Narrative Scenarios

AIM Workshop

17-19 Feb 2011 Tsukuba, Ibaraki

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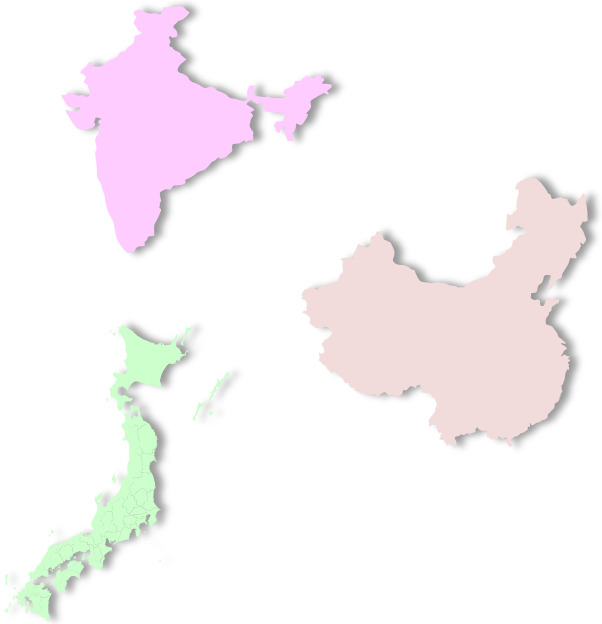
Simplified framework of Asian Scenario development

•Integrated mages of Asian regions need to be presented

Top Down

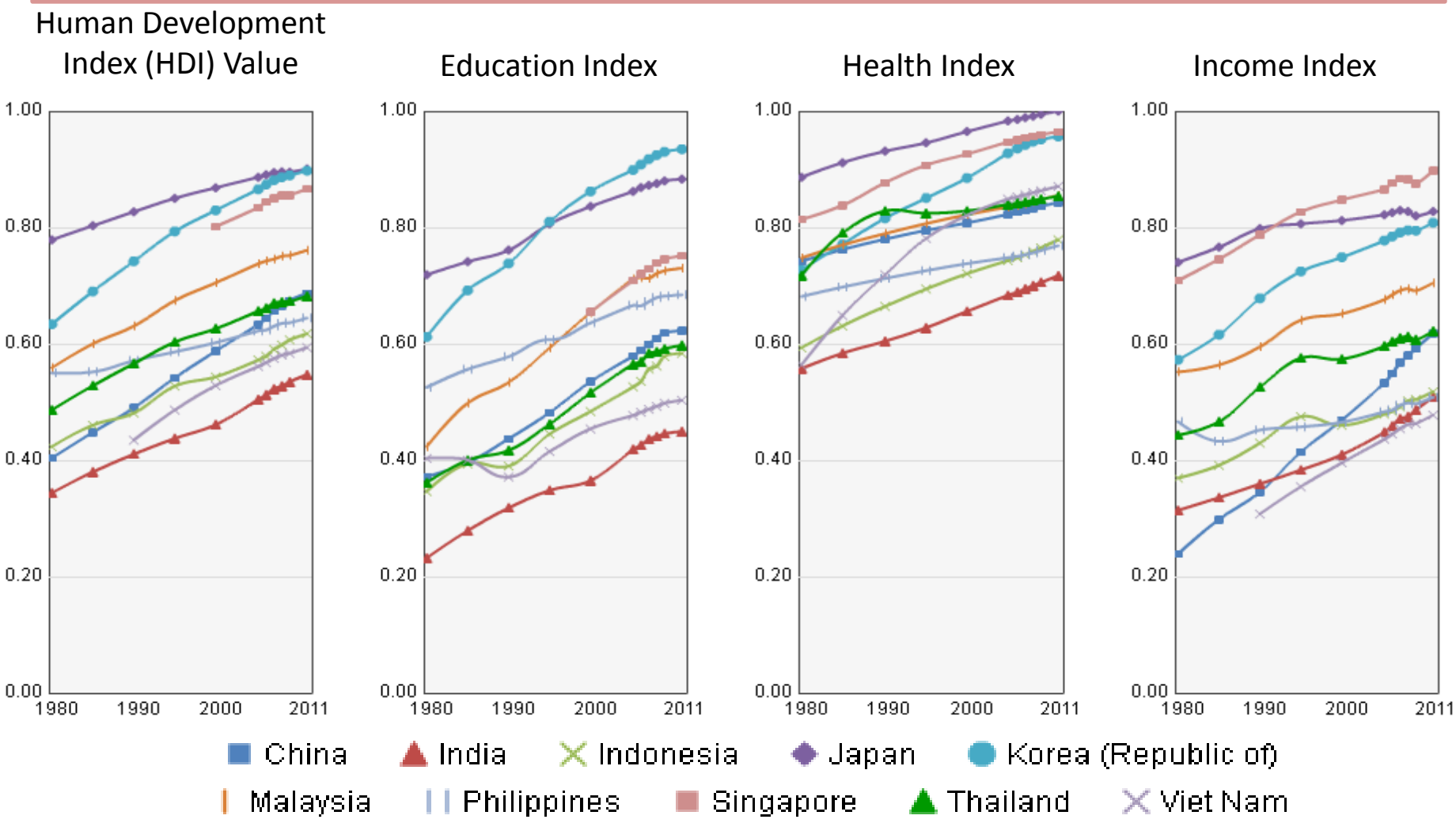
Bottom Up



•Assess the feasibility and possibilities of the assumed or calculated socio economic parameter in the study

Objective of the study

Objective of the study is to develop a general framework of narrative scenario development that is applicable to many Asian countries. One of the challenges is to develop aggregated Asian scenarios as well as each country's scenario in consistent manner



Approaches of Scenario Narrative scenario development

Quantitative scenario review

•To roughly understand the possible ranges of the parameter in question.

•To assess feasibilities of specific parameters

•To evaluate the political target regarding CC mitigations from the view point of fairness.

•To reassess and review your scenarios after the development in a comparative way.

Narrative scenario review

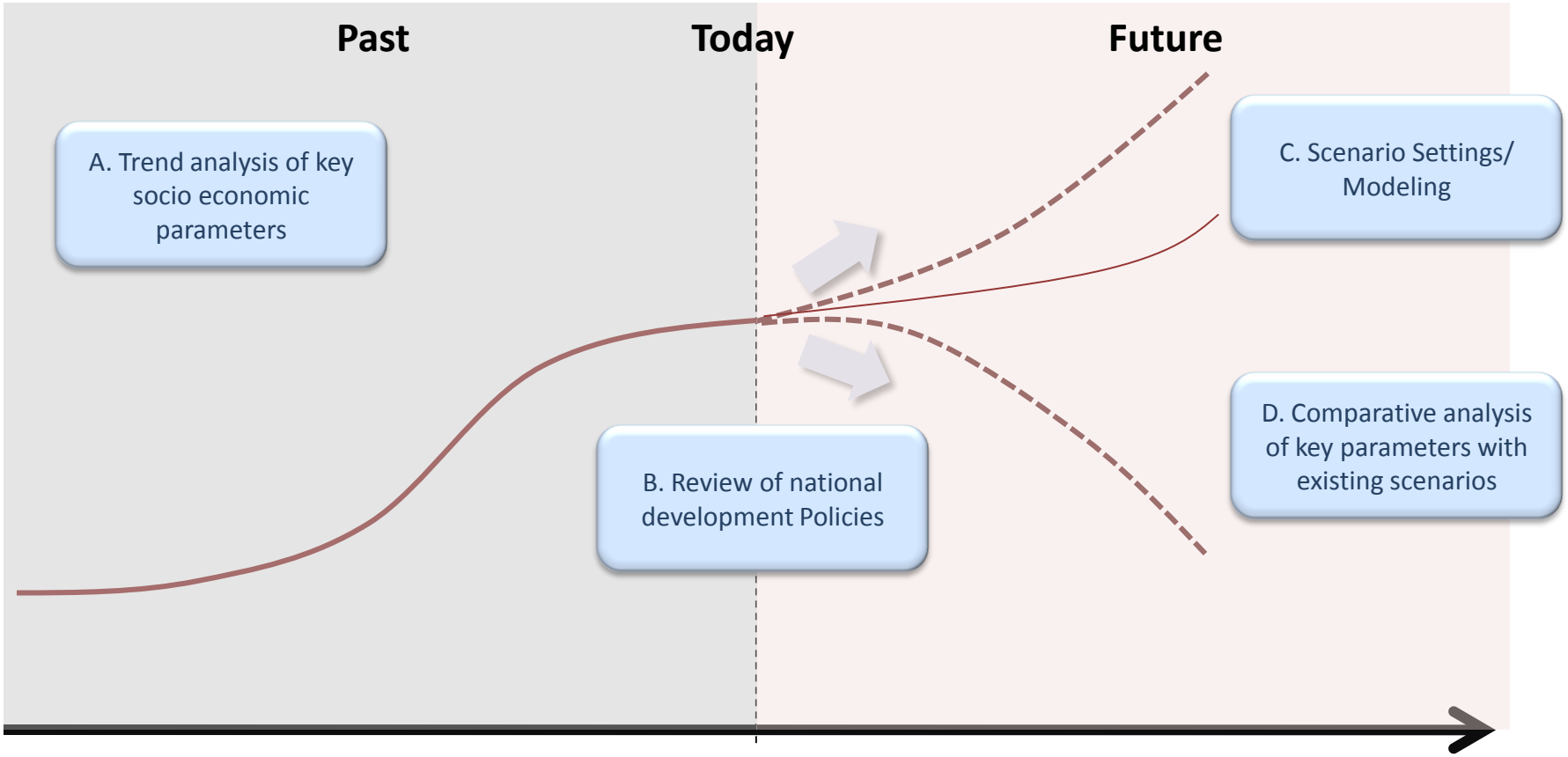
•To understand general direction of the policy and the possible consequences

•To identify public desire in terms of political/economical direction in the future

•To understand the possible interrelationship among the socio economic factors (causes & effects)

Narrative Scenario development

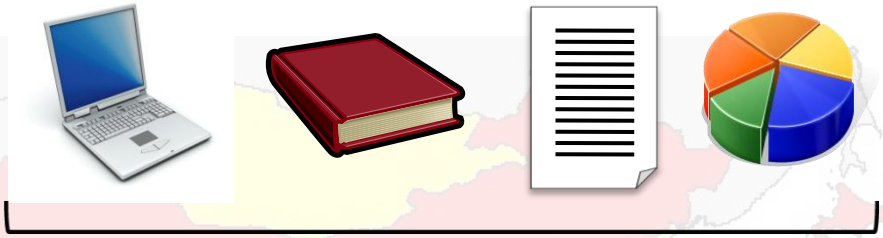
Conceptual image of Scenario Development Process



Trend analysis of key socio economic parameters

First step: Data collection

Future Scenarios, projections, and visions are collected from any kinds of sources including official documents or related studies. Gathered information will be stored in the databases and utilize as a basic references for scenario development both for top-down and bottom-up approaches.



