



# Risk Management Strategy for Infrastructure Public-Private Partnership Projects

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# Outline

- ❖ **Background: Private-Private Partnership in Taiwan**
- ❖ **Case: Taiwan High Speed Rail**
- ❖ **Initiative: Risk Management Strategy for Infrastructure Public-Private Partnership Projects**



# Part I: Background

## Private-Private Partnership in Taiwan



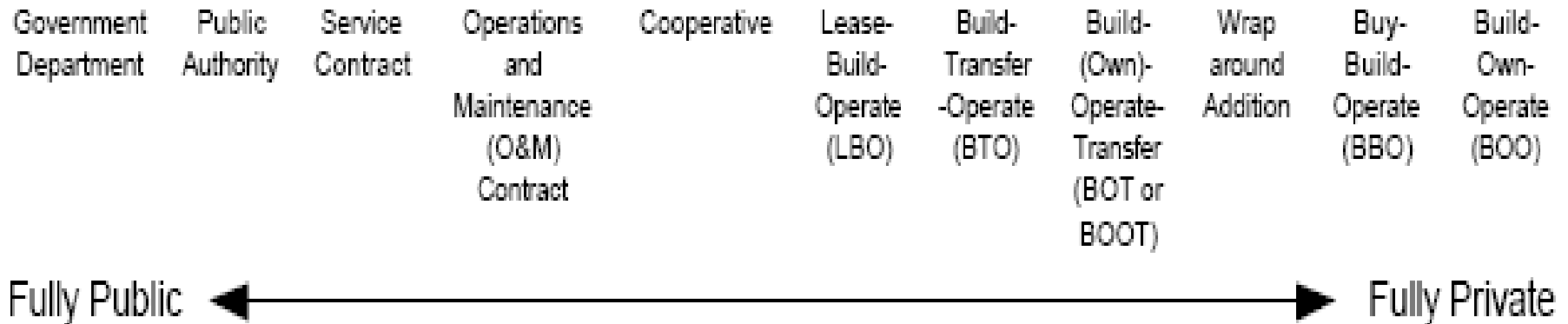
# PPP - Definition

***“A Public-private partnership is a contractual agreement between a public agency (federal, state or local) and a private sector entity. Through this agreement, the skills and assets of each sector (public and private) are shared in delivering a service or facility for the use of the general public. In addition to the sharing of resources, each party shares in the risks and rewards potential in the delivery of the service and/or facility.”***

***- National Council for Public-Private Partnerships***



# PPP - Spectrum



Source: Savas, E.S. [2000].



# PPP – Worldwide Trend

## 🔴 **Survey of PricewaterhouseCoopers**

- In 2004~2005, 206 PPP deals, totaled € 42 billion
  
- Outside Europe: €21 billion in 54 deals
  - Australia, Canada, Japan, Mexico, US
  - China, Hong Kong, Singapore, Middle Eastern countries
  
- Europe: €21 billion in 152 deals
  - UK, Spain, Portugal, German, France
  - Italy, Ireland, Netherlands, Greece, Denmark, Finland



# PPP in Taiwan – Location

Area: 36,000 km<sup>2</sup>

Population: 23 million

Climate: 24.7 °C Avg. in May





# PPP in Taiwan - History



**300km railway concession proposed by local government**



**Statute for Encouragement of Private Participation in Major Transportation Projects**



**Regulation of Open Electricity Industry**



**Plan for Public & Private Participation in Incinerator Projects**

**Law for Promotion of Private Participation in Infrastructure Projects**



**1887**

**1994**

**1995**

**1996**

**2000**



# PPP in Taiwan – PPIP Law

## ☉ **Underlying principles**

- ☐ General Application
- ☐ Maximization of private participation
- ☐ Maximum government prudence

