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Sustainability Pathways (SSP1) Fundamentals for cities: - factor analysis in three case studies

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Outline

1. **The development of SSPs city scale**
   Case study of Tokyo
   Alternative sustainability scenarios

2. **Case study of Bhutan**
   Bhutan's fundamentals for happiness

3. **Case study of Da Nang (Viet Nam)**
   Partnership SSP1

Background

The concern of climate change has been one of the central issues for long-term transformation of cities.

However, environmental loads has not been effectively taken into account for future urban plans. Specifically future carbon emissions from cities significantly rely on the technological progress and human life style changes, among others, which may be a barrier to estimate future environmental loads for cities.

In addition, Sustainable Development Goals (SDGs) of the 2030 Agenda has been adopted by the United Nations in 2015. For these comprehensive sustainable goals to be achieved, more integrated analysis for long-term benefits and trade-offs need to be taken into account for policy-making processes and implementation strategies.

There is, therefore, urgent need for developing methods to integrate climate change policies and sustainable development strategies into real development planning.

1. The development of SSPs city scale

Case study of Tokyo

Alternative sustainability scenarios

Miho Kamei, Keisuke Hanaki, Kiyo Kurisu

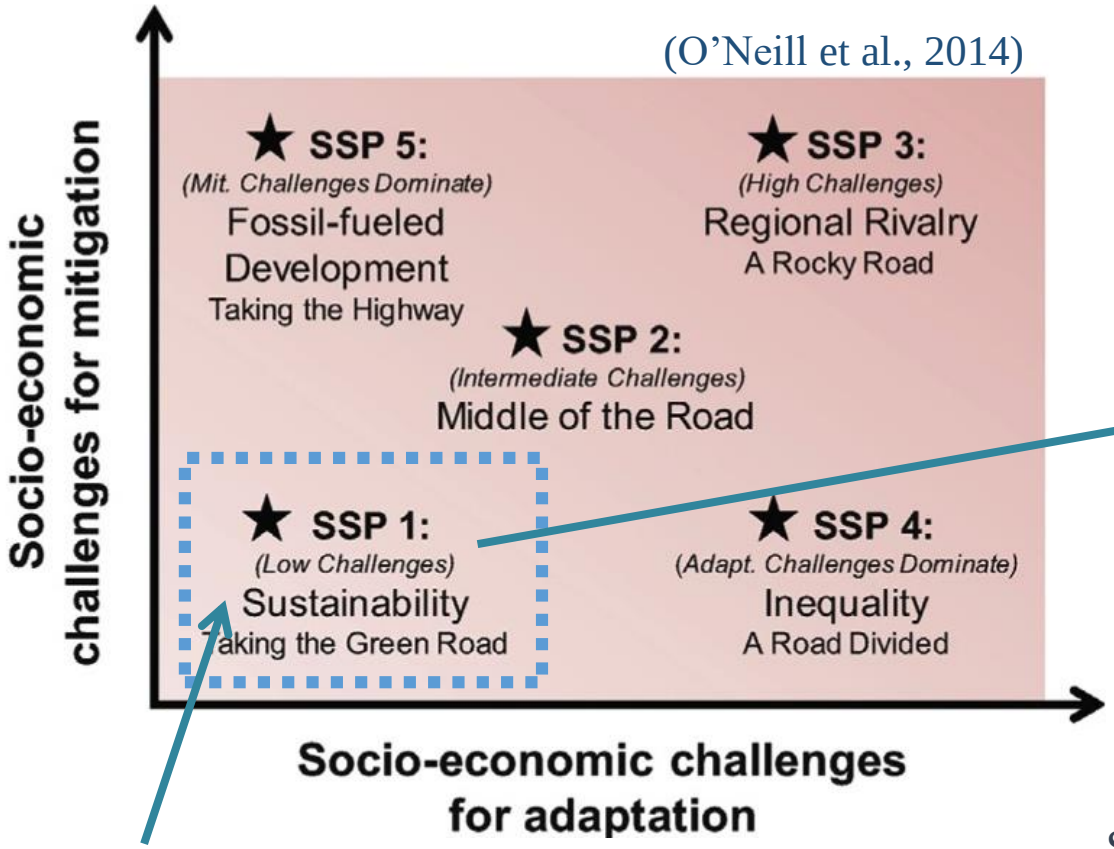
This work was developed at The University of Tokyo

The development of socioeconomic pathways for cities

Downscale shared socioeconomic pathways (SSPs) to city scale

Shared Socioeconomic Pathway (SSPs):
Global socio-economic scenario describing the possible alternative pathways.
(Moss et al., 2010; Van Vuuren et al., 2014; O'Neill et al., 2014; Kriegler et al., 2014; Riahi et al., 2017)