Database

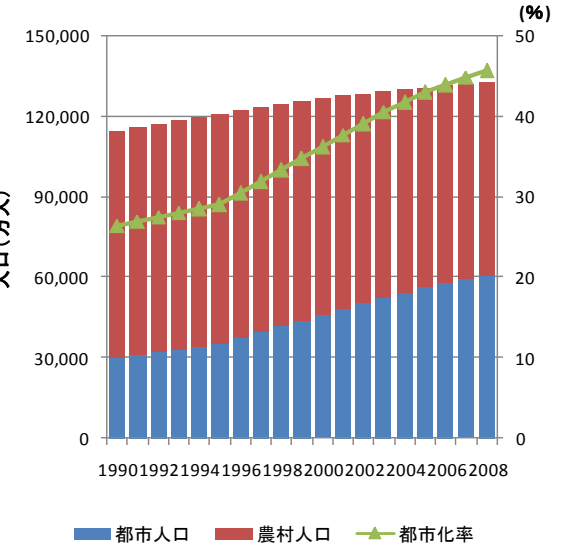
Quantitative

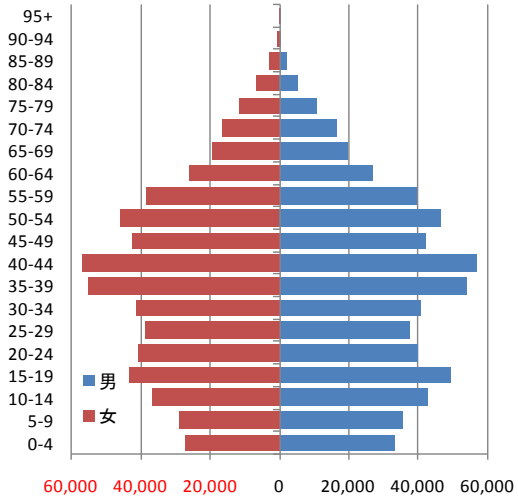
- Macro Frame (Population/GDP/Industrial Structure)
- Energy (Primary, Secondary, Power generation, Generation Capacity, Renewable potential)
- Transportation (Passenger, Freight)
- Other (No. of residences, Land use etc)

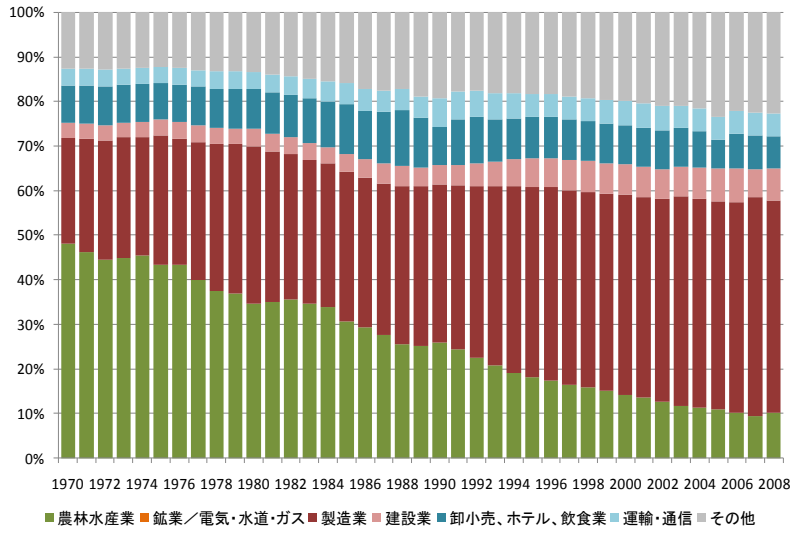
Narrative

- National Development Policies/Strategies
- Climate Change mitigation policies/targets
- Energy Policy Renewable Target
- Barriers for the economic developments

China (Socio Economic)

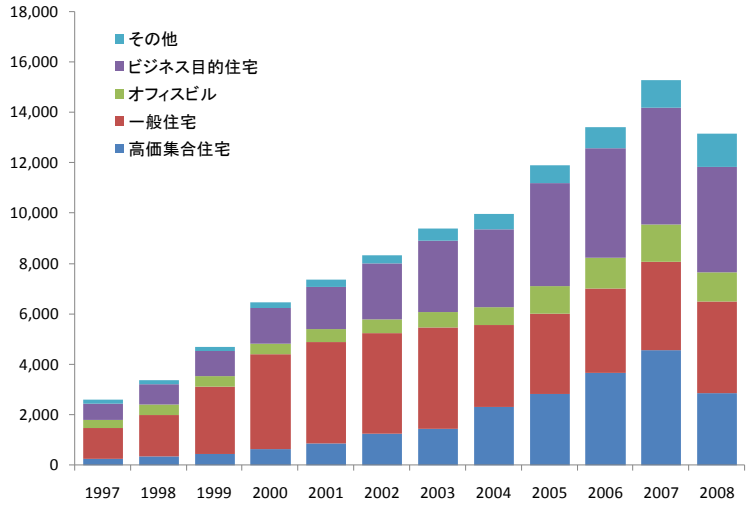


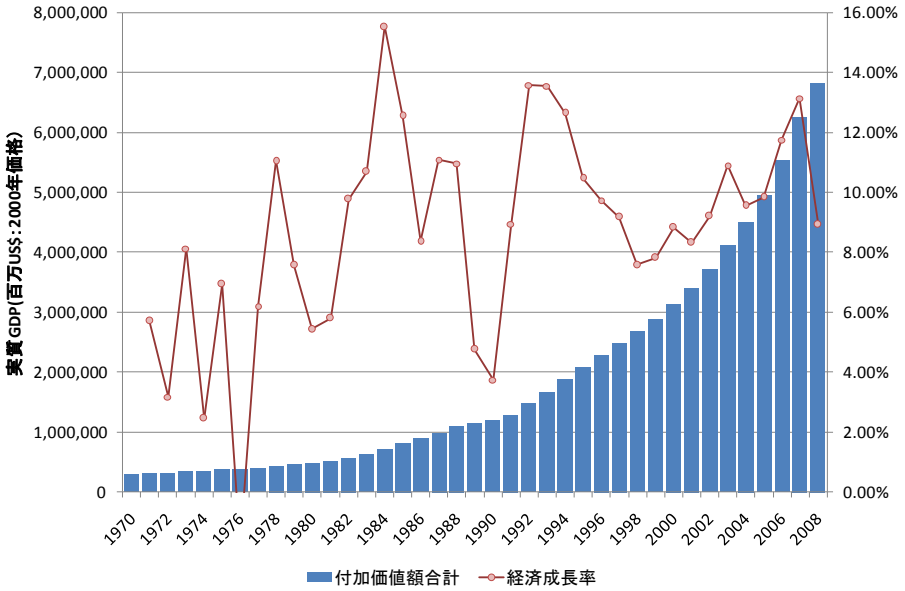




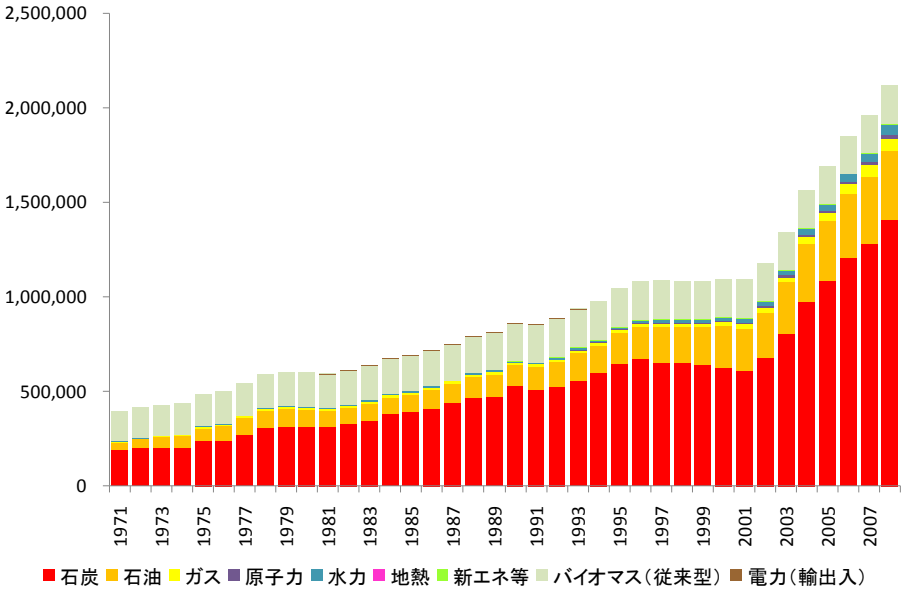
Industrial Structural change

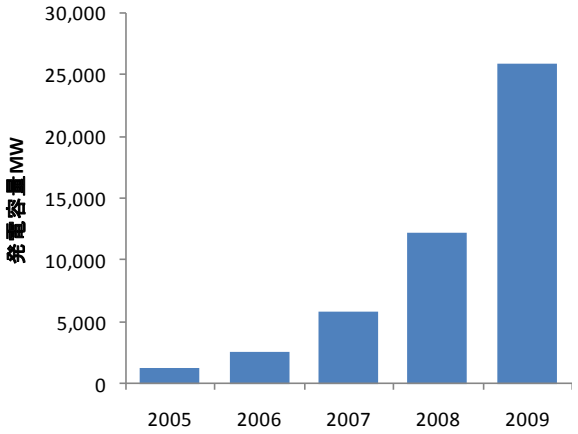
Demographic structures and urbanization

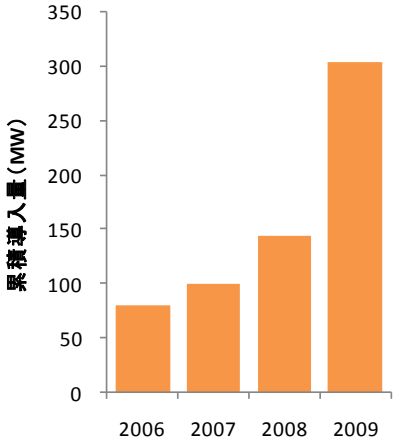


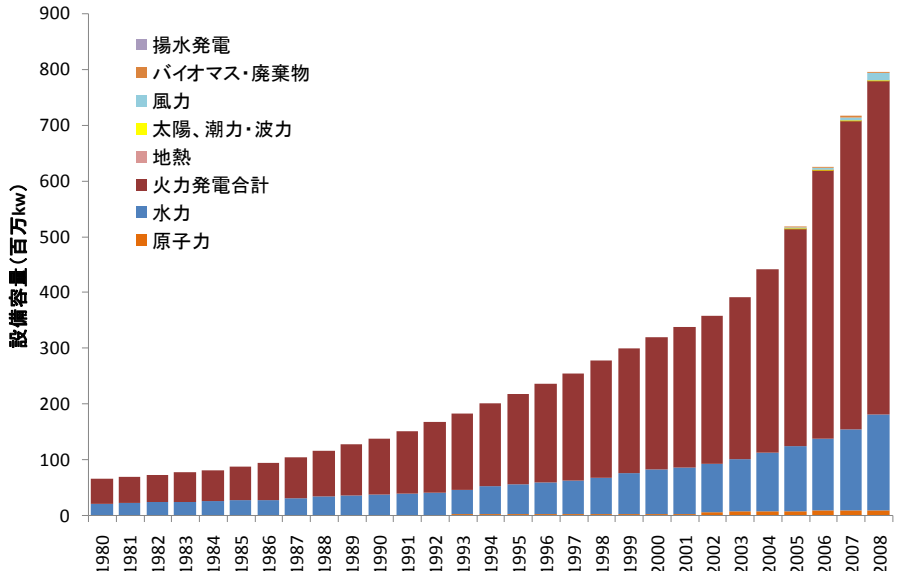


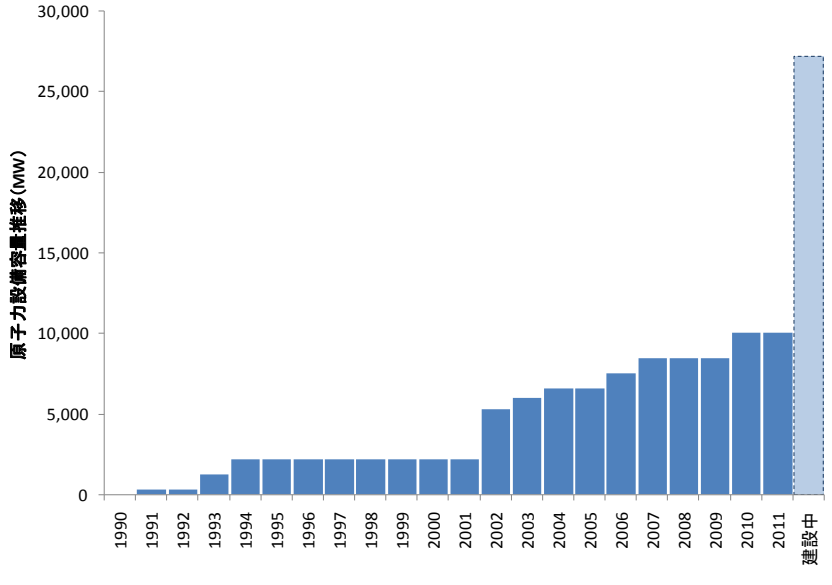
China (Energy)



