Japan's Urbanization and Growth Processes

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Purpose of Presentation

- <u>The Growth Report (2008)</u> by Commission on Growth and Development
 - Discusses urbanization that accompanies growth
- Challenges that urban planners face where massive urbanization occurs are not addressed in a concrete manner
- The purpose of this presentation is to bridge this gap and discuss strains that growth brings to the economy and the society
- These are difficult problems, but not impossible to overcome

Overview

- 1. Managing urbanization in Japan : mid 1950searly 1970s
 - Rapid urbanization during the high economic growth period: to enjoy economies of agglomeration
 - Government strategies for inclusiveness and sustainability
 - Solving congestion and correcting spatial disparity
 - Addressing income disparity
- 2. Planning railway systems in Tokyo as efficient and environmentally friendly public transport mode
- 3. Future urban challenges : climate change and Asian coastal megacities
 - JBIC-WB-ADB Joint Study on impacts of flood (2050)
 - Simulation results for Manila

1. Managing urbanization in Japan : mid 1950s-early 1970s

• Industrial production was increasingly concentrated in the core areas, the leading industrialized areas in Japan (Keihin and Hanshin industrial areas)

As a result,

• The second largest GNP in the world However,

- Income disparity between industrialized and other areas
- Overpopulation, heavy traffic congestion, air and water pollution in urban areas



In 1912



In 1968



Traffic jam



Correcting Spatial Disparity

- The role of central government evolved over the years
- Integrated Spatial Development Plan (1962): addressing concentration and spatial disparity
 - Massive investment in Pacific Ocean Industrial Belt
 - Development of "new regional clusters" through investments in infrastructure
- New Integrated Spatial Development Plan (1969) : addressing convergence
 - Geographical expansion of economic opportunities to less industrialized areas
 - Narrow the gap in living standards between urban metropolises and rural areas

Expansion of Expressways



during the 1960s

during the 1970s

during the 1980s

The first expressway connected the Keihin industrial area to the Hanshin industrial area (thanks to a World Bank Loan). After that, the connectivity were improved among the two core areas and along the Pacific Ocean Industrial Belt.

Public Investments and Relative Per Capita Income Among Different Areas



Figure 2. Change in Relative Per Capita Income (overall average=100)



Per capita public investments in infrastructure in less developed areas rapidly increased.

Figure 1. Change in Per Capita

Relative per capita income among different areas started to converge

Discussion Points from Japan's Urbanization Experience

- Strong and versatile leadership of the central government addressed the problems of concentration and then convergence
- However, decentralized governance and the development of private financial sector in later years led to criticism towards central government
- → How to optimize the role of central/local government during urbanization challenge? under capacity constraints? under information asymmetry? Under democratic reform?
- The agglomeration of industries made the rapid economic growth in Japan possible
- Constructing new industrial clusters in areas far away from the Pacific Belt proved to be difficult
- → How to fully benefit from economies of agglomeration? While managing urbanization as well as spatial disparity?
- \rightarrow How to find fiscal space to cope with massive urbanization?

2. Examples of managing urbanization: Planning subway systems in Tokyo

- Central Tokyo, which lies inside the ring railway network Yamanote line, has a mesh of subway networks. The area inside the Yamanote line (around 24 square miles) had developed subway systems since early 1900's. This was promoted by Tokyo Metro Public Cooperation, one of the governmental bodies (now privatized).
- Central Tokyo had depended on the development of these subway networks. At the present, the average distance from station to station is around 0.6 miles. Almost all areas inside the Yamanote line can be easily accessed on foot.
- Tokyo began to the construction of its railways when Tokyo had a smaller population, therefore the metro networks could expand so densely.

 \Rightarrow As a result, railway centered urban development could secure profitability on the investments by subway companies.

Planning subway systems



Land use development around the station in the suburban area

- Many private railway companies developed cities around their stations to profit from bus transport, real estate and construction of social infrastructure (e.g. housing)
- The government also supported their cooperative strategies and built many public apartments for lower-income people.

 \Rightarrow As a result, this non private vehicles-centered urban development never created slums, or caused crime, but created environmentally friendly cities.