(O'Neill et al., 2014)



SSP 1: Sustainability World (Global)

Alternative sustainability (SSP1)

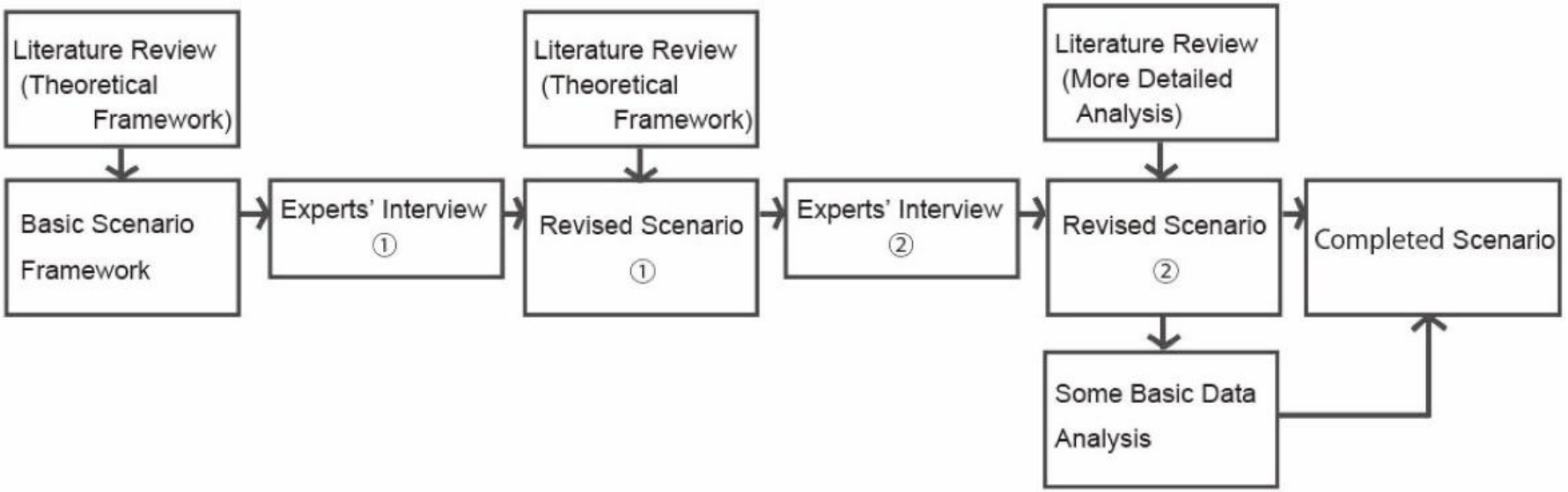
Creative & Happiness Scenario

High-tech & Efficiency Scenario

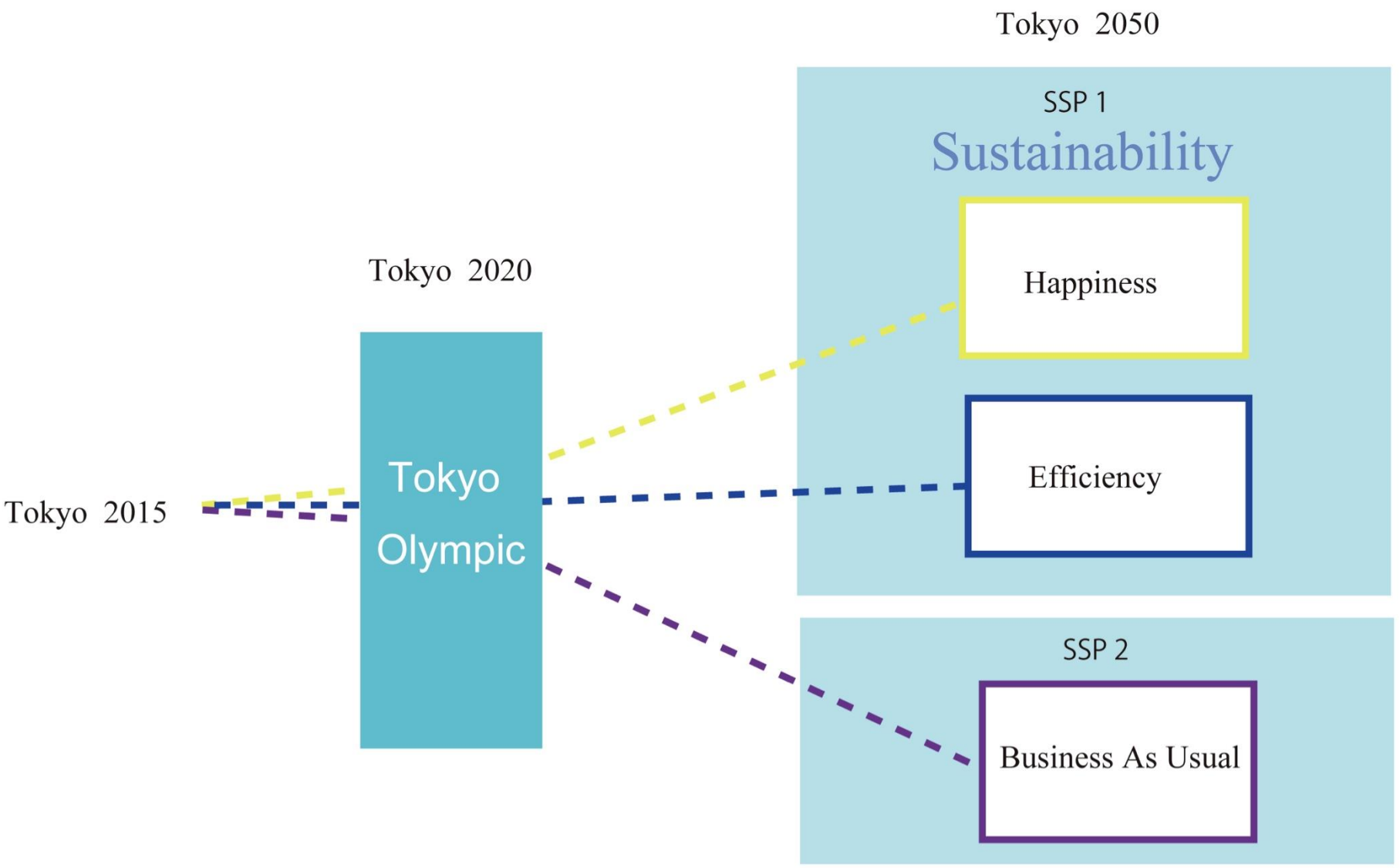
Self-sufficiency Scenario

SSP 1: Sustainability World (Tokyo)

Methodology for developing city scale SSPs



Revised Tokyo's SSPs



Key factors of Tokyo's SSP1: Sustainability

Happiness scenario

Driving Forces:

Diversity, Well-being, Social Capital