## ☉ **Models of Private Participation**

- ☐ BOT, BTO, BOO, ROT, OT

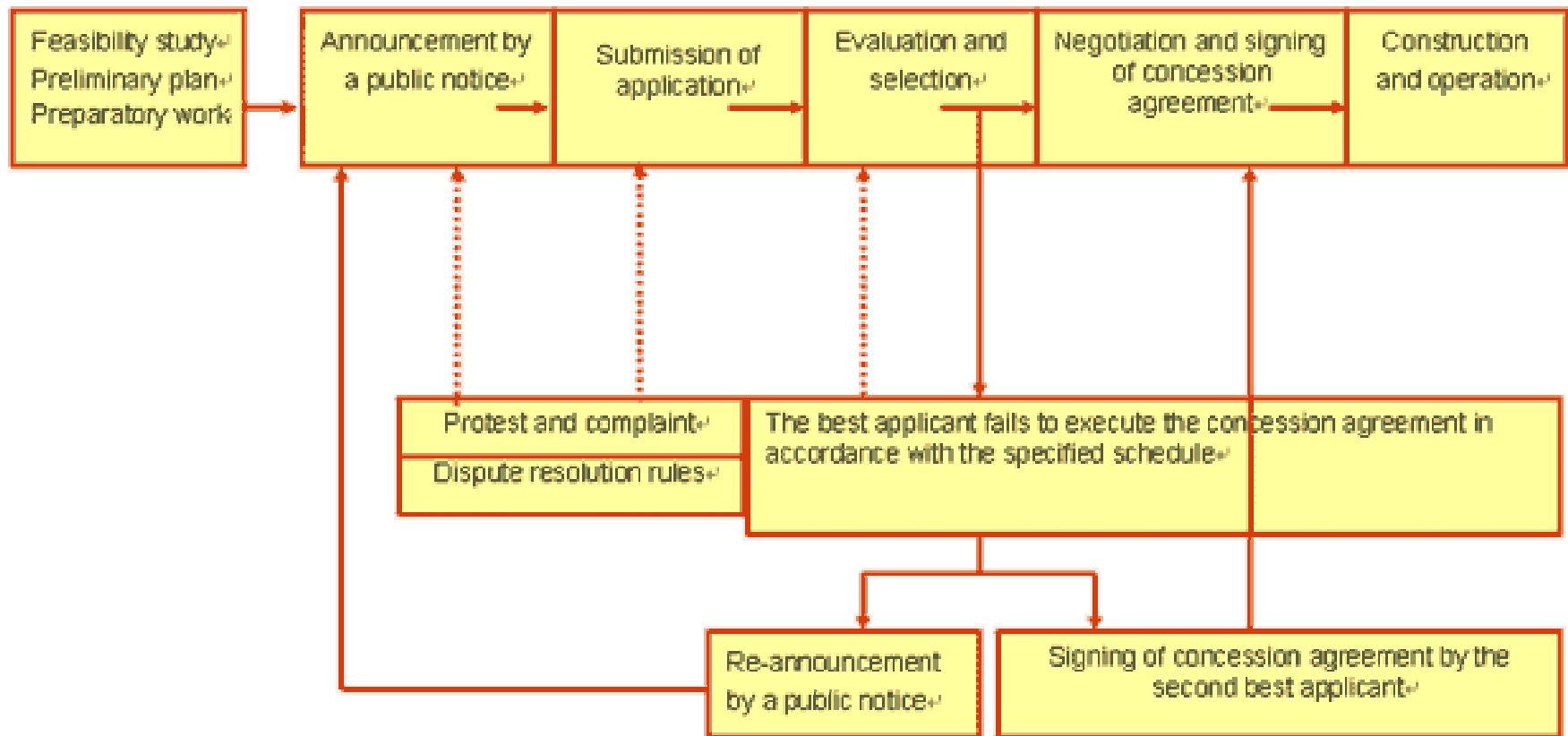
## ☉ **Procedures of Application**

- ☐ Government planned projects
- ☐ Unsolicited Proposal



# PPP in Taiwan – Application

## Government-Planned Projects





# PPP in Taiwan - Organizations

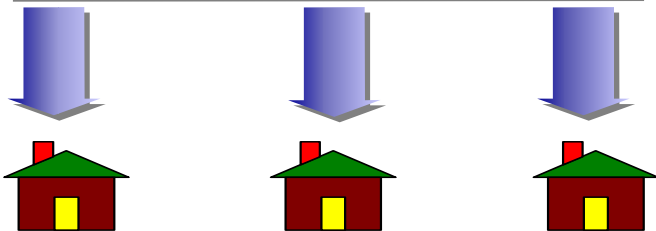
**Coordination Committee for the Promotion of Private Participation in Infrastructure Projects, Executive Yuan**



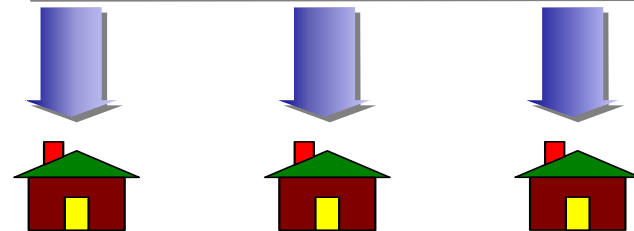
**Coordination Task force**

**County ( City ) government authority-in-charge promotion committees**

**Central government authority-in-charge promotion committees**



**Authority-in-charge of each project  
Implementing agencies of individual projects**



**Authority-in-charge of each project  
Implementing agencies of individual projects**



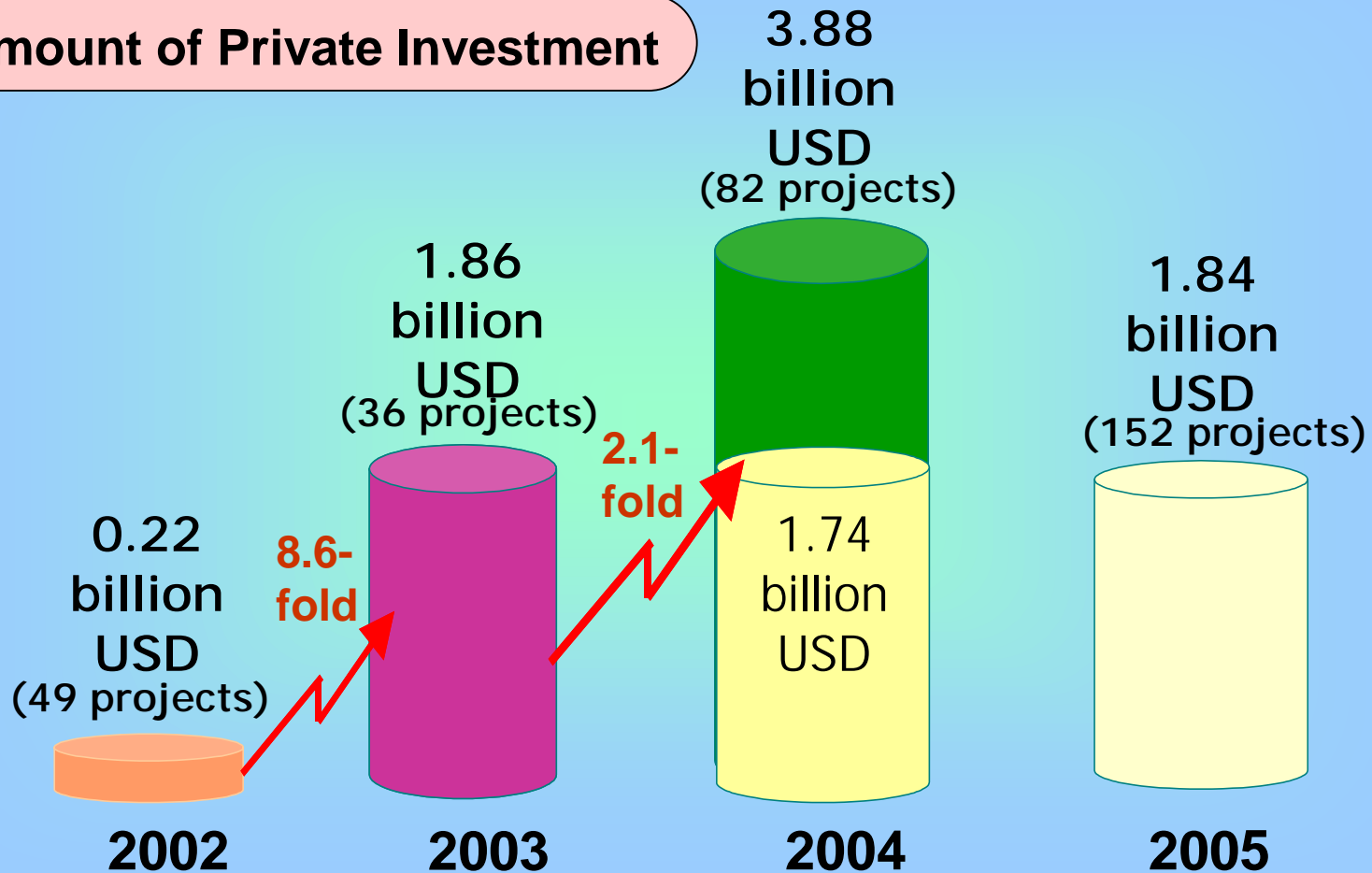
# PPP in Taiwan – Incentives

- ❖ **Land acquisition**
- ❖ **Capital raising**
- ❖ **Tax incentives for major infrastructure projects**
- ❖ **Ancillary enterprise**
- ❖ **Deregulation of foreign capital participation**