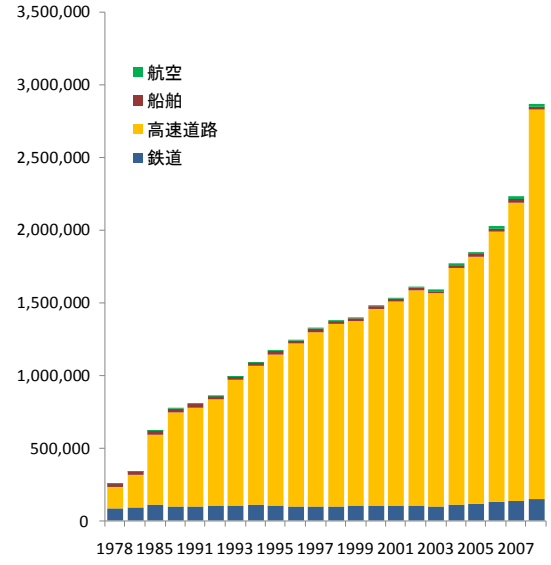


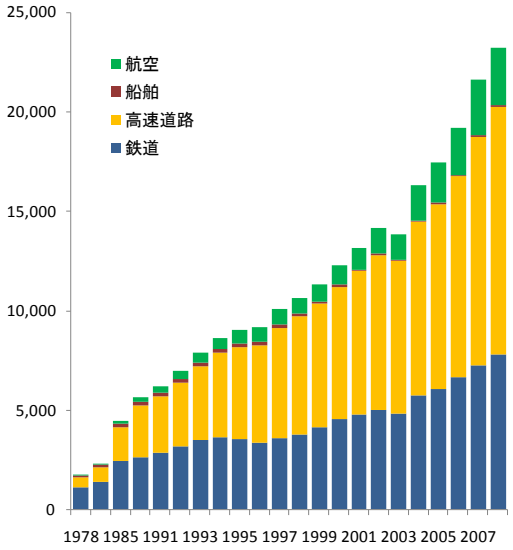


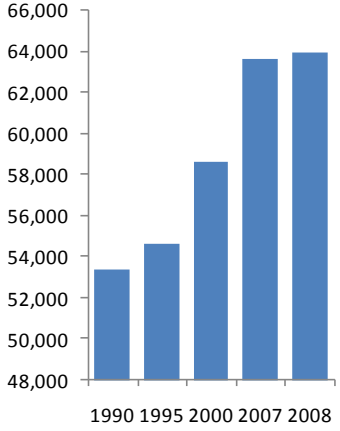


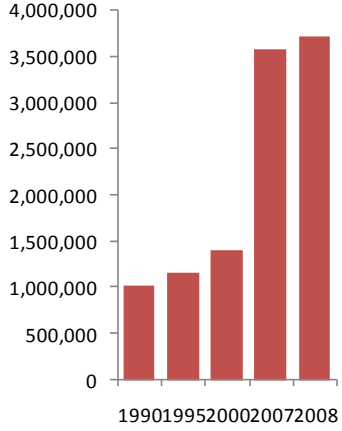


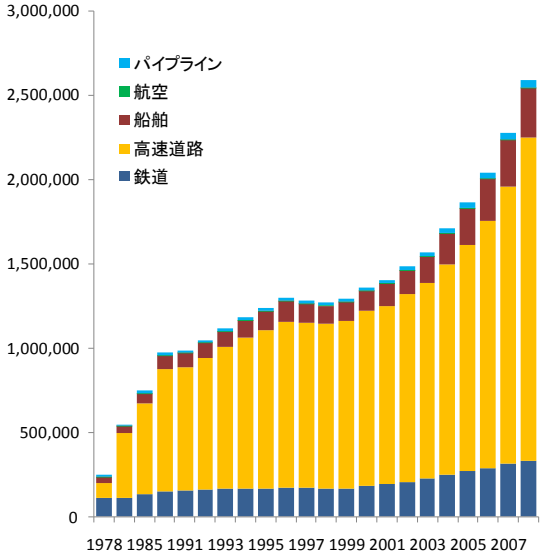
China (Transport)

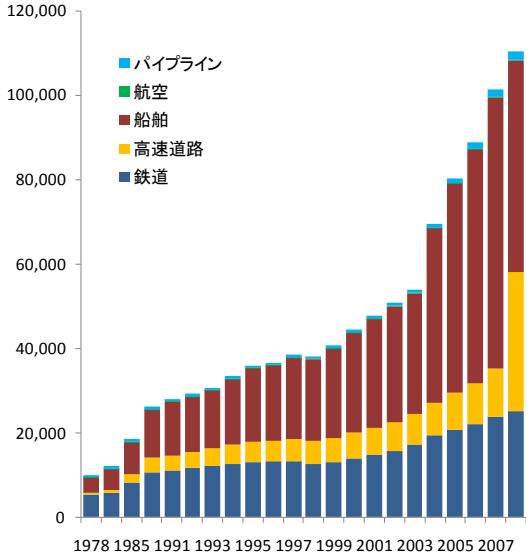












Review of national development Policies

National political targets (1)

Country	Economic Growth	Climate Change	Energy
China 	4 times higher GDP by 2020 from 2000	CO2 emission per GDP: 40-45% reduction from 2005 by 2020	Share of the Non-fossil energy in primary energy: 15% by 2020 Nuclear Capacity: 70-80GW(2020), 200GW(2030), 400-500GW (2050)
Indonesia 	2005-2010:5.5% 2010-2014:6.6% 2015:7.2% 2015-2030:7.2%	GHG emission: 26% reduction from BAU in 10 years. The target can be further exploited to 41% with international support	・Share of renewables (in Primary Energy): 17% by 2025 ・Oil Dependency: lower than 20% by 2025 ・Geothermal: more than 5% by 2025 ・New/Renewable Power: more than 5% by 2025 ・Bio-fuel: more than 5% by 2025
I 	2007-2012:9%	Emission per GDP: 20-25% reduction from 2005 by 2020	・Primary Energy: 117EJ (2052) ・Power generation：75EJ (2052) ・Renewable Energy：2.7EJ(2052) ・Nuclear: 19.4EJ (2052)
Japan 	Net GDP growth > 3% Gross GDP growth>2%	CO2 emission: 25% reduction from 1990 by 2020, 80% reduction by 2050	・Energy independence: Double the FF exploitation rate by 2030 ・Share of the zero emission electricity: 70% by 2030 ・Halve the energy consumption in daily lives
Korea 		2020年：30% reduction from BAU (4% reduction from 2005) Carbon sequestration from forest: 1854MtCO2 (2020)	・Energy Efficiency: 0.185kgoe/$ (46% reduction) ・Renewable energy supply (Primary Energy): 8.6% by 2020, 11% by 2030 ・Emission factor of electricity: 0.11kgC/kwh (2022)

National political targets (2)

Country	Economic Growth	Climate Change	Energy
Malaysia 	Become High income countries by 2020	CO2 emission by GDP: 40% reduction from 2005 by 2020 (voluntarily target with conditions)	・Strengthen import Hydro and Coal by 2015 ・Eliminate grants on Fossil fuel by 2015 ・Energy Efficiency program to reduce 4000 ktoe cumulatively ・Renewable power generation: 24% by 2050 (Capacity: 21.4GW, Annual Generation 44,208GWh)
Philippine 	Currently reviewing Midterm development policy (MTPDP)	No specific target	・Increasing Renewable energy capacity from 4500→9000MW in next 20 years ・47.95Mtoe of energy savings during 2008-2030 cumulatively ・Diesel to BDF at least 20%, Gasoline to BTL 20-80% by 2030 ・2400MW of Nuclear by 2034
Singapore 	Economic Growth rate 3-5% (by 2020)	7-11% of reduction compare to BAU by 2020. The target can be further expanded to 16% with the condition of international framework	・ Energy Efficiency improvement: 20% from 2005 by 2020, 35% by 2030

National political targets (3)

Country	Economic Growth	Climate Change	Energy
Taiwan 	Economic growth: 5% during 2009-2012, 4.6% during 2005-2015	・Reduce CO2 emission to 2008 level by 2016-2020 and to 2000 level by 2025	Energy Efficiency improvement: 20% from 2005 by 2015, 50% by 2025 Low carbon fuel in the power generation mix: 55% by 2025 from current 40%
Thailand 	Economic Growth : 3.8% during 2005-2030	No official target **	・Renewable Energy Share in final energy consumption: 20% by 2022 (Biomass power generation: 3700MW, PV: 500MW, Heat supply from MSW: 7.4 Mtoe etc)
Vietnam 	Economic Growth : 7-8% during 2005-2030	GHG emissions: 300MtCO2 (2020年), 516MtCO2 (2030年)	・Power generation:53.5TWh(2005)→349.4-446.6TWh (2025) ・Nuclear Power :15-20% (2050)

**タイのバンコクポスト紙によると、エネルギー部門からの排出を現状比30%削減（7700万トンの削減に相当）する目標をコペンハーゲンにおいて発表予定であったとしている。
http://www.bangkokpost.com/business/economics/29289/goal-set-to-cut-energy-emissions-30

Impacts of "Fukushima" accident on energy policy

	Before Fukushima	3.11	After Fukushima
Japan	55 plants were operational, 14 plants were under construction	?	Hamaoka power plants has been stopped Energy Basic Plan will be reviewed
India	20 plants were operational, 40 plants were under construction or planning phase	→	Government showed positive reactions to nuclear Nuclear Safety standard will be reviewed.
Korea	21 plants were operational, 14 plants are planned to be built by 2014	→	Government showed positive reactions to nuclear Nuclear Safety standard will be reviewed.
Viet Nam	13 plants were planned to be built by 2030	→	No changes in the plan Nuclear Safety standard will be reviewed.
Malaysia	The first nuclear power plant would be operational by 2021	→	Chairman of the energy committee claimed the necessities of nuclear in the future
China	13 plants were operational. 60 new plants were planned to be constructed by 2020	→	Construction and verification processes were temporarily ceased. Nuclear Safety standard will be reviewed.
Thailand	5 plants would be constructed by 2020-2025	→	National Energy Policy Committee (NEPC) has announced to postponed the first 3 plants, which was originally planned to be built in 2020-2021. The construction will later than 2023
Taiwan	6 plants were operational	↘	All the plants, which is currently operational, will be decommissioned during 2018 -2025
Philippine	Although the first nuclear power plant was constructed in 1986, the plant have not been operated because of the safety issues.	⊘	There is a plan to use the non-active reactors for tourist attractions
Indonesia	The construction plan was frozen because of the public acceptance.	⊘	N/A
Singapore	N/A		N/A

※As of May 2011

New development plan coming up

India Twelfth Five Year Plan (2012-2017)

Drivers for the economies

Macro Economic Fundamentals

- High rates of investment and private sector savings
- Improvement in the government savings (fundamentals)

Impact of Economic Reforms

- Flexible conditions for entrepreneurs
- Competitive market environment

Development of Dynamic Private Sector

- Expansion of India's economic footprint in the global economy
- Progress in private sector reforms
- R & D for innovation

Management and Labour Skills

- Managerial talent

Aspiration Drivers

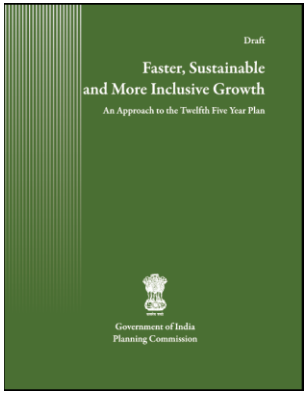
- Aspirations for change amongst young

Constrains

- Availability of Energy
- Problem with water availability
- Slower improvement in farm output/logistics
- land acquisition for industry & infrastructure development
- Credible and fair system for exploitation of mineral resources