Higher quality of life

Key factors:

Human capital (Education)
Urban amenity & services
Population density (Diversity)
Vacant house ratio (Renovations)
Public & green space ratio (Public realm)

Efficiency scenario

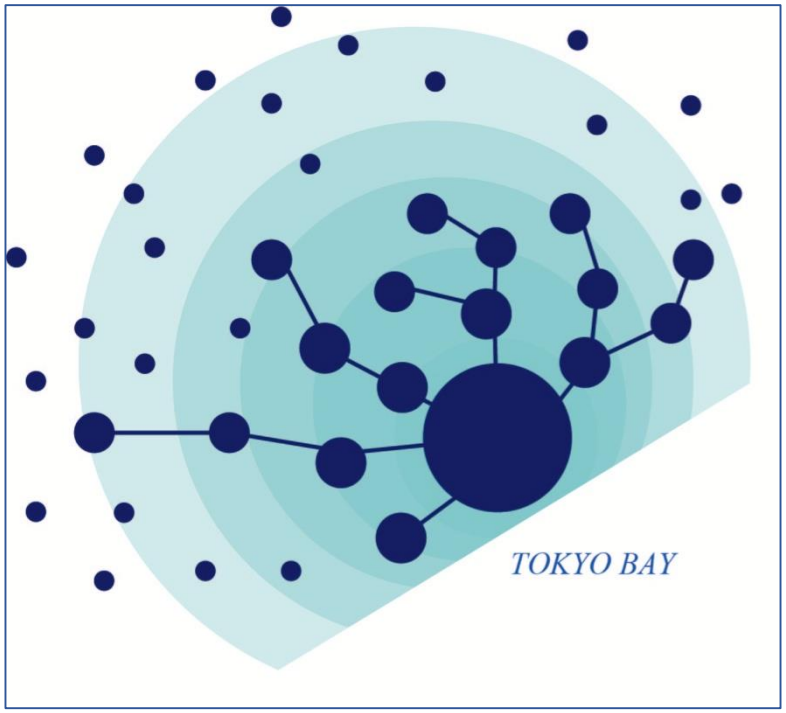
Driving Forces:

Advanced technology, High density
Compact urban form

Key factors:

Energy Efficiency
Population density (High)
New technology deployment ratio
Renewable energy ratio
Commuting time

Tokyo Business As Usual Scenario (SSP2)