# PPP in Taiwan – Statistics

## Amount of Private Investment





# PPP in Taiwan – Statistics

Private Participation	Investment Volume (Unit: million US\$)	No. of Projects
<b>BOT</b>	<b>5,742.5</b>	<b>34</b>
BTO	3.1	1
<b>ROT</b>	<b>145.5</b>	<b>61</b>
<b>OT</b>	<b>120.6</b>	<b>93</b>
<b>BOO</b>	<b>906.3</b>	<b>10</b>
BOT + OT	92.5	1
BOT + ROT	35.9	4
OT + ROT	3.8	2
<b>Total</b>	<b>7,050.2</b>	<b>192</b>

Source: Public Construction Commission [2005]



# PPP in Taiwan – Statistics

Facilities	Investment Volume (Unit: million US\$)	No. of Projects
<b>Cultural &amp; Education</b>	198.0	<b>49</b>
<b>Transportation &amp; Common Conduit</b>	<b>4,154.4</b>	<b>25</b>
Sewerage, Water Supply & Conservancy	386.3	4
Social & Labor Welfare	83.0	15
<b>Industrial, Commercial &amp; Hi-tech</b>	<b>1,022.3</b>	7
Agricultural	75.1	12
<b>Sanitation &amp; Medical</b>	197.0	<b>64</b>
<b>Tourism</b>	<b>934.1</b>	16
<b>Total</b>	<b>7,050.2</b>	<b>192</b>

Source: Public Construction Commission [2005]



# Part II: Case

## Taiwan High Speed Rail



# Specifications

## Alignment

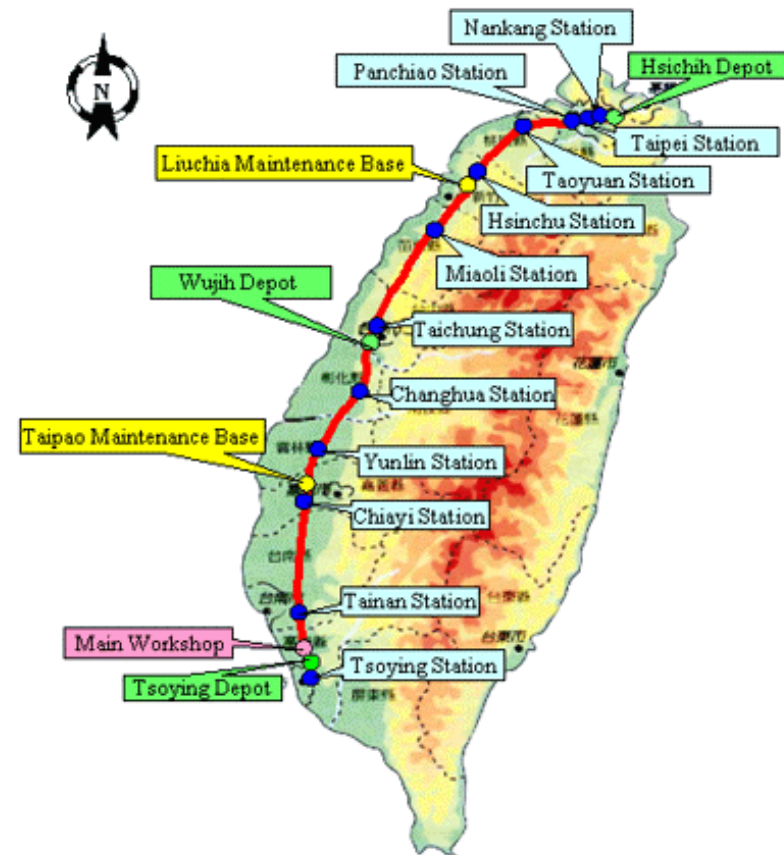
- 345 km, Taipei~Kaohsiung
- 12 stations, 5 maintenance bases

## Structure types

- Viaducts & bridges – 207km
- Tunnel/cut&cover – 56km
- Embankments/cuttings – 81km

## Track

- 2 tracks
- Standard gauge (1,435mm)





# Specifications

## ❁ **Core system**

- ❁ TGV+SKS hybrid system

## ❁ **Design speed**

- ❁ 350 km/hr

## ❁ **Operating features**

- ❁ 250~300 km/hr operation speed
- ❁ 4-min service interval in peak hour
- ❁ 18-hr operation every day
- ❁ 80-min travel time for direct train
- ❁ 989 seats per train





# Model of Private Participation

**10 Years**  
**Government**

**35 Years**  
**Taiwan High Speed Rail Corporation**

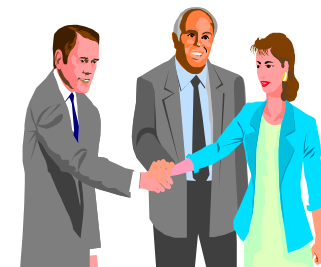
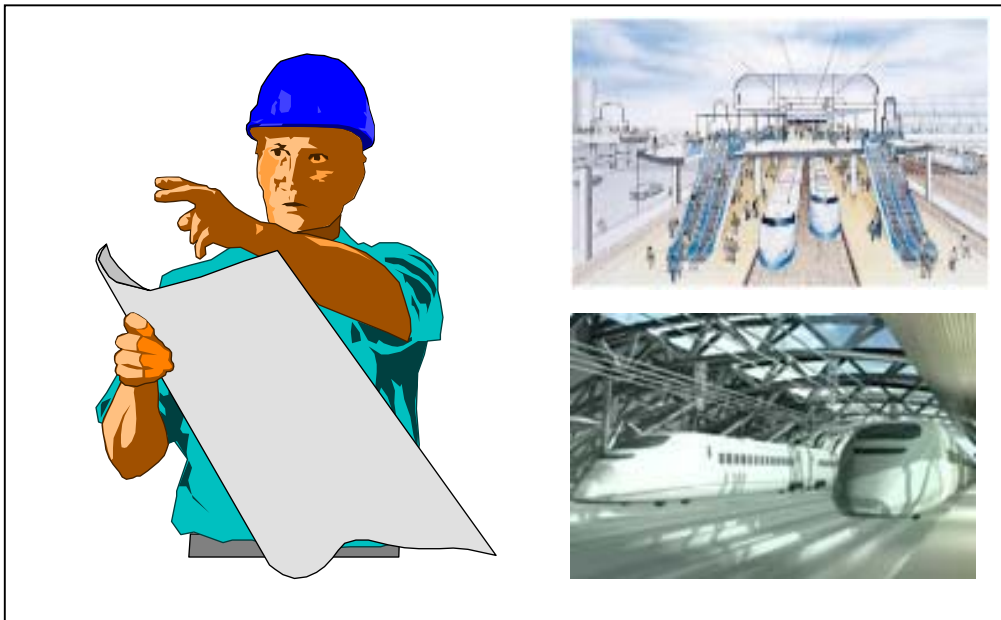
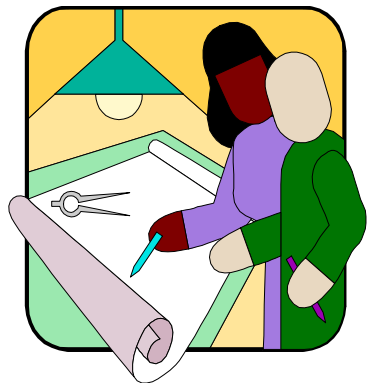
**Government**