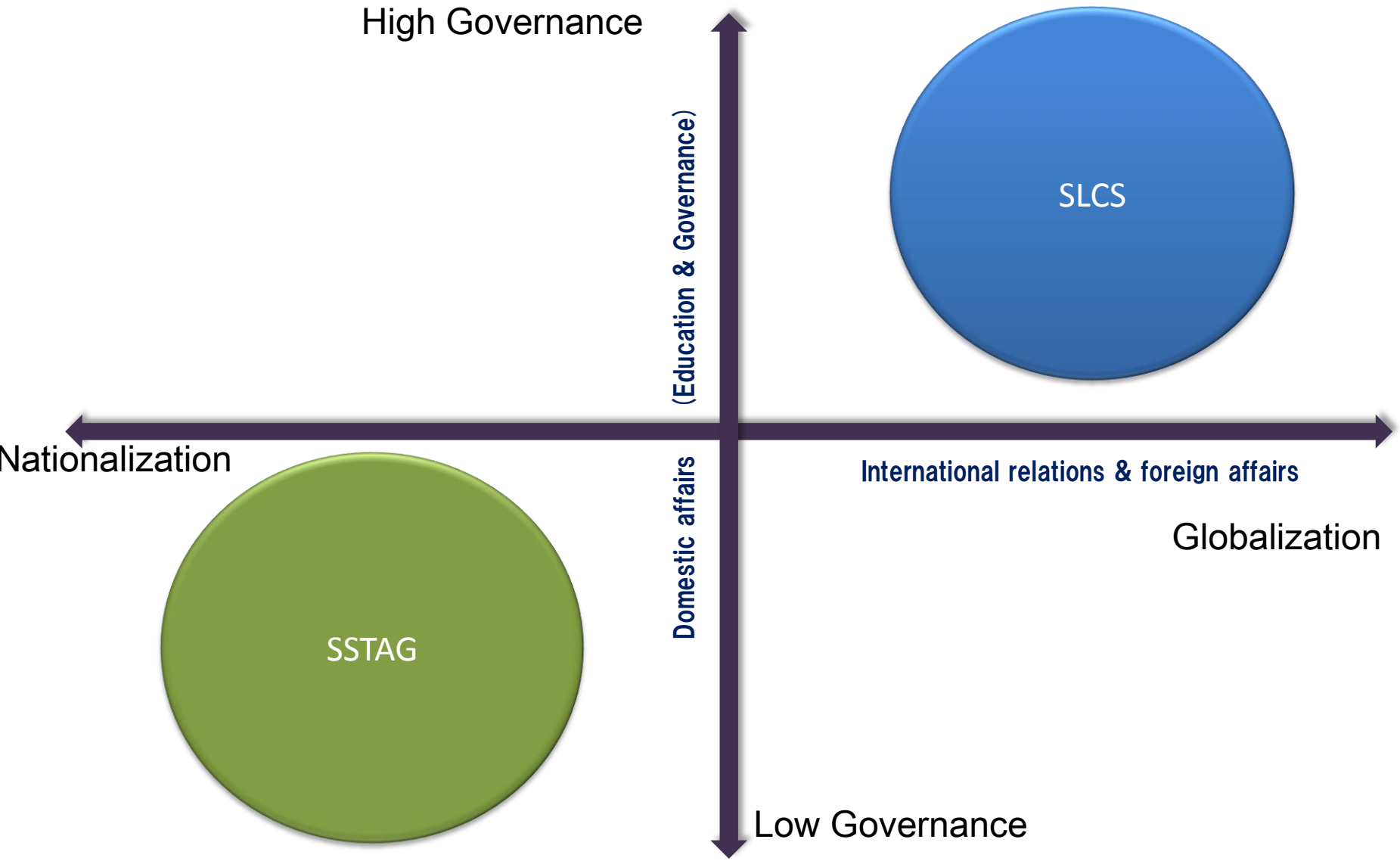
Target

9.0%
(2012-2017)



Scenario Setting and modeling

Preliminary Scenario Concept for Asia



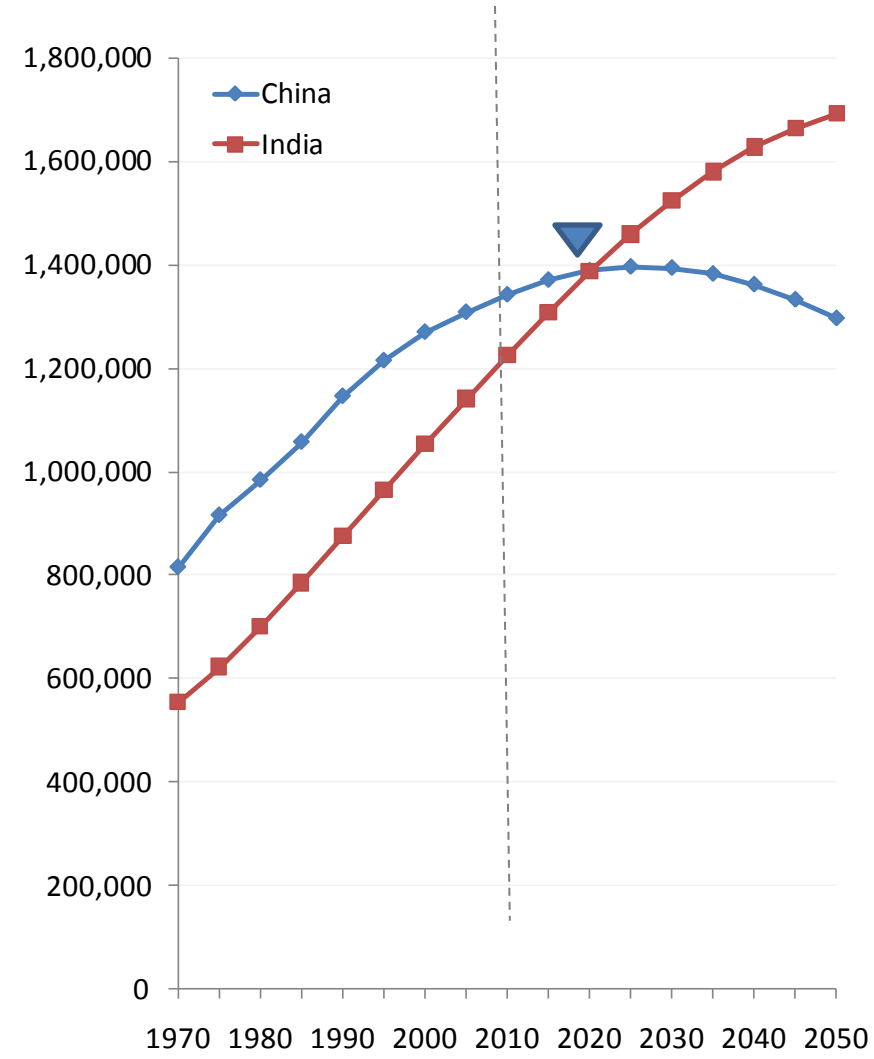
Two Scenarios for Asian LCS studies

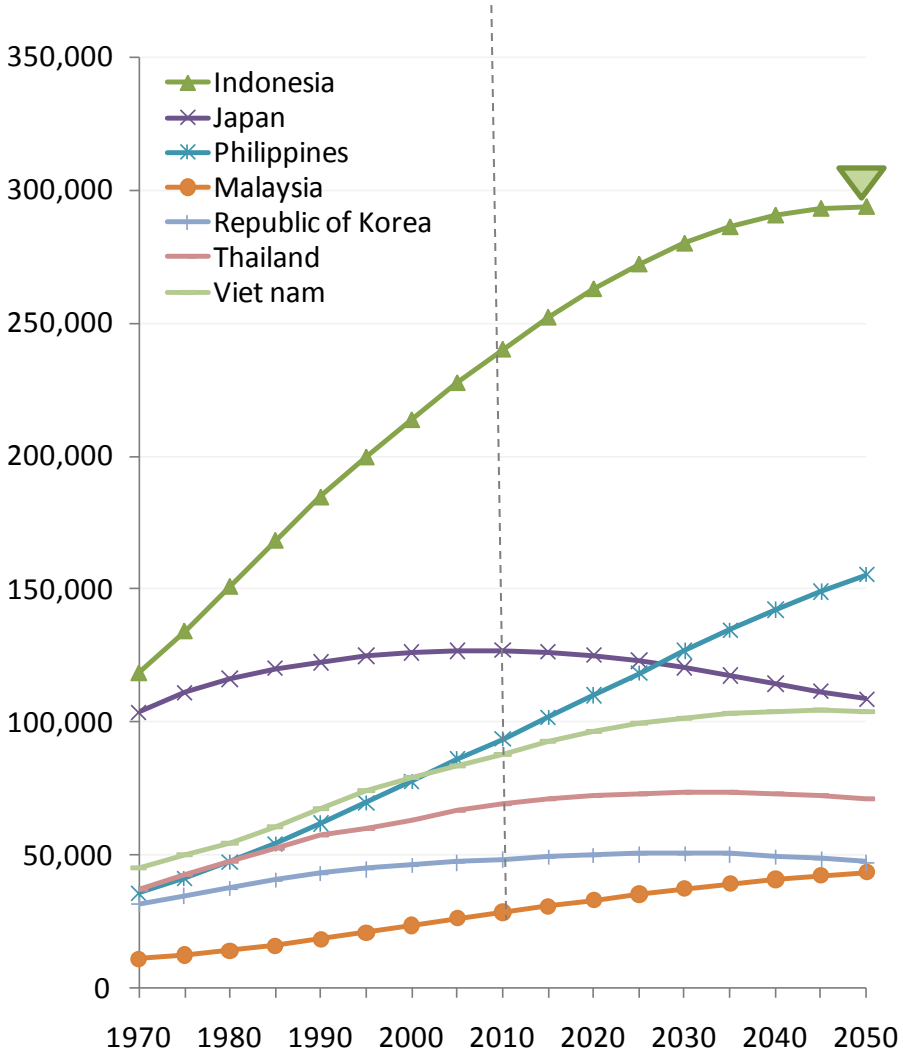
□Two scenario concept was developed. The key parameters that differentiate the two scenarios include; Education, Governance, and International relationship

	SLCS	SSTAG
General Description	Governance in each country has improved substantially and so as the education level. Foreign investments are concentrated to Asia. Dialogues between government and public have been widely accepted in many countries. As a result, Asian countries attain high economic growth based on many technical innovations invented in the regions.	Many Asian countries have failed to restructure the inefficient state owned company. Governance and economic levels stay relatively lower. Those investment conditions of Asian countries are perceived as high risk from foreign countries and foreign investments are not expand as expected. Each countries have pursue short-term profit and, as a result, technical improvement and economic growth rate have stayed relatively low
Economy	・Annual growth rate: 4.4%/year	・Annual growth rate: 3.4%
Population	・Total Population: 4.6 billion (2050)	・Total Population: 4.6 billion (2050)
Education	・Success in educational policy (Average educational year：4-12 years (2005)→11-13 years (2050))	・Limited success in educational policy(Average educational year：4-12 years (2005)→11-13 years (2050))
Government	・Greatly improvement	・Limited improvement
International Cooperation	・Asian cooperation in both economic and social aspects (Globalization)	・Less cooperative activities among the Asian countries (Nationalization)
Innovation	・High technology improvement rate	・Moderate technology improvement rate
Transport	・High demand based on high economic growth	・Relatively lower transportation demand
Urban	・Intensive infrastructure development in the urban areas and slums are decreasing	・Infrastructure development could not catch up the increase in population in the urban area
Local	・Improved public services using ICTs in the local area	・Expansion in disparity. Relatively higher rate of poverty
Land use	・Planned land use with appropriate zoning	・Land use without planning

Total Population (World Population Prospects 2010)

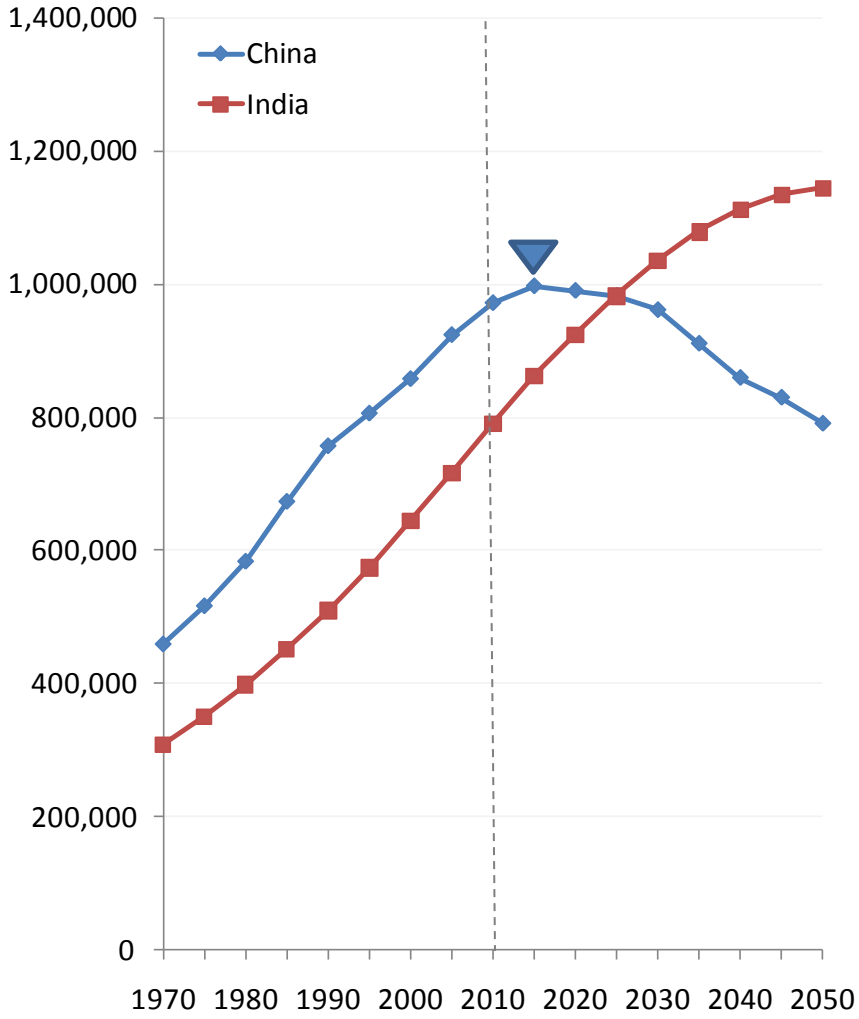
Total population in Japan will decrease. China will also face population decreasing stage around 2020-2030