Urban Form Concept: Sprawl + functionally shrink

Social Factor

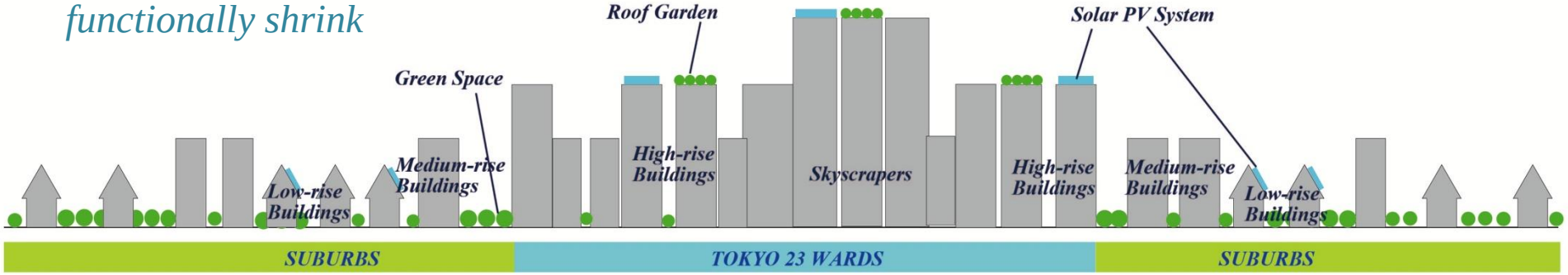
Aging populations and infrastructures cause serious expansions of social costs.. Social communications decrease and are replaced with IT communication technologies. Therefore, social separation is increased between communities and nations.

Economic Factor (economic growth rate 1%)

The tertiary industry is the main industry. However, labour intensive industries continuously increase social inequality.

Urban Form

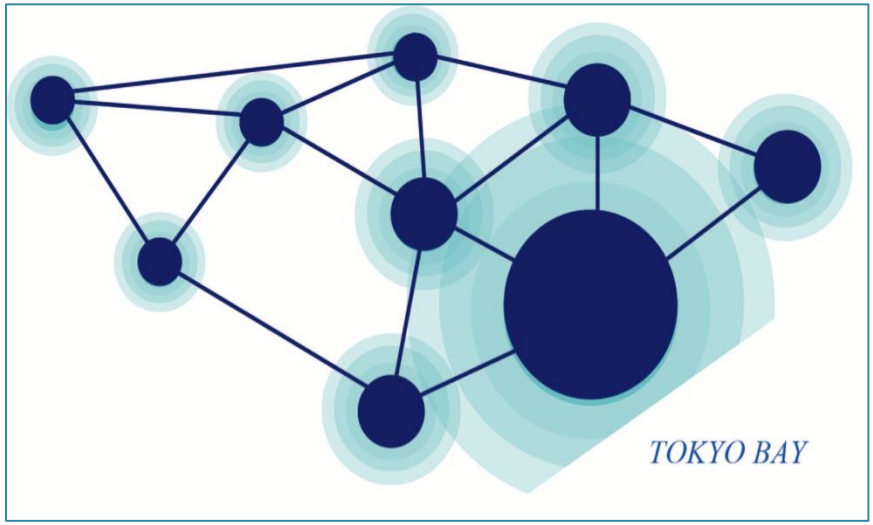
The sprawling edge is gradually modified. However, elderly people remain in suburbs with old infrastructures that are in fragmented condition. The city centre lacks comfortable urban open spaces. Each urban cluster increases inequality and leads to social separation.



Building Typology

Miho Kamei, Keisuke Hanaki, Kiyo Kurisu, 2016

Tokyo Local Vitality (Happiness) Scenario (SSP1: Sustainability)



Urban Form Concept: Polycentric Form

Social Factor

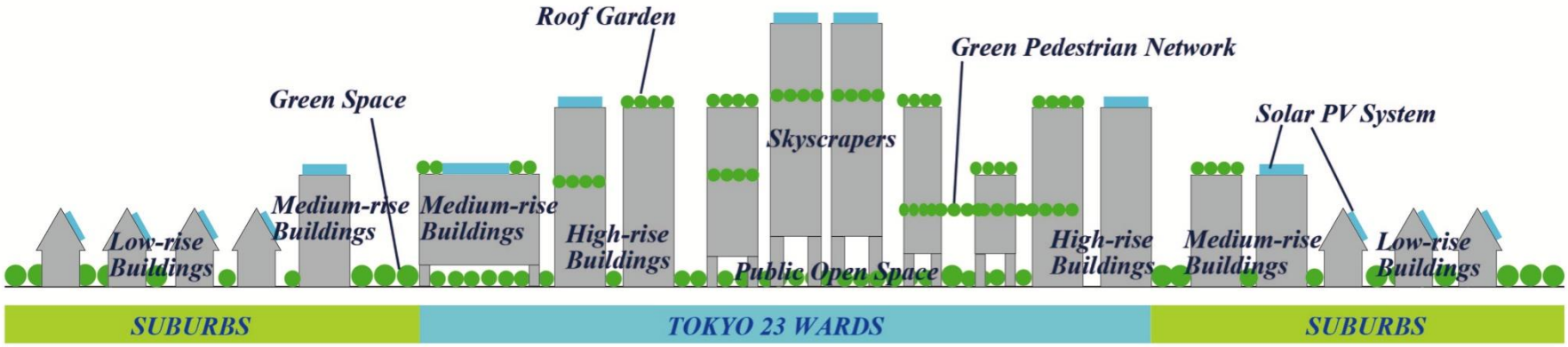
Urban amenities are strongly emphasised. All living residents can access clean, safe, and beautiful neighbourhoods as well as basic services. Diversity is an important feature. The environmental awareness is high,