**Planning**

**Build**

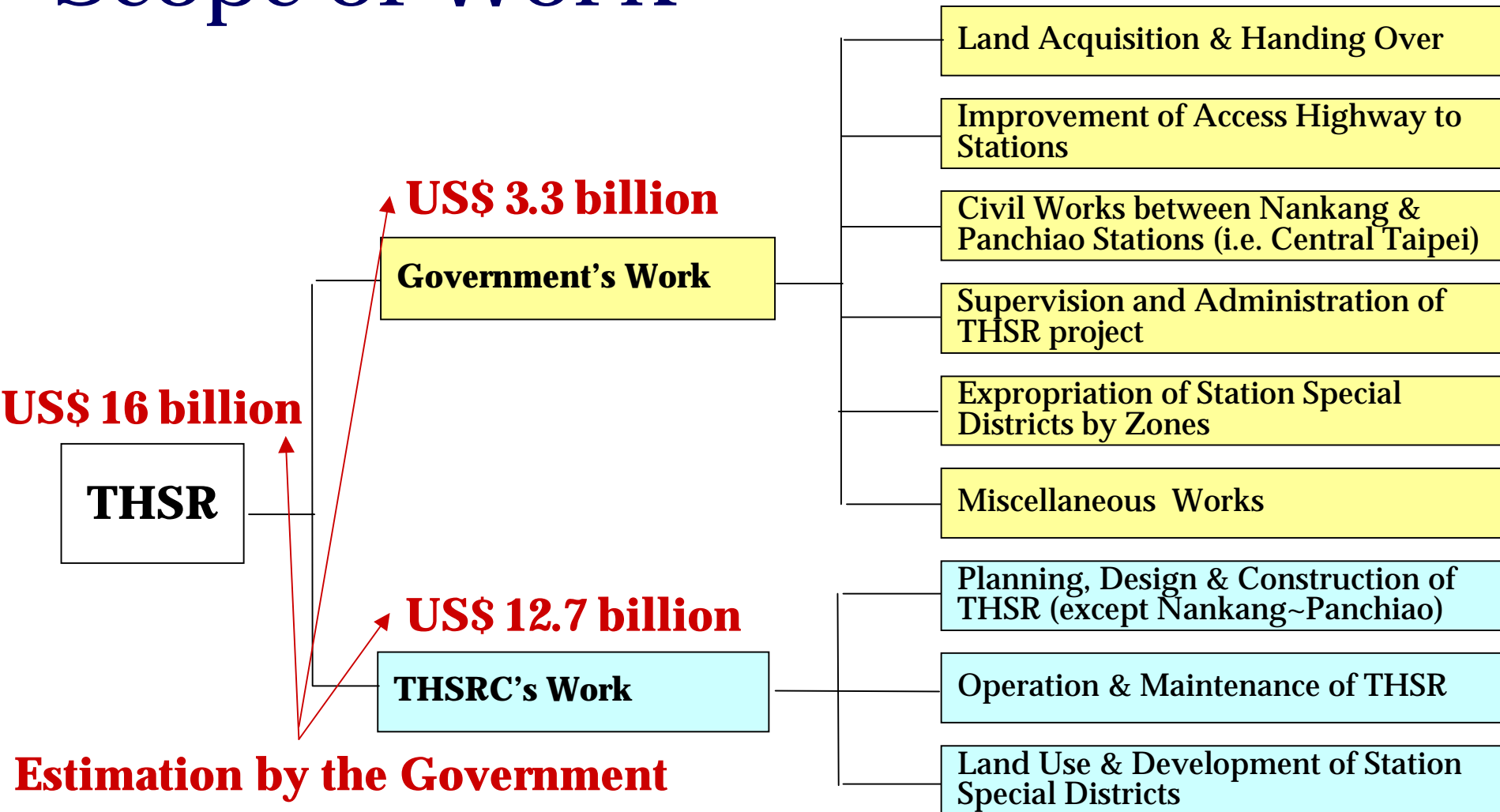
**Operate**

**Transfer**



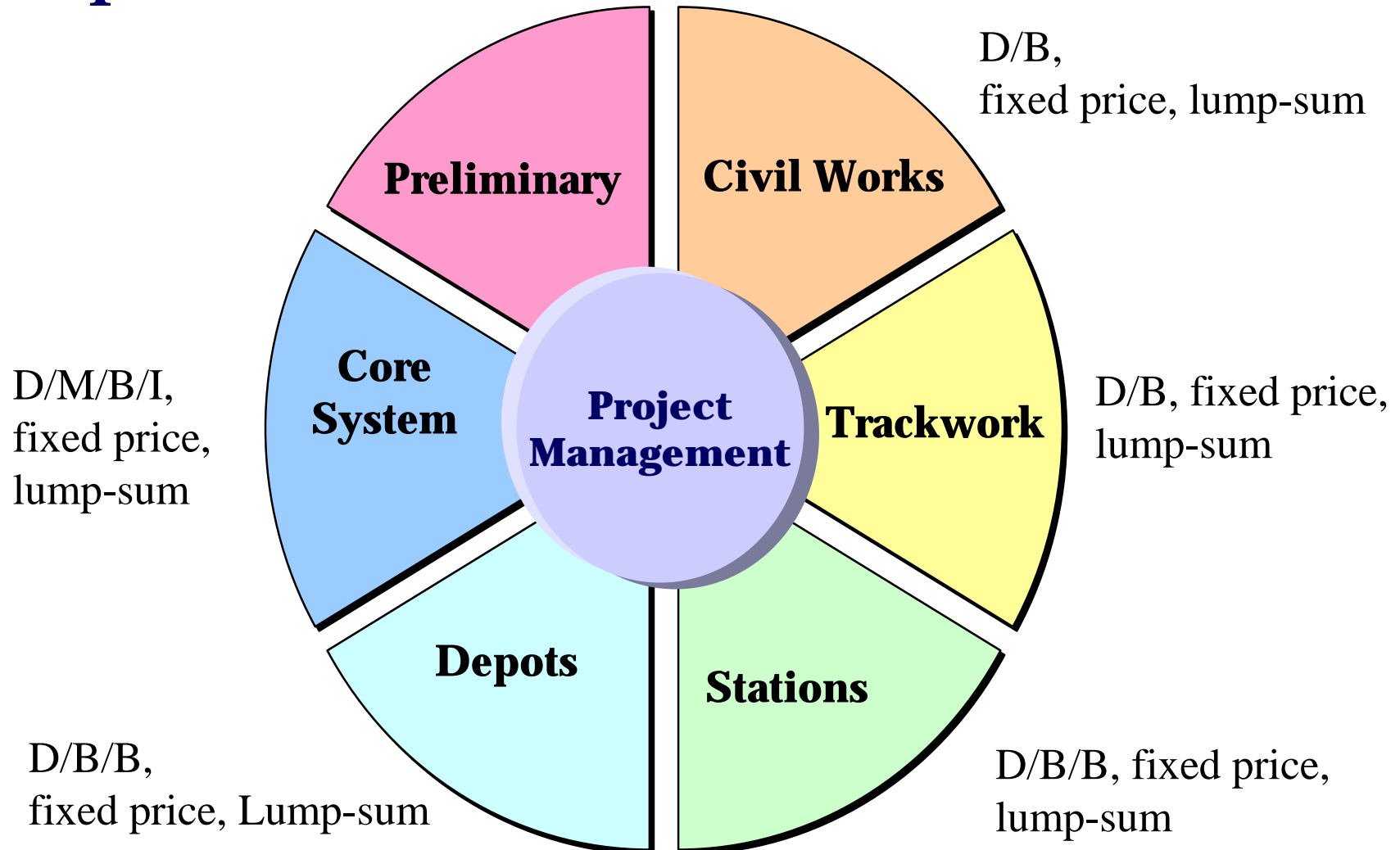


# Scope of Work





# Scope of Works





# Chronology

1990/07	<ul style="list-style-type: none"><li>• Provisional Office of the High Speed Rail was established.</li></ul>
1992/06	<ul style="list-style-type: none"><li>• The alignment of THSR was permitted by the Executive Yuan.</li></ul>
1995/01	<ul style="list-style-type: none"><li>• <b>The Legislative Yuan passed the THSR plan, requiring the part of private investment in THSR must exceed 40%.</b></li></ul>
1996/10	<ul style="list-style-type: none"><li>• Announcement to invite private participation.</li></ul>
1997/09	<ul style="list-style-type: none"><li>• Taiwan High Speed Rail Consortium was selected as the best applicant by the Selection Committee.</li></ul>
1998/05	<ul style="list-style-type: none"><li>• Taiwan High Speed Rail Corp, Ltd. (THSRC) was officially registered with the capital volume of US\$1.56billion.</li></ul>
1998/07	<ul style="list-style-type: none"><li>• THSRC was awarded the concession agreement by MOTC.</li></ul>
1998/09	<ul style="list-style-type: none"><li>• Chiao Tung Bank (CTB), Bank of Taiwan (BoT), and International Commercial Bank of China (ICBC) formed the finance syndicate for THSRC.</li></ul>
1999/08	<ul style="list-style-type: none"><li>• <b>THSRC signed the Tripartite Contract with MOTC and CTB, representing the Bank Consortium, comprised of 25 banks.</b></li></ul>
2000/01	<ul style="list-style-type: none"><li>• Design contracts of all Stations were awarded.</li></ul>



# Chronology

2000/01	<ul style="list-style-type: none"><li>• Design contracts of all Stations were awarded.</li></ul>
