gibson, Jr.
9/28/2004

Risk Management Register for Navy Barracks / Great Lake Training Project

	PDRI Sections	Issue	Schedule	Cost	Impact	Mitigation	Who	When
1	A5: Facility Requirements D4:Government Regulatory Requirements	Building/EPA Permit acquisitions	H	L	Cannot start entire job	1) Improvement needed on Pre-Project Planning. 2) Need better work on front end and better job addressing	Project Manager	Before construction phase
2	F4: Mechanical Design G3: Equipment Utility Requirements	Design problems: Valve, mechanical and galley equipment access	M	H (< 5% of Project cost)	1) Useless utilities 2) Maintenance problems	1) To be addressed in design time-out by designers. 2) Do monthly walk-through and status updates	Design Manager	During design phase
3	B4: Design Philosophy	Entire design review process and its documentation of comments.	M	L	Hard to make good progress and alignment	1) A team design review meeting. 2) Work the timeliness of receiving the comments and the quality of the review.	Design Manager	Before design review and construction phase
4	L2: Owner Approval Requirement	Occasional delays in resolving change orders and customer changes late into construction	M	M	Rework and cost more	1) Pay more attention on completing the paperwork 2) Fix through design review process. 3) When personnel turnover occurs, enforce the previous decisions to avoid late changes	Project Manager Construction Manager Design Manager	Throughout project life
5	K: Project Control	Severe winter work conditions	H	H (< 5% of Project cost)	Delay and less productivity	1) Development of Heating plan 2)Thawing out the frost lines	Construction Manager	During construction phase
6	K5: Safety Procedures	Construction safety	H	H (< 5% of Project cost)	Accidents can stop the project	1) Monthly recognition with tangible awards 2) Subcontractor's participation	Project Team	Throughout project life
7	J2: Documentation/Deliverables	Delay in submittals by A-E designers	M	L	1) We cannot start each sections 2) Delay of the entire work	Increase design team's capacity	Design Manager	Throughout project life
8	K1: Project Quality Assurance and Control	Air emission standards when boiler operates with back up fuel	L	L	Bad to environment	1) Raise plant boiler stack height 2) Use very low sulfur content fuel	Design Manager Project Controls Manager	During design and operation phase
9	D1: Site Layout	Utility system coordination : Choosing best locations for grease traps and transformers	L	L	Maintenance Issues	1) Coordinate utility distribution more closely 2) Special co-ordination meeting	Design Manager Construction Manager	Throughout design phase
10	J2: Documentation/Deliverables	Completion of As-builts	L	L	Operations and maintenance issues	Ensure they are compiled and issued	Design manager Construction Manager	Project Completion

Legend > H : High Impact
> M : Medium Impact
> L : Low Impact

Q & A

Please Feel Free to Contact Me at shchi@snu.ac.kr