Economic Factor(economic growth rate 2%)

The tertiary industry will be the main industry, specifically knowledge-based industries will flourish. The work conditions of labour-intensive industries can be improved and social inequality decreased.

Urban Form

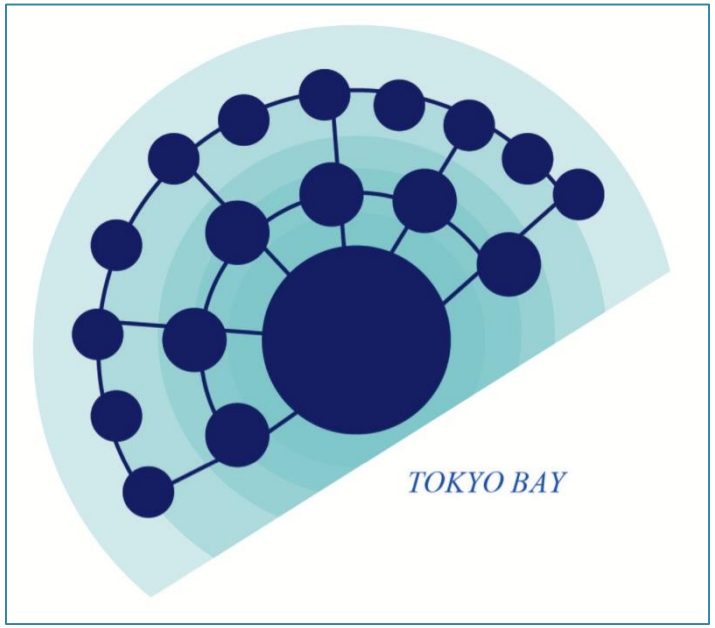
The centre area (Central Business District; CBD) has the highest density. Most of the old buildings and infrastructures are being renovated, and neighbourhoods are also regenerated while preserving local identities



Building Typology

Miho Kamei, Keisuke Hanaki, Kiyo Kurisu, 2016

Tokyo Efficiency Scenario (SSP1: Sustainability)



Urban Form Concept : Monocentric Form

Social Factor

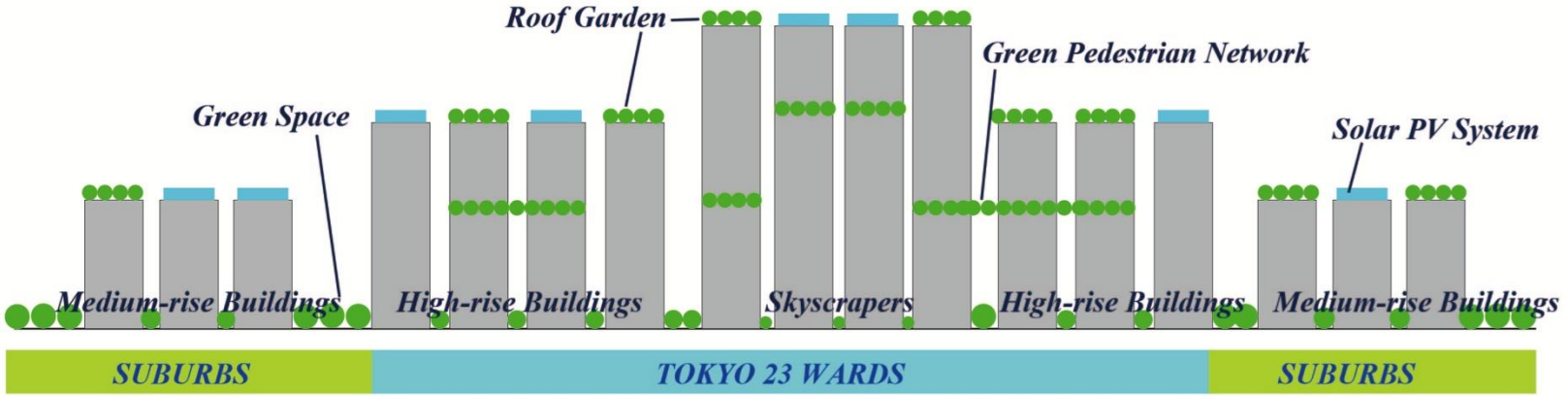
Political control is effectively emphasised. New technologies are introduced and adopted successively. People are likely to choose energy efficient lifestyles through intelligent consumer choices. Active policies can decrease this inequality.