2000/02	<ul style="list-style-type: none"><li>• The Contract of Syndicate Loan totaled US\$10.1 billion was signed between THSRC and 25 banks, represented by the CTB.</li></ul>
2000/04	<ul style="list-style-type: none"><li>• Design/build contracts of all civil works were awarded.</li></ul>
2000/12	<ul style="list-style-type: none"><li>• <b>THSRC signed core system supply and installation contracts valued at US\$3 billion with the Taiwan Shinkansen Corp. and the Taiwan Shinkansen International Engineering Corp.</b></li></ul>
2003/03	<ul style="list-style-type: none"><li>• Contract of automated booking and tolling system was awarded.</li></ul>
2003/07	<ul style="list-style-type: none"><li>• T240 Rail Installation Ceremony, symbolized the commencement of track work.</li></ul>
2004/01	<ul style="list-style-type: none"><li>• The production of THSRC 700T trains by Kawasaki was finished.</li></ul>
2004/05	<ul style="list-style-type: none"><li>• Construction works along the route completed.</li></ul>
2005/01	<ul style="list-style-type: none"><li>• 700T Test Run Inauguration started in Tainan.</li></ul>
2005/09	<ul style="list-style-type: none"><li>• <b>THSRC announced the revision of Target Operation Date from 2005/10/31 to 2006/10/31.</b></li></ul>
2005/10	<ul style="list-style-type: none"><li>• <b>700T Test Run reached top speed of 315km/hr.</b></li></ul>



# Shareholders of THSRC

## ● **A/E/C, Transportation & Materials**

- **Continental Engineering Corp.**
- **EVA Airways Corp.**
- Tung Ho Steel Enterprise Corp.

## ● **Finance**

- **Taipei-Fubon Commercial Bank**
- Shinkong Insurance Co., Ltd.

## ● **Electronics & Communication**

- **Pacific Electric Wire & Cable Co., Ltd.**
- **TECO Electric & Machinery Co., Ltd.**
- Walsin Lihwa Co, Ltd.