Both government and local authorities designated areas around • major railway stations as a "downtown" (radius of 0.4-0.5 miles, appropriate walking distance). Here, regulation of infrastructure was greatly reduced to allow taller buildings and more intensive commercial developing.

 \Rightarrow As a result, many shops and offices had been located in these designated areas and had had easy access to public transport.

Subsidies to the subway systems

- Subsidies to subway systems in Tokyo are applied to the construction of future subways. 35% of total costs are subsidized by the Japanese government, 35% are provided by Tokyo metropolitan authorities, and the remaining 30% are borne by the subway companies. Although the subway systems were privatized in 2004, the subsidy system has not been changed.
- Subsidies from governments gradually increased until the 1970s, and had decreased until the 1990s. In the last 10 years, the subsidies have dramatically increased because subway networks expanded (the new line, Fuku-toshin line, opened in 2008) and connected to the railway networks of private railway companies which run in the outskirts. People living in the suburban area can easily access to the central Tokyo because of the physical connection among railways operated by different railway companies and it is not necessary to transfer at the stations on the edge of the city.
- Expansions of networks and increases in the number of through trains secure profitability to subway companies. One of the subway companies 'the Tokyo Metro' had \$3.8 billion in sales and a \$0.4 billion net profit in FY2008 without any subsidies. Therefore, the autonomy of the subway company shows that they do not need any subsidies if they do not expand railway networks. The subway systems which have been improved by subsidies and have run on time make the subway systems more attractive than private vehicles.

Subsidies to the subway systems





Source: Tokyo Metro Co.

3. ADB-WorldBank-JICA Joint Study: "Climate Change Impact and Adaptation in Asian Coastal Cities"

- (1) Cities: Manila (JICA)Bangkok, Kolkata (WorldBank)Ho Chi Minh City (ADB)
- (2) Purpose: To inform urban planners on potential risk and cost/benefit of adaptation
- (3) Study team; Simulation model developed by Univ. of Tokyo (Ibaraki Univ.)

(On-going study, slides show tentative results only.)

Approach to assess climate change vulnerability

1

Downscale IPCC climate models for temperature increase @2050 for B1 and A1FI scenarios

2

Assess local effects on precipitation and combine with sea level rise/ storm intensification

3

Simulate different types of hydraulic effects: 1) through river systems, 2) through accumulation of water at lake, and 3) through sea level rise and storm surge at the coast (combination depends on city)

4

Based on the flood maps produced for 12 cases (3 climate scenarios x 2 infrastructure scenarios x 3 return periods), estimate socioeconomic impact (both direct and indirect) with available data, thus deriving the benefit side of adaptation.

5

Consider investment mix and their costs necessary for adaptation (focusing on flood control infrastructure)

6

Conduct Net Present Value (economic, not financial) and EIRR calculations

In addition:

- Firm and urban poor household surveys to understand the details of vulnerabilities.
- Health impact analysis
 (Both status quo analysis)





Flood-prone areas in Manila



Flood Prone Areas in Metro-Manila



Downscale IPCC climate models for temperature increase @2050 for B1 and A1FI scenarios

Global temperature projection by IPCC



		Year		
		2020	2030	2050
Scenario	A1FI	0.7K	1.0K	2.0K
	B1	0.6K	0.8K	1.3K

Simple statistical downscaling



http://criepi.denken.or.jp/jp/event/forum/2007/maruyama/maruyama_ppt.pdf

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Assess local effects on precipitation and combine with sea level rise/ storm intensification

Simulation Cases (Case of Metro Manila)

	Simulation Case	Temperature Rise (°C) (downscaled)	Sea Level Rise (cm) (global)	Increase Rate of Rainfall (%)	Storm Surge Height (m)
1	Status quo climate	0	0	0	0.91
2	B1 with storm level at status quo	1.17	19	9.4	0.91
3	B1 with strengthened storm level	1.17	19	9.4	1.00
4	A1FI with storm level at status quo	1.80	29	14.4	0.91
5	A1FI with strengthened storm level	1.80	29	14.4	1.00

*Note: ground subsidence considered to arrive at local sea level rise

Simulate different types of hydraulic effects: 1) through river systems, 2) through accumulation of water at lake, and 3) through sea level rise and storm surge at the coast (combination depends on city)

Metro Manila (National Capital Region)