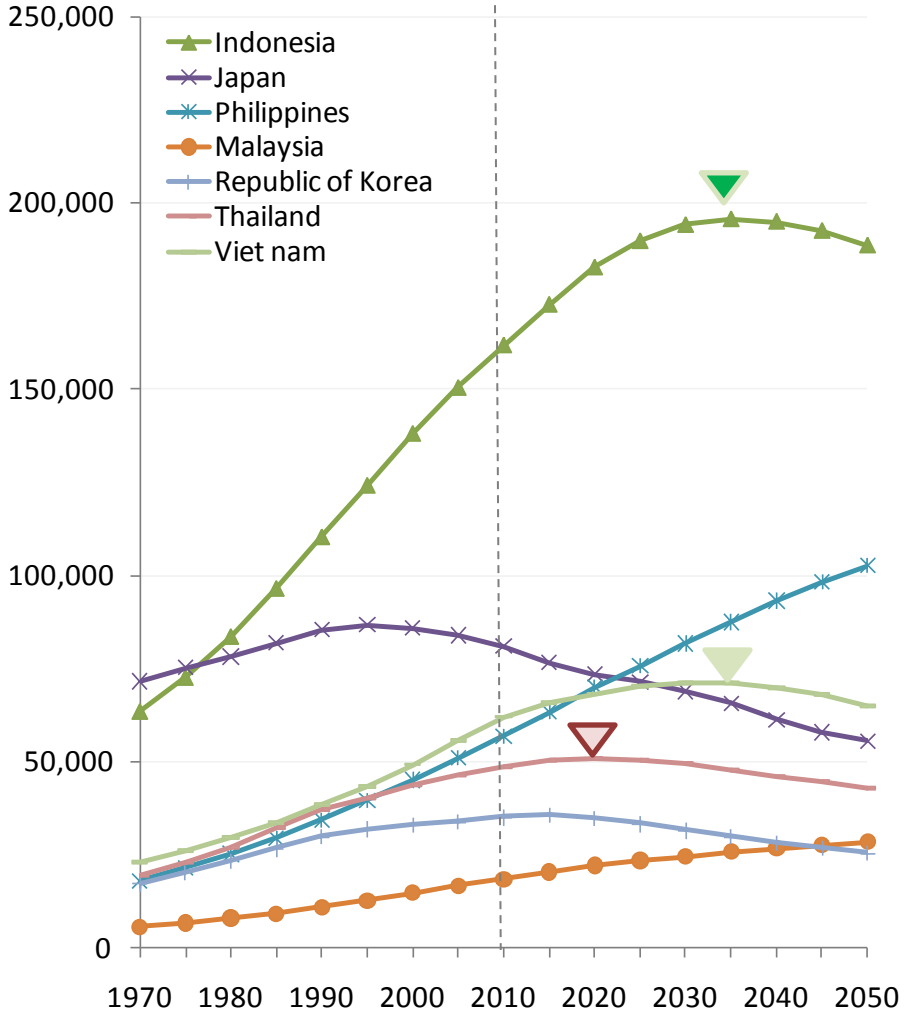




Labor forces (15-64)

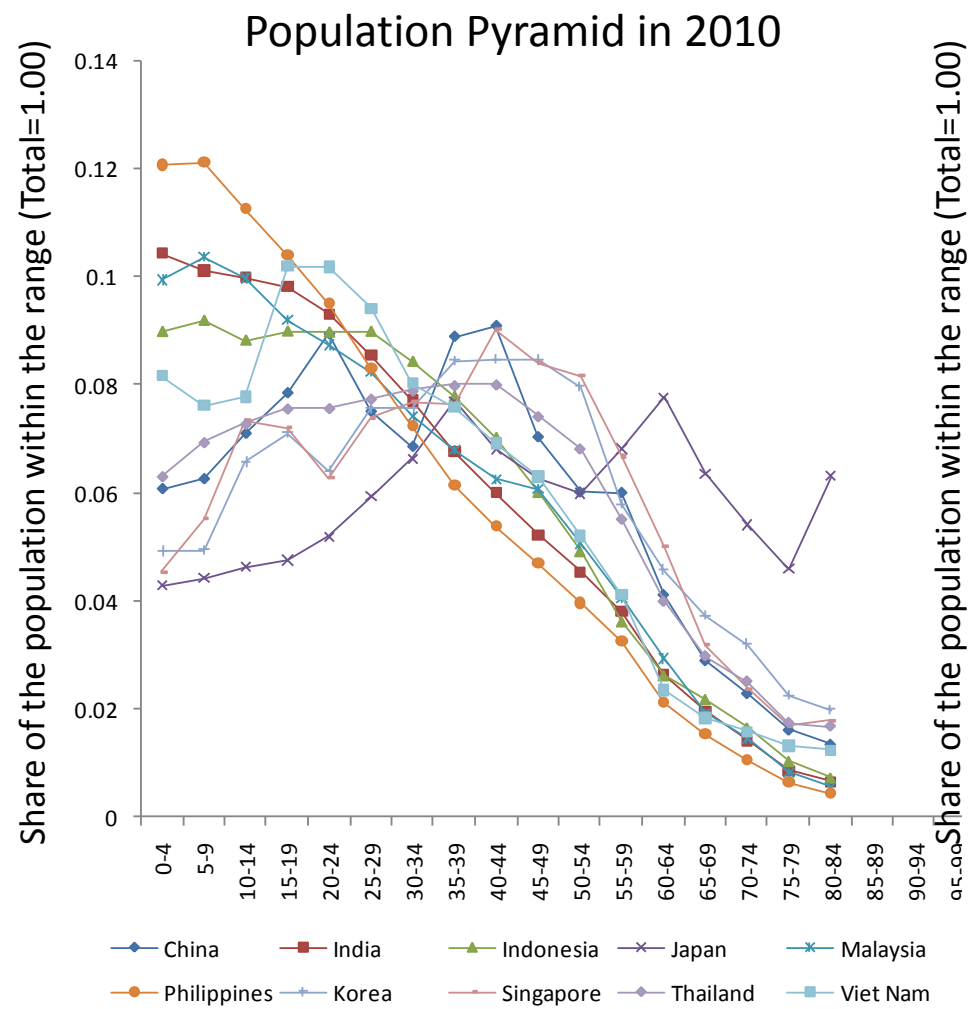
Peaks in labor forces will come even earlier. Decrease in labor forces will surely have significant impacts on its economy

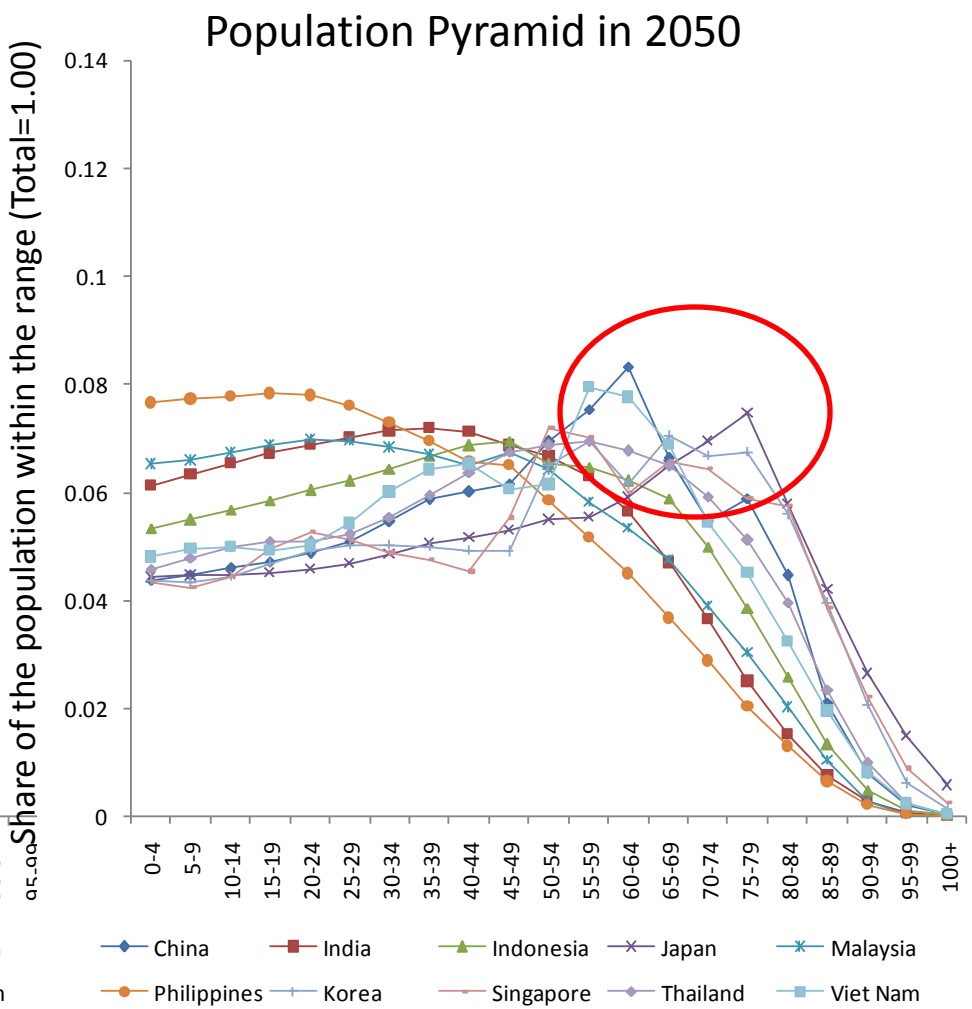




Population Pyramid in 2050

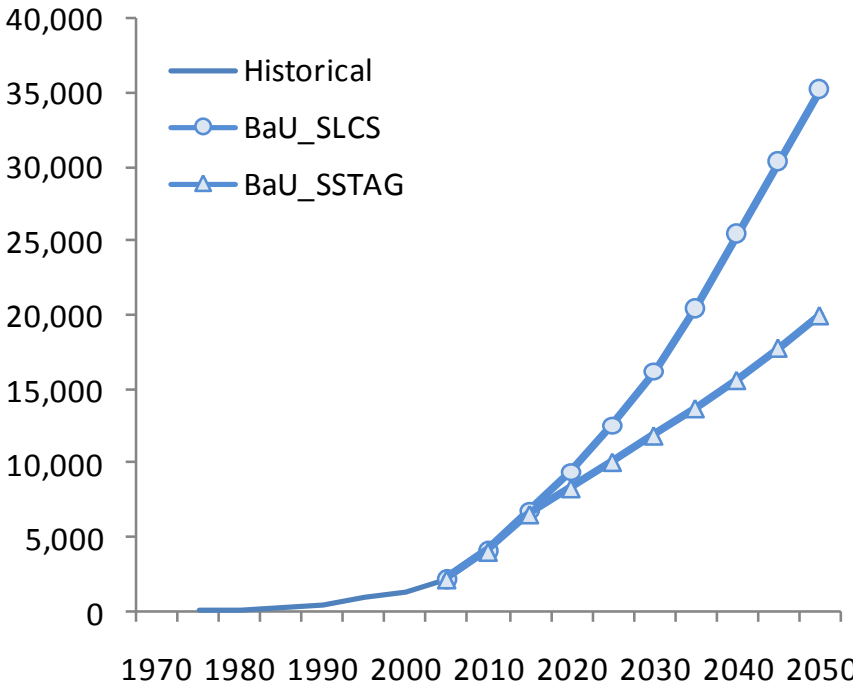
Many countries will face the problem of “Aging society” in 2050.
Universal design for elder population will be required for LCS design.