## ● **Government & Relevant Organizations**

- **Executive Yuan Development Fund**
- **Taiwan Sugar Corp.**
- **China Aviation Development Foundation**
- **CTCI Foundation**

## ● **Institutional & Individual Investors**



# International Teamwork

## ● **THSRC**

- 1500 engineers & technical staff
- 1/3 of above are foreigners from 26 countries

## ● **Contractors**

- Civil works – 12 subprojects
  - Taiwan, Japan, Korea, Hong Kong, Thailand, Italy, Germany, Netherlands, France
- Stations – 8 subprojects
  - Taiwan, Japan
- Depots – 4 subprojects
  - Taiwan, Japan
- Electric & Mechanical – 2 subprojects
  - Taiwan, Japan, France



# List of Contractors – Civil Works

Subproject No.	Start Mileage	Finish Mileage	Length (m)	Contractor	Award Date	Commencement Date
C210	16K+800	28K+080	11,280	Obayashi - Futsu JV	2000/1/10	2000/4/1
C215	28K+080	68K+540	40,460	Obayashi - Futsu JV	2000/1/10	2000/4/1
C220	68K+540	86K+320	17,780	Daiho Corporation	2000/3/1	2000/4/1
C230	86K+320	109K+760	23,440	Hyundai - Chung Lin - Zen Pacific JV	2000/4/1	2000/5/1
C240	109K+760	130K+600	20,840	Hyundai - Chung Lin JV	2000/4/1	2000/5/1
C250	130K+600	170K+400	39,800	Hochtief - Ballast Nedam - Pan Asia JV	2000/5/1	2000/5/1
C260	170K+400	207K+015	36,615	BB - CEC JV	2000/4/1	2000/4/1
C270	207K+015	249K+814	42,799	BB - CEC JV	2000/3/1	2000/4/1
C280	249K+814	284K+221	34,407	Samsung - Doosan - IE&C JV	2000/2/1	2000/3/1
C291	284K+221	312K+734	28,513	Evergreen - Shimizu JV	2000/3/1	2000/4/1
C295	312K+734	340K+058	27,324	Evergreen - Italian Thai - PEWC JV	2000/3/1	2000/4/1
C296	340K+058	343K+120	3,062	Evergreen - Shimizu JV	2001/1/5	2001/1/5



**Tunnel Construction**



**Viaduct Construction**



**Track Works**



**Vehicle Testing**



# Progress



**Overall**

**94.05%** [Feb 2006]

**Civil works**

Completed **100%**

**Stations**

Completed **98.71%**

**Trackwork**

Completed **100%**

**Core system**

Completed **79.05%**

**Depots**

Completed **94.71%**



# Part III: Initiative

## Risk Management Strategy for Infrastructure Public- Private Partnership Projects

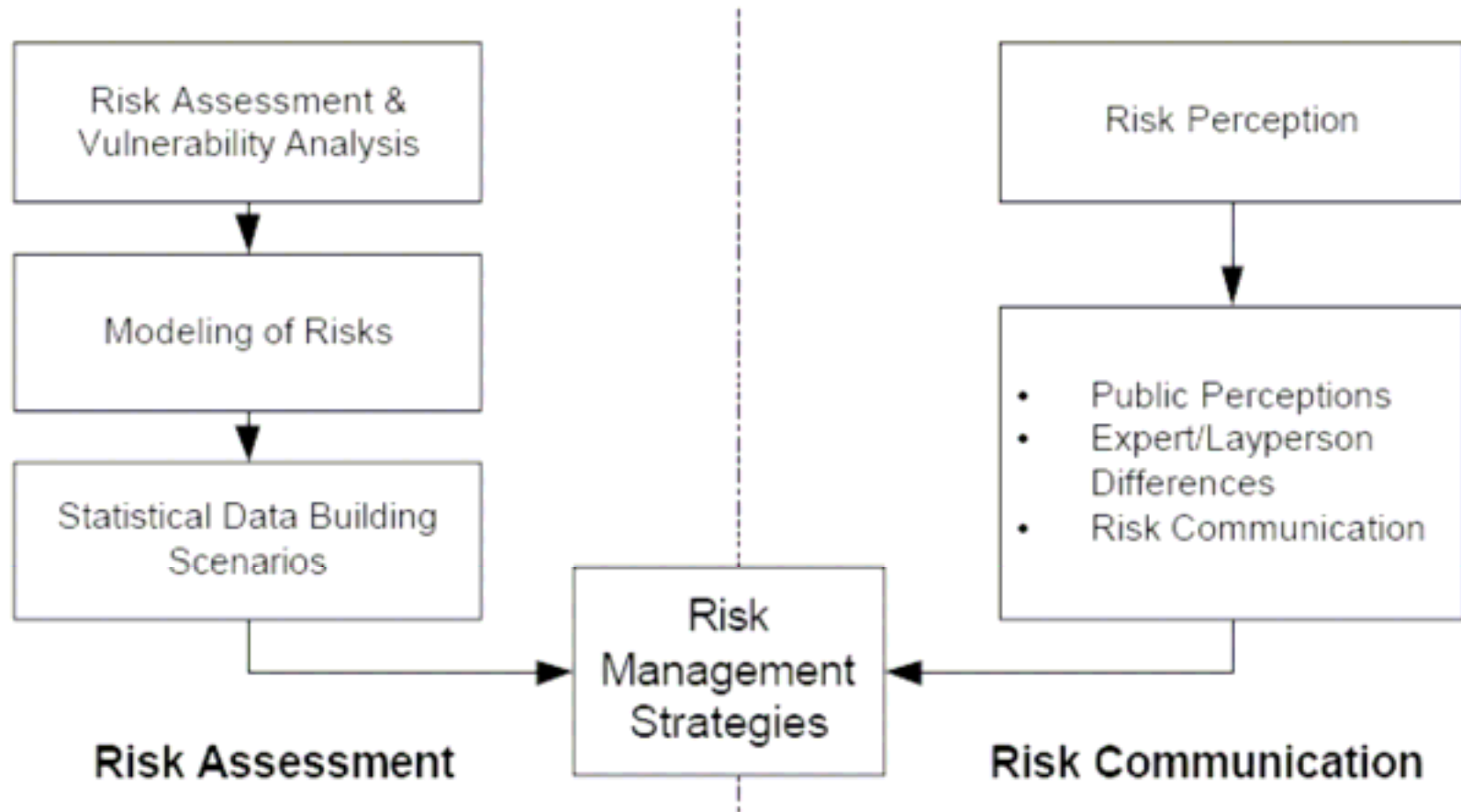


# Research Objective

- **To investigate the optimal risk allocation and risk management strategies for infrastructure PPP projects, by considering**
  - The interdependency of risk events and actions of project participants,
  - Different types of PPP, and
  - Different stages of infrastructure projects.



# Risk Management



Source: Kunreuther, H. [2004]



# What is “Risk Interdependence”

***“Risk faced by one person or firm depends on both its own security investments as well as on the actions of others.”***

***- Heal and Kunreuther (2004)***

**Interdependent Security (IDS)  
Problems**



# Examples of IDS Problems

- ✚ **Airline security**
- ✚ **Fire protection**
- ✚ **Vaccinations**
- ✚ **Computer security**
- ✚ **Theft protection**
- ✚ **R&D investment**
- ✚ **Protection against bankruptcy**



# Classes of IDS Problems

## ☉ **Class 1: Partial Protection**

- ☐ The more firms invest in preventive measures, the lower are the negative externalities in the system.