Economic Factor (economic growth rate 2%)

The tertiary industry (Mainly IT, (R&D), and healthcare). Tokyo can showcase of advanced technologies in the global market. Some workers in labour intensive industries can be replaced by robots to reduce social inequality.

Urban Form

The population density of the centre area (23 wards) increases as suburbs decrease and some areas are abandoned. Large scale area developments are promoted rather than renovated. Old infrastructures can be effectively replaced with more efficient ones.



Building Typology

Miho Kamei, Keisuke Hanaki, Kiyo Kurisu, 2016

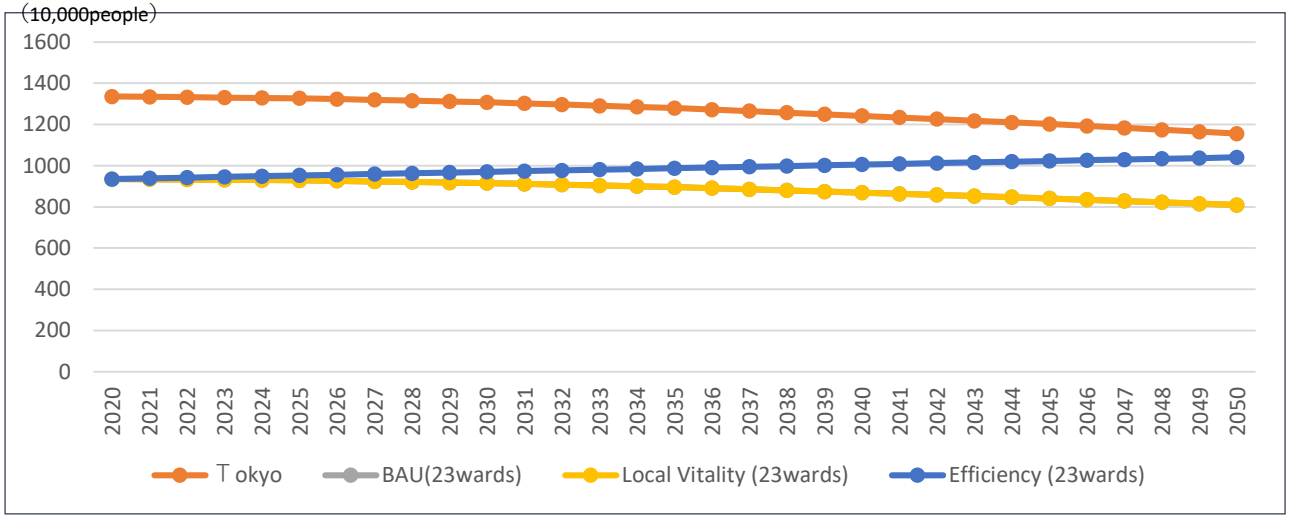
Summary of Tokyo's SSPs (kamei et al., 2016)