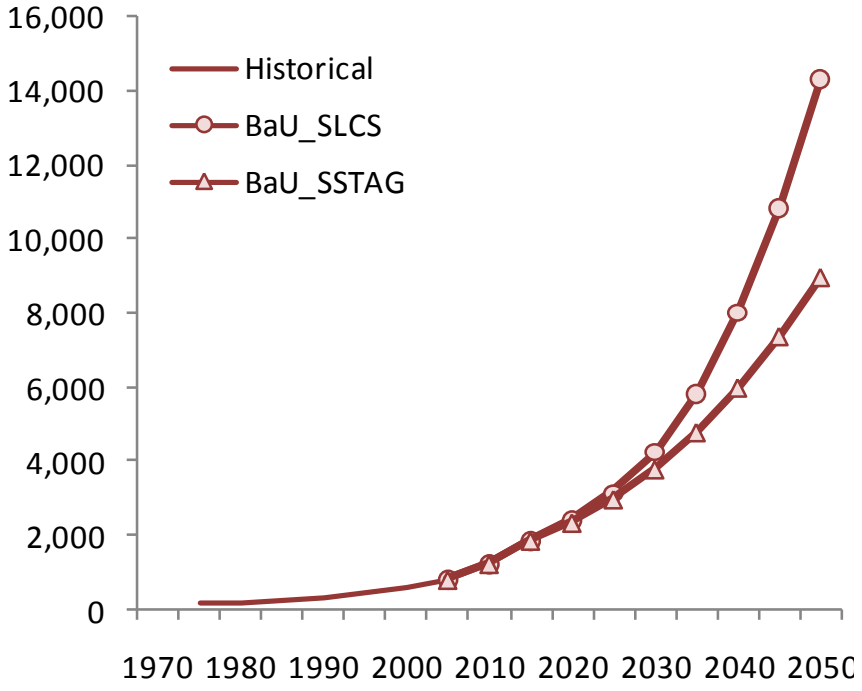




GDP for the two scenario

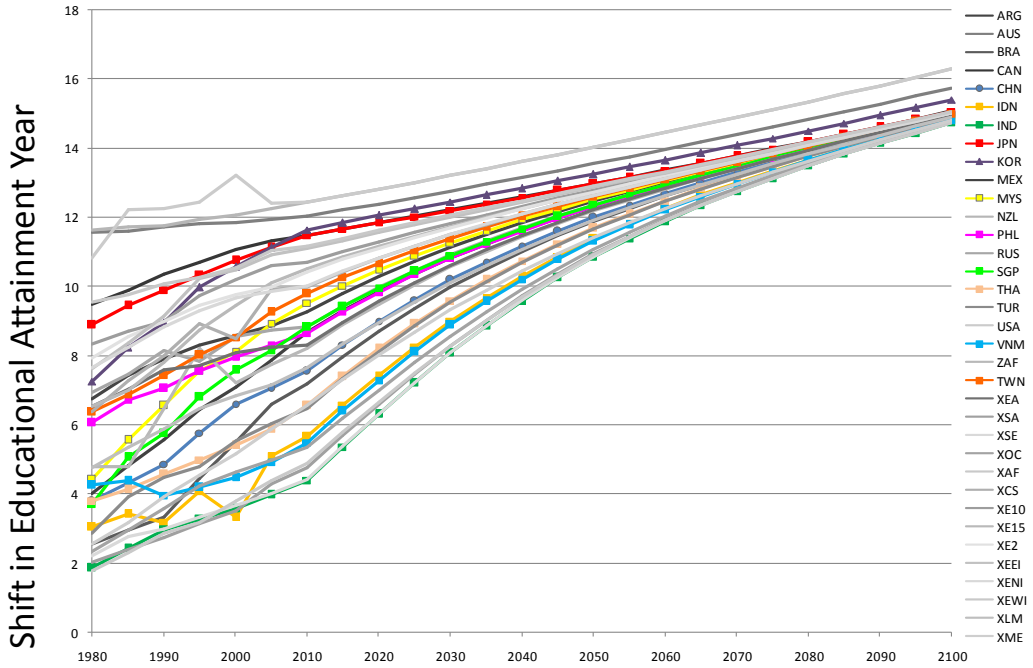
Economic growth is estimated from Macro-economic model developed by Kyoto Univ. Governance effectiveness and educational attainment were used for TFP estimation.

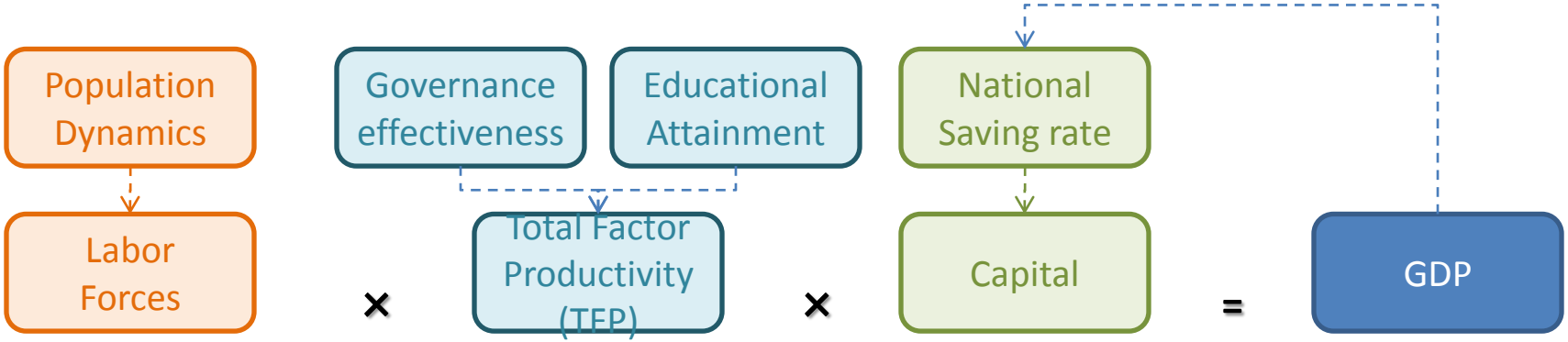




Economic Growth Estimation

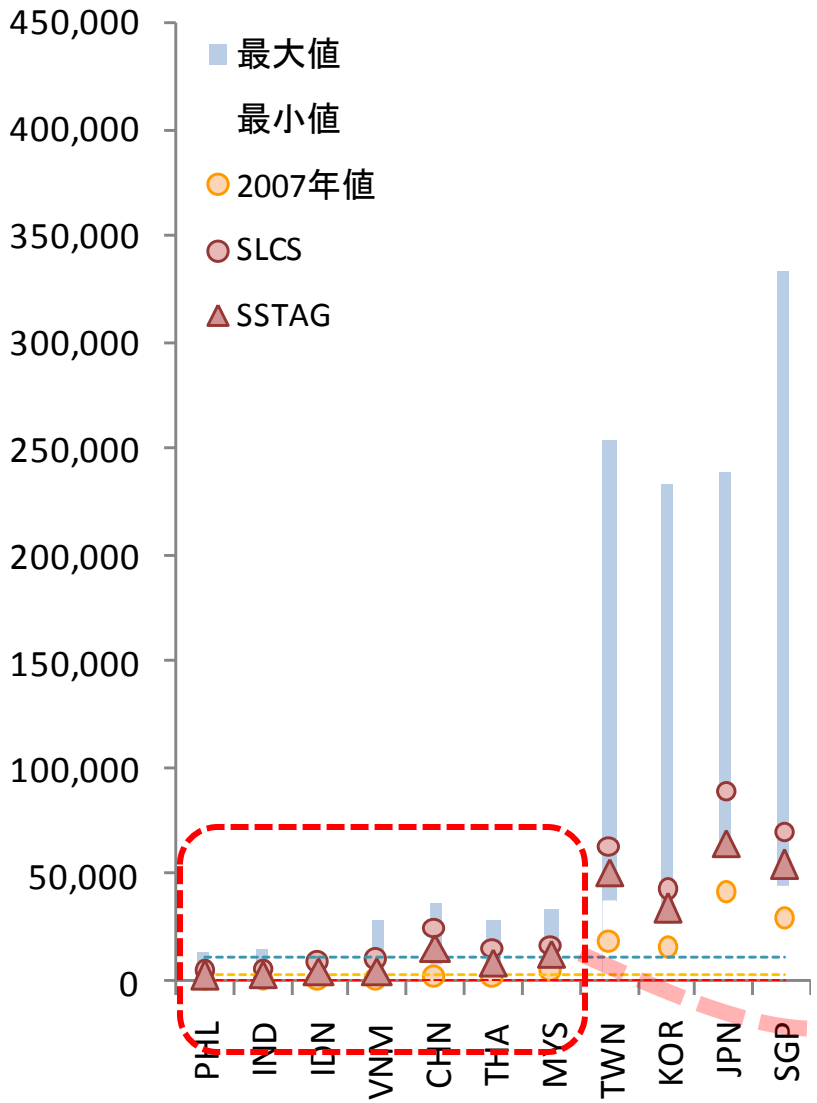
Economic growth is estimated from Macro-economic model developed by Kyoto Univ. Governance effectiveness and educational attainment were used for TFP estimation.