## ☉ **Class 2: Complete Protection**

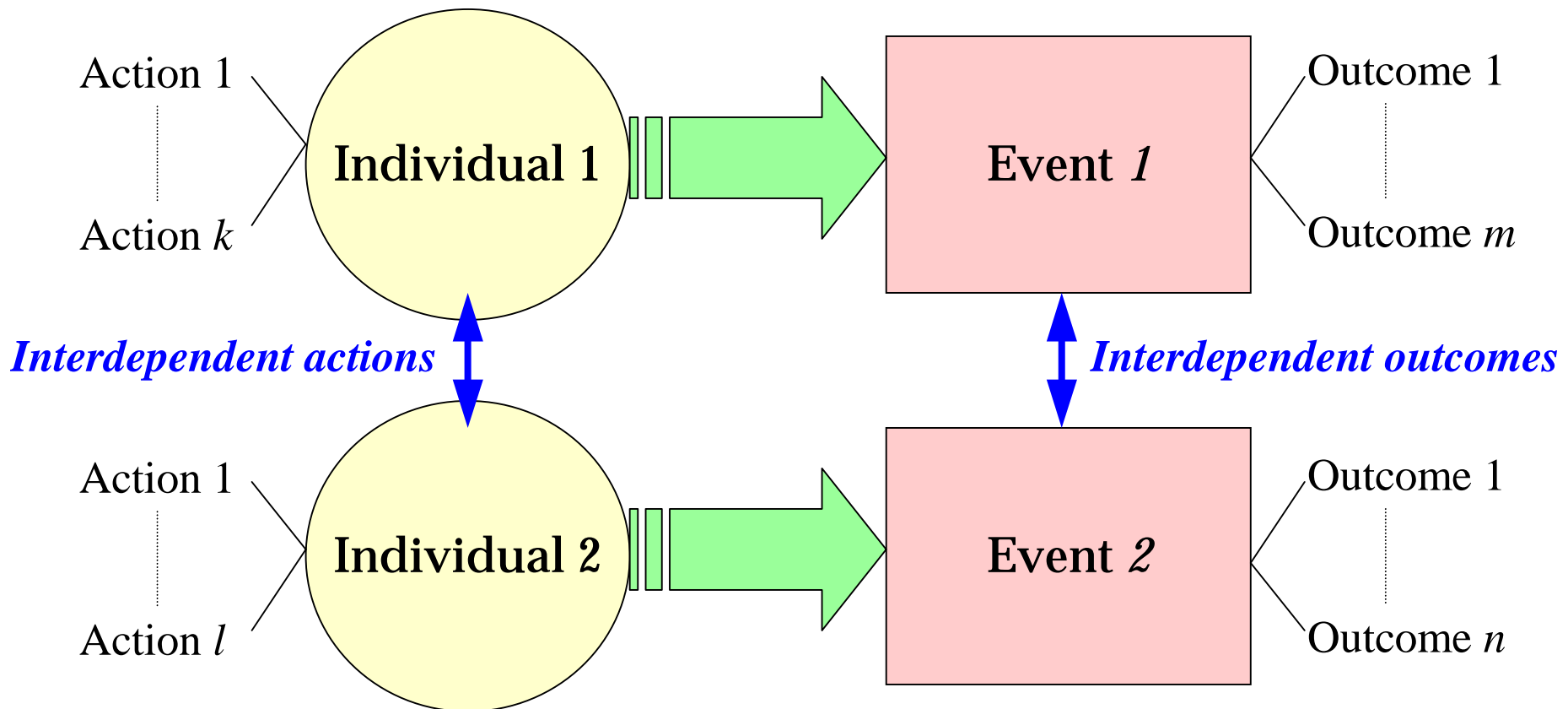
- ☐ If an individual invests in prevention it cannot be harmed by the actions of others nor can it harm others

## ☉ **Class 3: Positive Externalities**

- ☐ Investment by one individual creates positive externalities, substituting for the same investment by others & making it less attractive for others to follow suit.