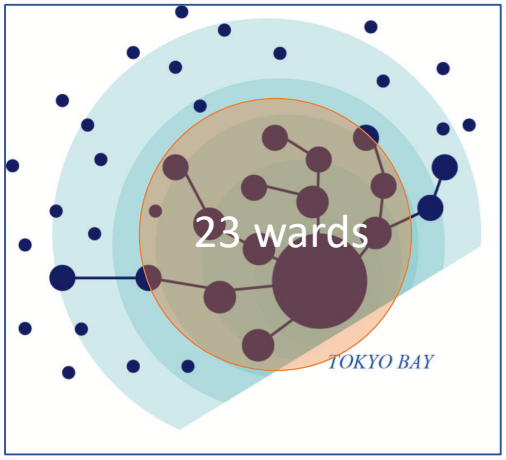
Indicators and Elements

Factors	Indicators	Tokyo BAU scenario (SSP2)	Tokyo Local Vitality scenario (SSP1)	Tokyo Efficiency scenario (SSP1)
Social Factors	Demographic	Slightly decrease, Aging rate is high	Slightly decrease, Aging rate is high	Slightly decrease, Aging rate is high
	Culture value	Steady	High (Enhance local culture and vitality)	Medium (Enhance more globalism)
	Life style	Miner changes	Diverse and selective	Compact and efficient
	Human capital	Steady	High and diverse	High
	Community	Relatively decrease	High (Relatively face to face)	Medium (Relatively IT communications)
Economic Factors	Economic growth	1% (GDP per capita)	2% (GDP per capita)	2% (GDP per capita)
	Industry	Mainly tertiary industry (high rate of labour intensive fields)	Mainly tertiary industry (knowledge, food, medical and welfare, tourism, public)	Mainly tertiary industry (IT, knowledge, R&D, medical and welfare, financial, public)
	Market	Open to global	Open to local + global	Open to global
	Income inequality	Moderate	Reduce	Relatively reduce
	Unemployment rate	Moderate	Low	Low
Environmental Factors	Environmental awareness	Medium	High	High
	Environmental policy	Medium	Medium (more local governance)	High (relatively topdown)
Urban form and Urban amenity Factors	Physical urban form	Spraql + functionally shrink	Polycentric	Monocentric
	Quality of urban space	Unequal	Divers of identity, High amenity value	High density, Efficient mixed use
	Infrastructure	Serious problems of upgrading infrastructures in low density areas	Active renovations and regenerations	Deployment of newtechnologies and active new developments
	Density	Relatively high	Relatively high and diverse	High
	Commuting time	Medium	Different in areas, relatively low	Lowest
	Green space	Moderate	Overall increase	Centre: relatively low, Suburb: increase
	Services	Moderate	High	High
	Housing cost	Steady	Diverse	High

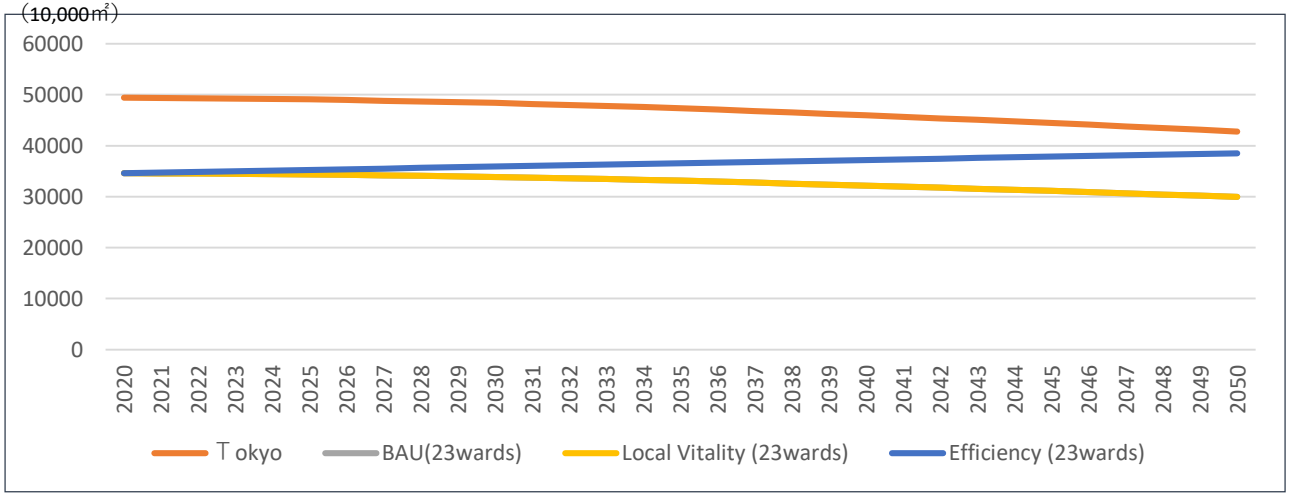
Parameters in alternative scenarios (consistent with global assumptions)

Demographic changes by 2050 (Tokyo 23 wards by scenarios)





The demand of gloss floor area (Housing : Tokyo 23 wards by scenario)