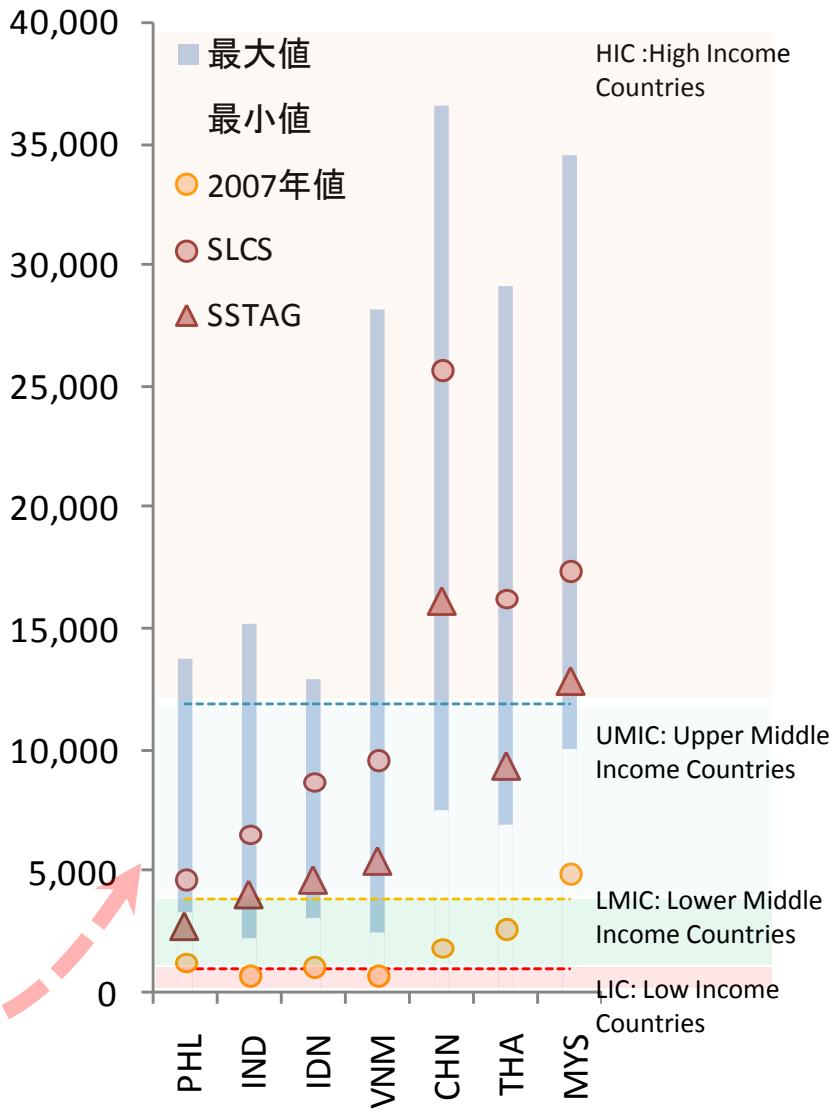




Example of the analysis from the outputs

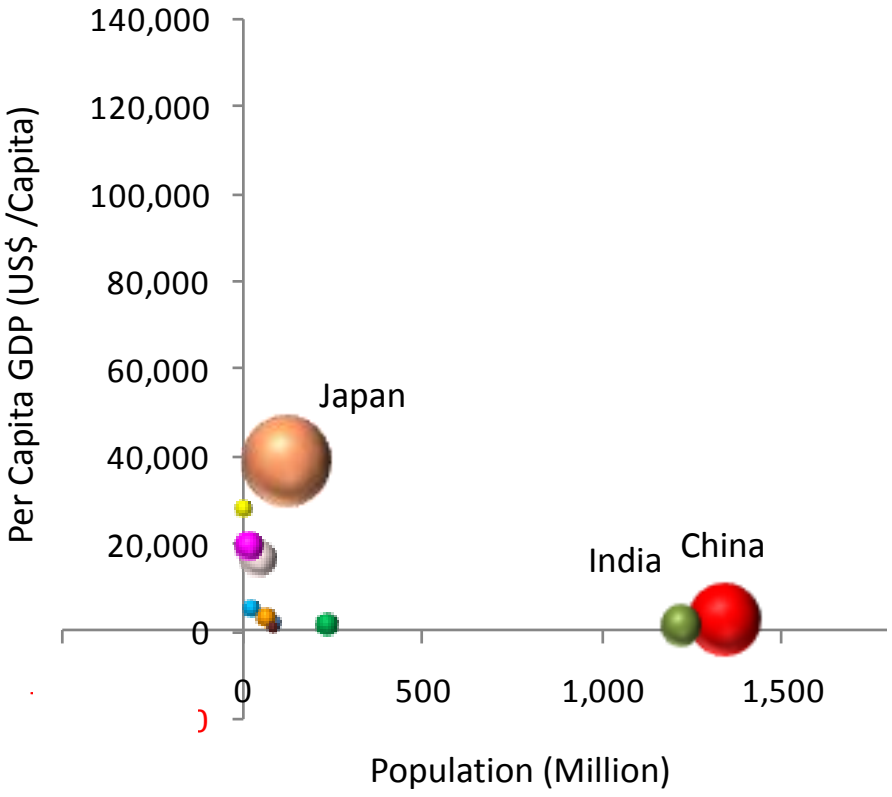
- Japan, Korea, Taiwan, and Singapore is still high in per capita GDP
- China, Thailand, Malaysia becomes HIC in 2050

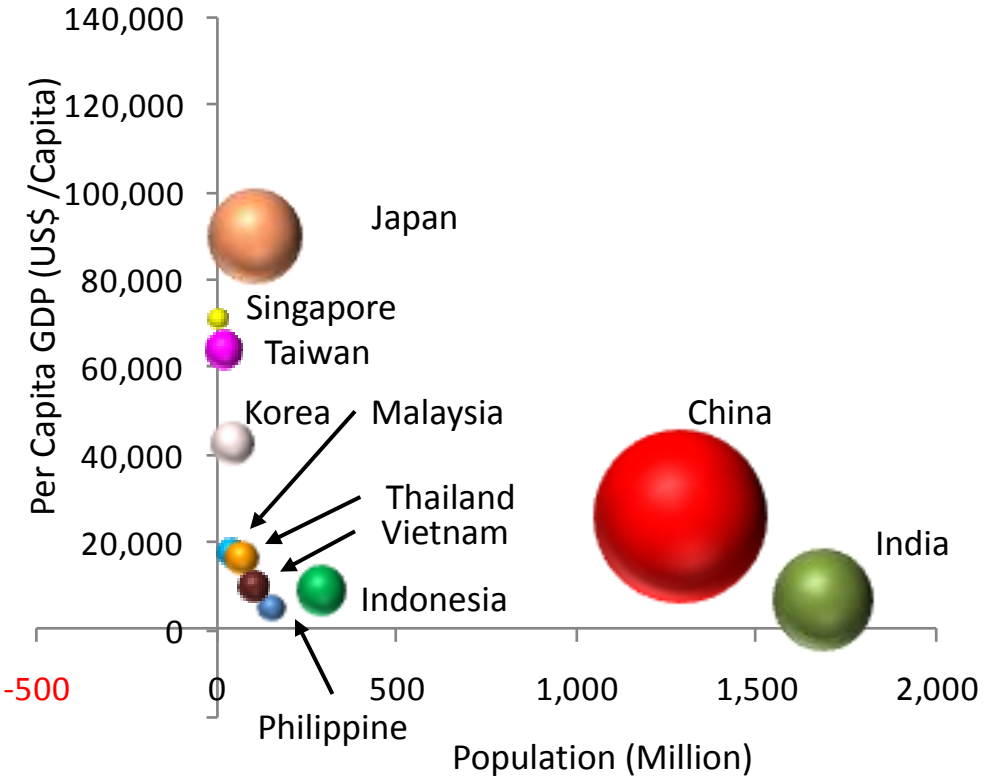




Example of the analysis (SLCS)

- Presence of China, India become significant.
- There would be 2 different types of group in terms of GDP structure.
- Other ASEAN countries would be also increase their presence in Asian Economy, on the contrary Japan's status has not been changed so much



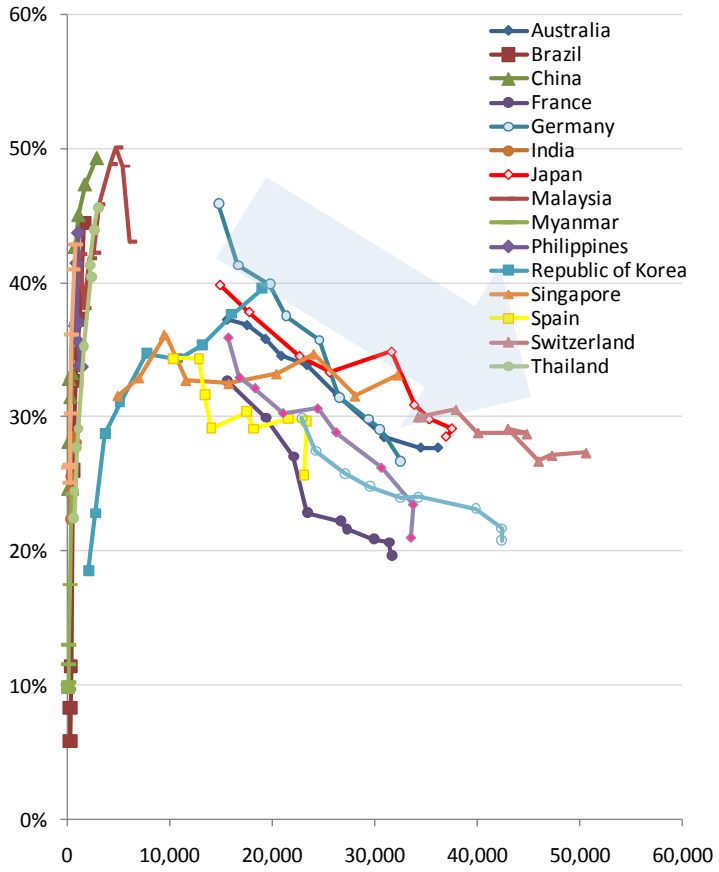


*バブルの大きさはGDPの大きさを相対的に表したもの。

Industrial structure as a function of per capita GDP

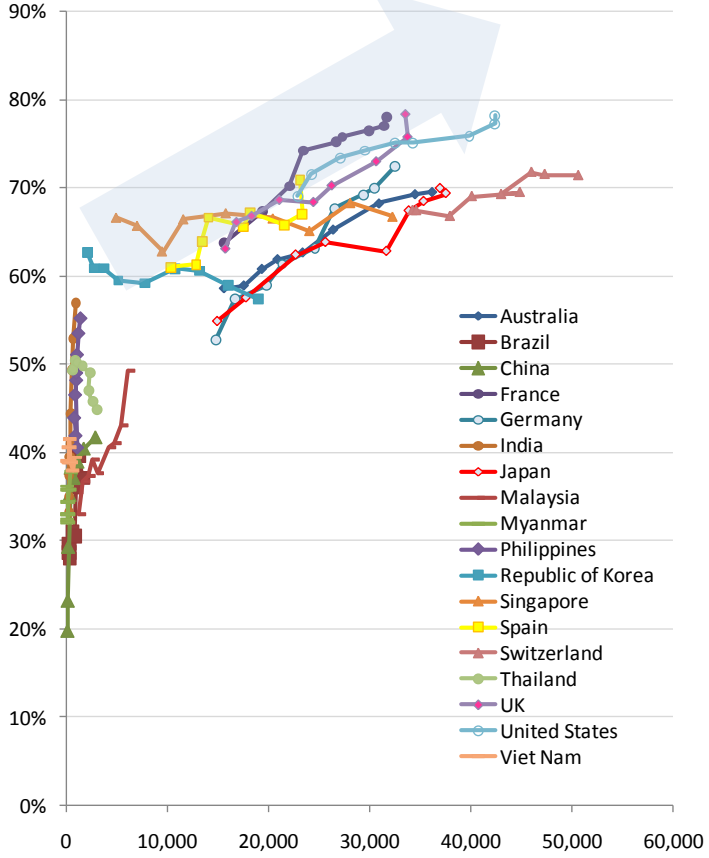
Petty-Clark's Law: Industrial structure changes, by economic development, from the Primary sector of industry to Secondary sector of industry, and to the Tertiary sector of industry
India shows very different trajectory with quite low secondary industry share. One of the reason is probably the impact of globalization. In the closed market, Petty-Clark law is very useful for estimating the industrial structure.

Share of Secondary industry



Per capita GDP (USD/capita)

Share of Service industry



Per capita GDP (USD/capita)

Comparative study of estimated parameters

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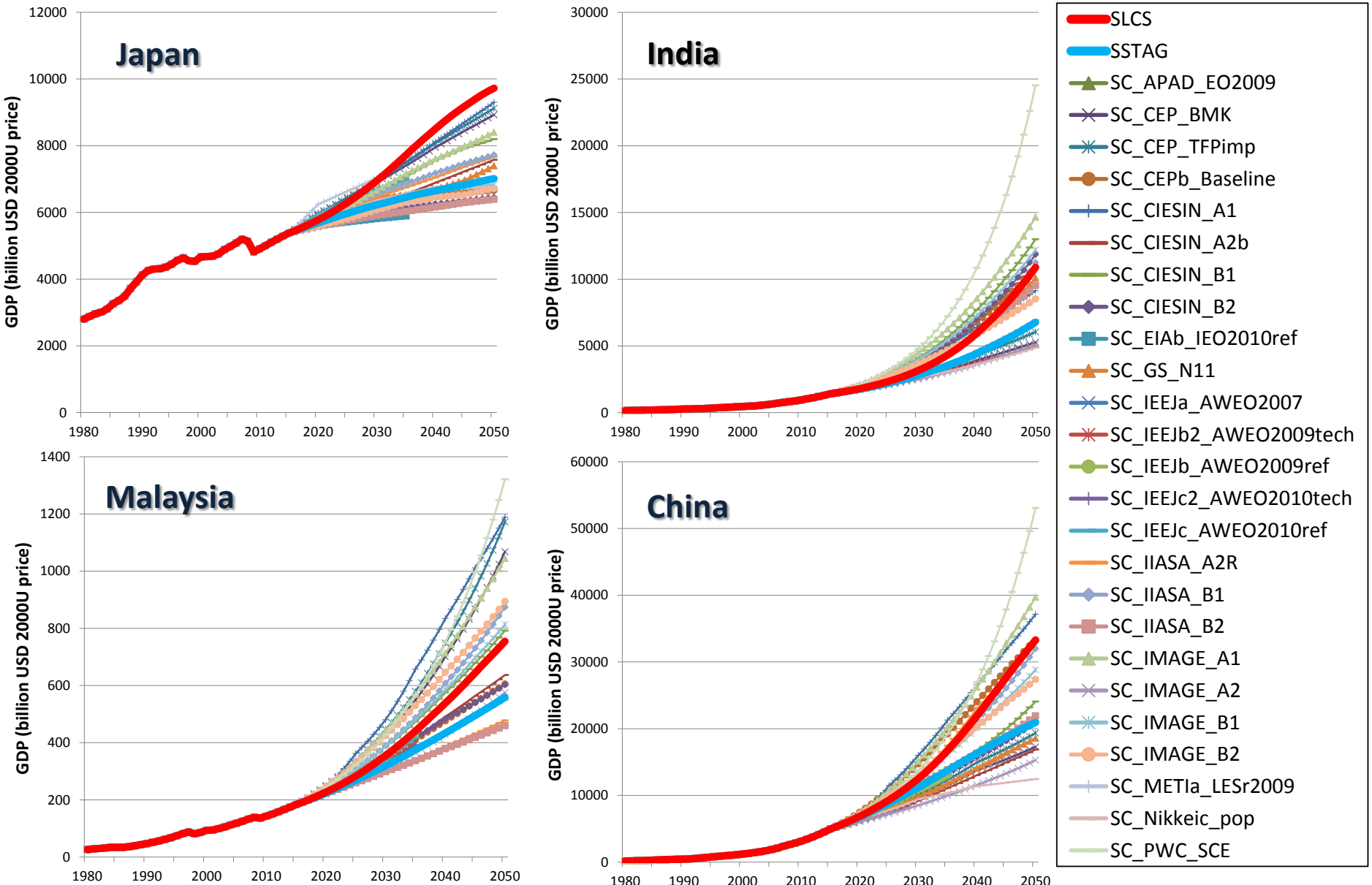