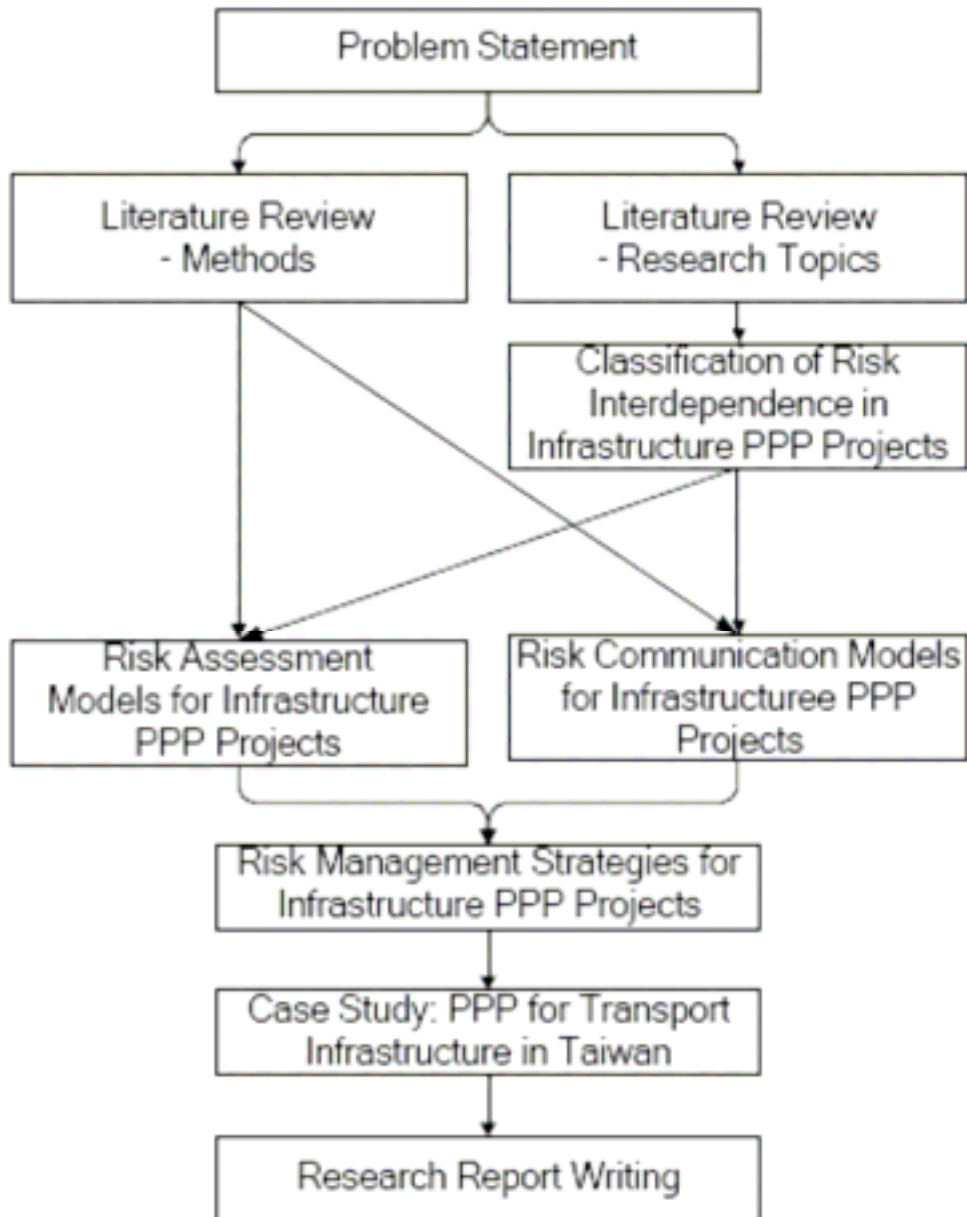


# Risk Interdependence





# Research Procedure

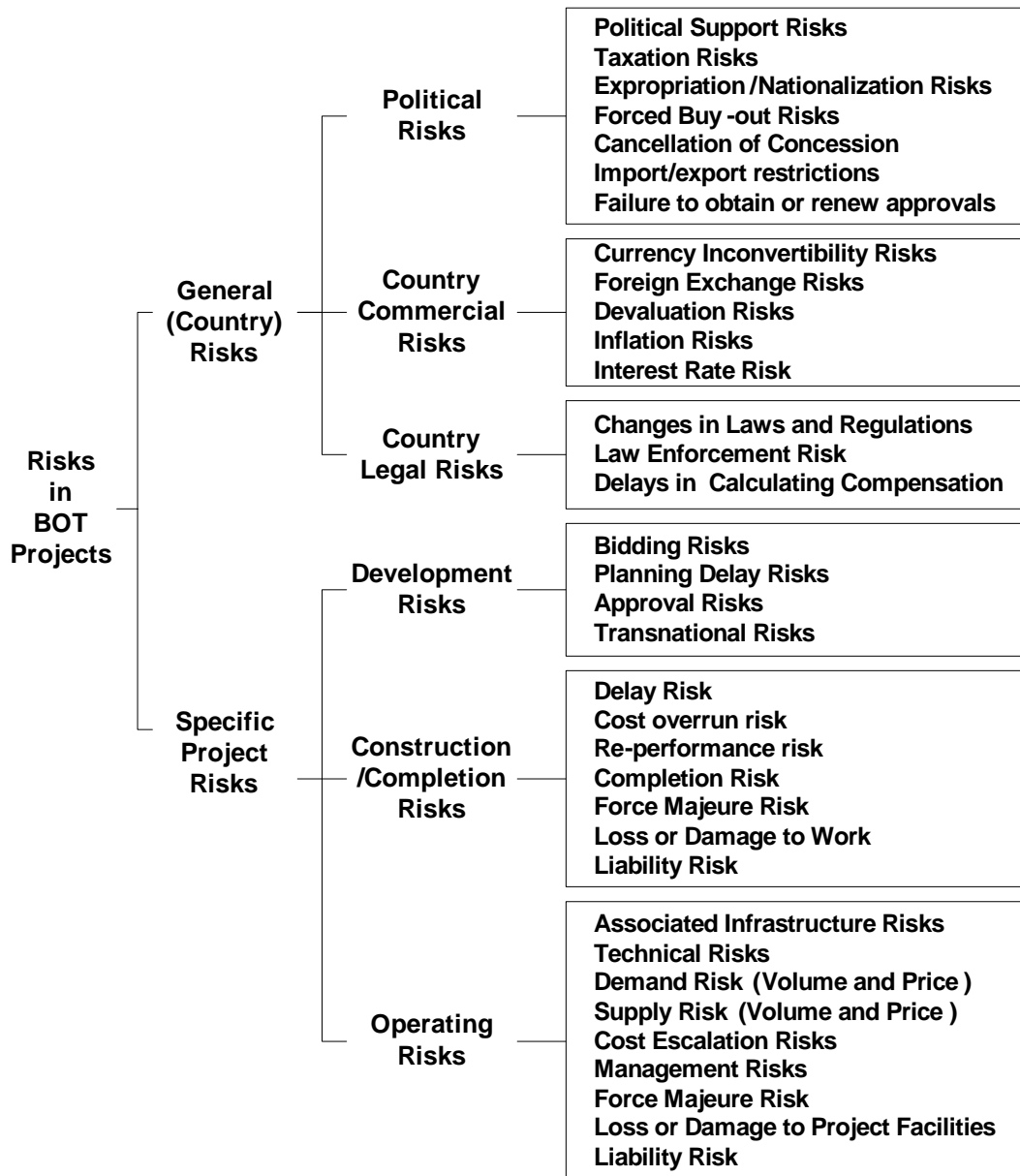




# Risk Classification

Complexity of output	Complexity of markets	
	Low	High
High	Defense facilities Maintenance facilities Public waste management Computer facilities	Airports Telecoms networks Channel Tunnel Private railways
Low	Power stations Water supplies Sewage treatment Incinerators Telecoms links Imputed toll roads	Toll crossings Toll roads Container ports Light rail links

**Source: Walker & Smith [1995]**



# Risk Classification

Source: UNIDO[1996]



# Research Strategy

- **From quantitative to qualitative**

- **From local to global**

- Taiwan  $\Rightarrow$  Great Chinese Area  $\Rightarrow$

- Transportation

- Taiwan High Speed Rail, Kaohsiung Mass Rapid Transit, Taipei Port Container Terminal, Farglory Free Trade Zone, Taipei City Hall Transfer Station

- **From simple to complex**

- N stages, N agents, factor model



**Dapeng Bay Scenic Area →  
(Biggest Tourism PPP in Taiwan)**



**↑ Landscape of  
Taiwan High Speed Rail**

**Taipei 101 & Taipei City →**





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***Looking forward to more and closer  
collaboration with you!***