16 cities and 1 municipality

- Total area 636km²
- Population 9.93 million (2000, NSO)
- Dry season Nov.-Apr
- Wet season May-Oct.
- Climate change will appear:
- 1) Increase of peak precipitation
- 2) Increase of intense tropical storm
- 3) Increase of extreme high sea level incidence

Administrative Boundaries of Metro Manila

Major Works: Pasig-Marikina Channel Improvement Project



Major Works: KAMANAVA Area Flood Control and Drainage System Improvement Project



Major Works: West of Mangahan Floodway Project





Based on the flood maps produced for 12 cases (3 climate scenarios x 2 infrastructure scenarios x 3 return periods), estimate socio-economic impact (both direct and indirect) with available data, thus deriving the benefit side of adaptation.

Summary of Inundation Area in the Pasig-Marikina Basin

Simulation Case		30-year Flood		100-year Flood		
		Existing Structures (halfway through current Master Plan)	Continue Implementing Current Master Plan	Existing Structures (Halfway through current Master Plan)	Continue Implementing Current Master Plan	
1	Status quo climate	34.6 km ²	14.7 km²	53.7 km²	29.1 km ²	
2	B1	42.5 km ²	20.8 km ²	63.2 km²	40.1 km ²	
3	A1FI	47.0 km ²	22.8 km ²	68.0 km ²	44.1 km ²	

Socio-economic assessment



Added up benefits (savings)

- Cost of buildings
- Travel time savings through existing/future road investments
- Vehicle operation cost savings
- Avoided income loss (firms, formal/informal households)
- Use future predicted values as much as possible. Use growth rate to arrive from these future values up to 2050.

Affected area and population



P100 Affected Area (%)			
EX SQ	11.87		
EX B1	12.95		
EX A1F1	13.64		
BAU SQ	5.25		
BAU B1	6.97		
BAU A1F1	7.62		

P100 Affected Pop (%)			
EX SQ	20.08		
EX B1	22.13		
EX A1F1	23.27		
BAU SQ	7.08		
BAU B1	7.08		
BAU A1F1	11.74		

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Consider investment mix and their costs necessary for adaptation (focusing on flood control infrastructure)

Adaptation Measures to Climate Change in Metro Manila

Situation	Case	Study Area	A : Marikina Dam	B: Improvement of Embankment	C: Enhancement of Drainage Pomp	Cost	Total Cost
30 year return		Pasig		+0.2m	_	67,510,000	2,307,060,000
		Marikina		+0.5m	_	89,550,000	
	Pattern 1	SanJuan			_	0	
		West Mangahan			+43m³/s	2,150,000,000	
		KAVANAVA	-	_	_	0	
period A1FI		Pasig			_	0	9,577,640,000
		Marikina	Construction	less than +0.5m	_	7,427,640,000	
	Pattern 2	SanJuan			_	0	
		West Mangahan		_	+43m³/s	2,150,000,000	
		KAVANAVA		-		0	
		Pasig			_	0	1,439,550,000
		Marikina		+0.5m	_	89,550,000	
	Pattern 1	SanJuan			_	0	
		West Mangahan	_	_	+27m³/s	1,350,000,000	
30 year return		KAVANAVA				0	
period B1		Pasig		_	_	0	8,777,640,000
		Marikina	Construction	less than +0.5m	_	7,427,640,000	
	Pattern 2	SanJuan		_	_	0	
		West Mangahan		_	+27m³/s	1,350,000,000	
		KAVANAVA				0	
100 year return period A1FI	Pattern 1	Pasig		+0.6m	_	231,720,000	2,971,270,000
		Marikina	Construction	+0.5m	_	89,550,000	
		SanJuan	_	_	_	0	
		West Mangahan	_	_	+53m³/s	2,650,000,000	
		KAVANAVA				0	
100 year return period B1	Pattern 1	Pasig	_	+0.4m	_	148,070,000	1,887,620,000
		Marikina	Construction	+0.5m	_	89,550,000	
		SanJuan		_	_	0	
		West Mangahan		_	+33m³/s	1,650,000,000	
		KAVANAVA				0	

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Conduct Net Present Value (economic, not financial) and EIRR calculations

Framework for EIRR & NPV