Examples of narrative scenarios

Example of the scenarios (SLCS_China)

Landuse

SLCS

Forest area will be 30% of the total land area by 2050

2010

Transportation

SLCS

Increase in transportation demand due to active economic acth

中国の旅客交通需要

Material Use

High economic growth rate demand more materials for infrastructure deve

Local areas

Improvement in public services but population decreases drastically

中国全土のIT普及率

Urban Areas

Many Mega-Cities have emerged

Urbanization rate

80%
70%
60%
50%
40%
30%
20%
10%
0%

Population & Household

Population peaked in 2020-2030 but number

Total Population

百万人

1,600
1,400
1,200
1,000
800
600
400
200
0

1990 2000 2010 2020 2030 2040 2050

Number of Household

百万世帯

600
500
400
300
200
100
0

1990 2000 2010 2020 2030 2040 2050

2005年の約3.5人/世帯から2050年には2.75人/世帯にまで縮小している。世帯数は2030年以降も増加しつづけ、2050年ごろには5.3億世帯に至っている。

Economy and Industry

SLCS

Achieved inclusive growth through provisions of various services & solutions for local areas

GDP growth (bil. US$)

25,000
20,000
15,000
10,000
5,000
0

1990 2000 2010 2020 2030 2040 2050

Economic Growth rate

12%
10%
8%
6%
4%
2%
0%

1990-2000 2000-2010 2010-2020 2020-2030 2030-2040 2040-2050

2010

Most of the inefficient state owned companies are privatized. Business infrastructures have been intensively developed and China has achieved high economic growth rate continuously.
Manufacture sector is strong but share of the service sector is increasing due to improvement in economic status of domestic market. Restructuring the agricultural sector plays a key role in achieving inclusive growth in this area.

2030

In 2030, China is one of the most powerful countries in terms of global economy. It may not too much to say that China is a center of the economy. In addition, Chinese highly educated and skilled population attain many respects from other countries. Chinese service sector growth is further accelerated.
On the other hand, employment in agricultural sector is decreasing continuously due to mechanization and efficient agricultural production practices.

2050

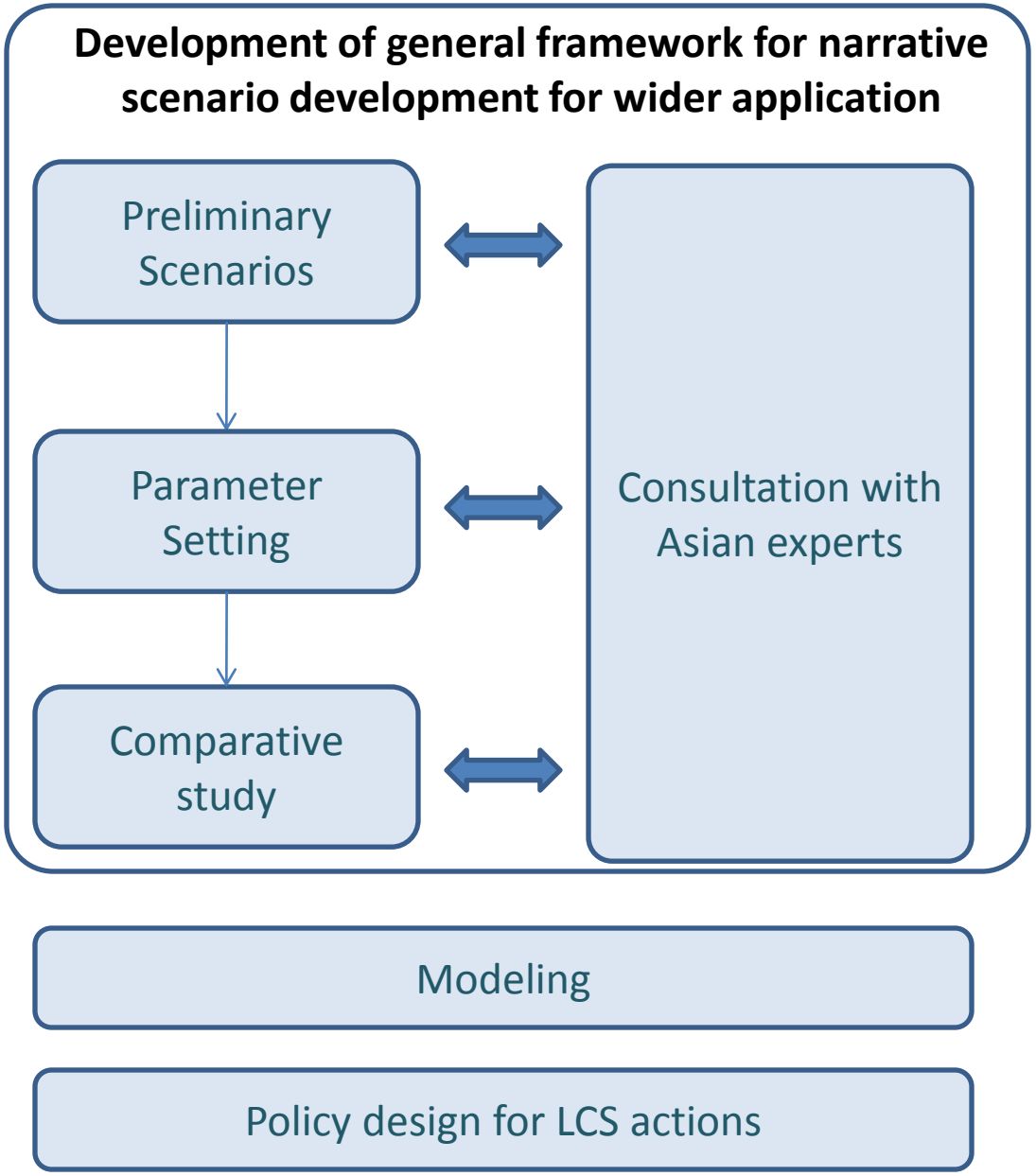
Development of preliminary scenarios (China)

Factors			Unit	SLCS			SSTAG		
				Value		Growth rate (%)	Value		Growth rate (%)
				2005	2050	2010-2050	2010	2050	2010-2050
Socio economic scenario	**Population and Urbanization**								
		Total population	Million	1,308	1,296	-0.02%	1,308	1,296	-0.02%
		Labour fources (15-64)	Million	923	790	-0.34%	923	790	-0.34%
		Urbanization	%	43%	73%	N/A	43%	73%	N/A
	Social								
		Average Education year	Years	7.06	12.00	1.19%	7.06	12.00	1.19%
		Governance	Index (-2 to 2)	0.004	0.522	N/A	0.004	0.004	N/A
	Economy								
		GDP	Bil US$ (2005)	2,266	35,251	6.29%	2,266	20,026	4.96%
		TFP improvement	2005=1.00	1.0	4.2	3.25%	1.0	2.8	2.32%
		Per capita GDP	US$/capita	1,732.0	27,191.0	6.31%	1,732.0	15,446.8	4.98%
	Industrial Structure				12				
		Primary Share	%	12%	5%		12%	5%	
		Secondary share	%	47%	25%	N/A	47%	35%	N/A
		Tertiary share	%	41%	70%		41%	60%	
	Energy Inteisive Industry								
		Crude steel production	Mt/year	550	550		550	550	
	Residential & Commercial								
		Energy demand in household	kgoe/capita	137	459		137	368	
		Electrification rate	%	6%	45%		6%	40%	
	Transportation								
		Share of daily trip mode by private cars	%		85%			65%	
		Passenger transportation vollume index	2005=1.00	1.00	15.56	6.29%	1.00	8.84	
		Share of freight mode by trucks	%						
		Freight transportation vollume	2005=1.00	1.00	15.56	6.29%	1.00	8.84	
		Transport efficinecy improvement	2005=1.00	1.00	0.61	1.00%	1.00	0.61	
	Power generation								
		Nuclear	Mtoe	14	180		14	180	
	Energy Intensity								
		Energy intensity	toe/US$						
	Technology Improvement								
		AEEI_Coal	%/year	N/A	N/A	2.50%	N/A	N/A	2.50%
		AEEI_Oil	%/year	N/A	N/A	1.50%	N/A	N/A	1.50%
		AEEI_Gas	%/year	N/A	N/A	0.50%	N/A	N/A	0.50%
		AEEI_Electricity	%/year	N/A	N/A	1.50%	N/A	N/A	1.50%

Development of preliminary scenarios (India)

Factors			Unit	SLCS			SSTAG		
				Value		Growth rate (%)	Value		Growth rate (%)
				2005	2050	2010-2050	2010	2050	2010-2050
Socio economic scenario	**Population and Urbanization**								
		Total population	Million	1,224	1,692	0.72%	1,224	1,692	0.72%
		Labour fources (15-64)	Million	716	1,143	1.04%	716	1,143	1.04%
		Urbanization	%	29%	54%	N/A	29%	54%	N/A
	Social								
		Average Education year	Years	3.98	10.86	2.26%	3.98	7.77	1.50%
		Governance	Index (-2 to 2)	-0.025	0.498	N/A	-0.025	-0.025	N/A
	Economy								
		GDP	Bil US$ (2005)	818	14,328	6.57%	1,246	8,981	4.49%
		TFP improvement	2005=1.00	1.0	9.0	5.00%	1.0	5.0	3.63%
		Per capita GDP	US$/capita	668.3	8,468.1	5.81%	1,018.0	5,307.9	3.74%
	Industrial Structure								
		Primary Share	%	19%	5%	N/A	19%	5%	N/A
		Secondary share	%	28%	40%		28%	40%	
		Tertiary share	%	53%	55%		53%	55%	
	Energy Inteisive Industry								
		Crude steel production	t	70	550		70	550	
		Cement Production	t	??	??		??	??	
	Residential & Commercial								
		Energy demand in household	kgoe/capita	137	295		137	261	
		Electrification rate	%	6%	30%		6%	30%	
	Transportation								
		Share of daily trip mode by private cars	%		55%			50%	
		Passenger transportation vollume index	2005=1.00	1.00	17.52	6.57%	1.00	7.21	
		Share of freight mode by trucks	%						
		Freight transportation vollume	2005=1.00	1.00	17.52	6.57%	1.00	7.21	
		Transport efficinecy improvement	2005=1.00	1.00	0.61	1.00%	1.00	0.61	
	Power generation								
		Nuclear		2%	2%	N/A	2%	2%	
		Fossil fuels		86%	86%	N/A	86%	86%	
	Energy Intensity								
		Energy intensity	toe/US$						
	Technology Improvement								
		AEEI_Coal	%/year	N/A	N/A		N/A	N/A	
		AEEI_Oil	%/year	N/A	N/A		N/A	N/A	
		AEEI_Gas	%/year	N/A	N/A		N/A	N/A	
		AEEI_Electricity	%/year	N/A	N/A		N/A	N/A	

Future Work



Apply to many regions for scenario development

Level 2 (15 region)
Japan
China
India
Taiwan
Indonesia
Malaysia
Philippine
South Korea
Singapore
Thailand
Vietnam
Other Eastern Asia
Other East West Asia
Other South Asia
Other Oceania