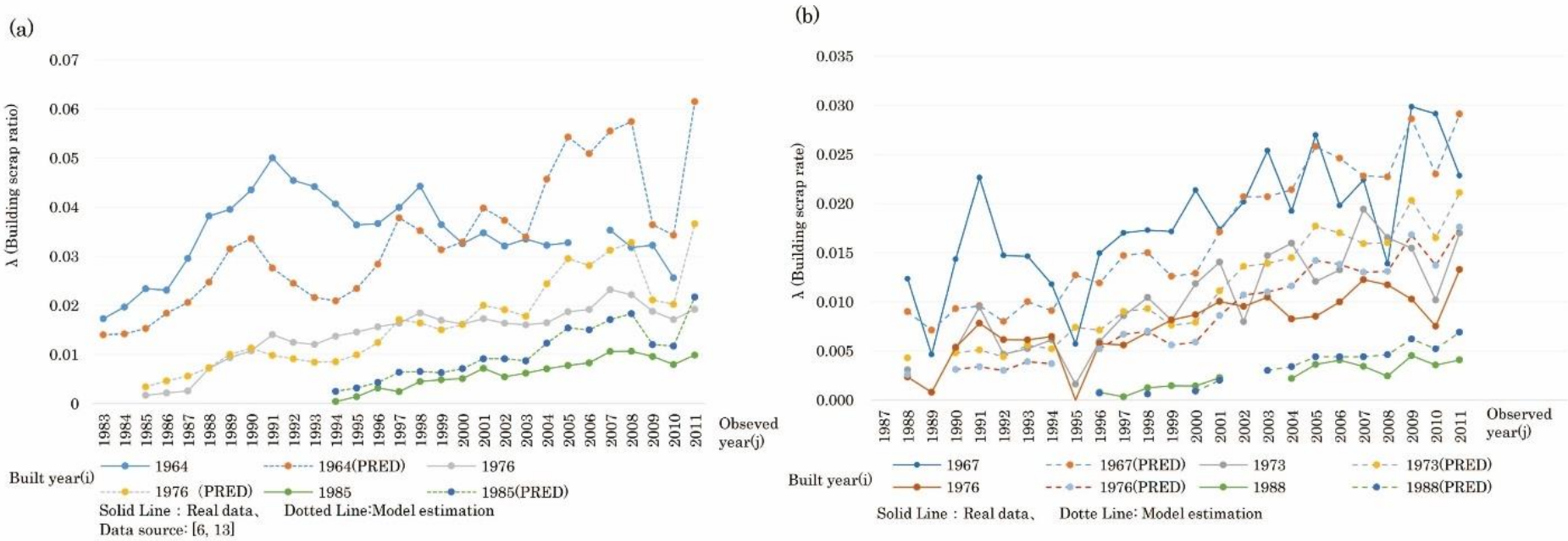


Analysing significant explanatory variables influencing building scrap rate

Applying COX hazard model

$$\lambda(t|x) = \lambda_0(\mathrm{t})\exp(\beta x) = \lambda_0(\mathrm{t})\exp(\textstyle\sum_{k=1}^{m}\beta_k x_k)$$

$$\lambda_0(\mathrm{t}) = \frac{m}{\mathrm{T}^m}\cdot t^{m-1}$$

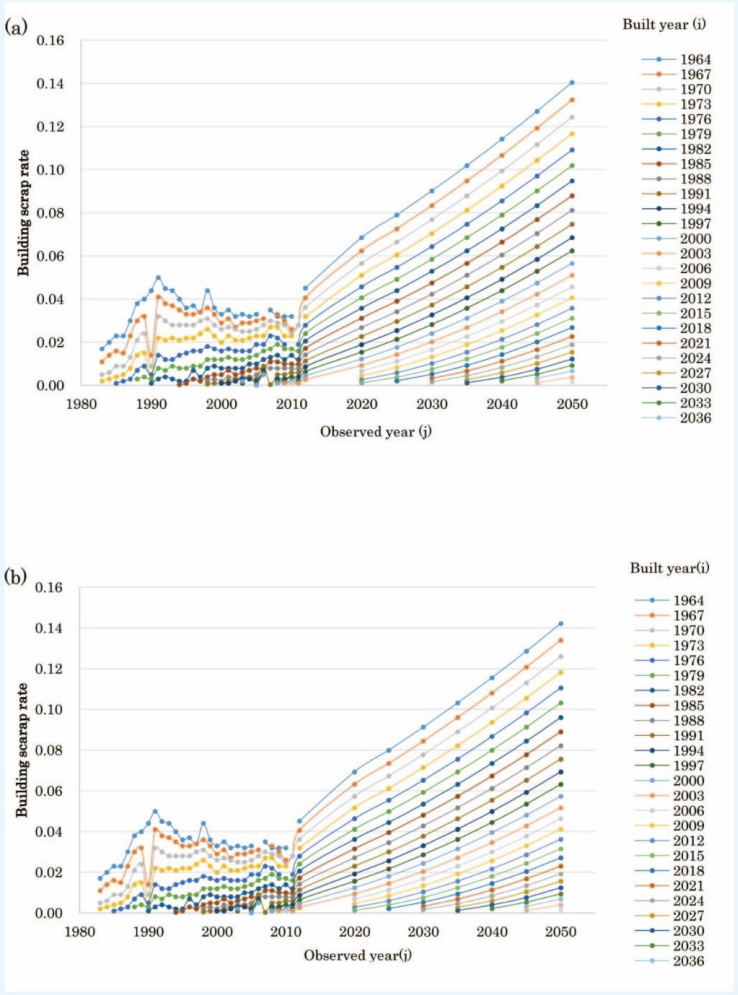


The comparison of building scrap rate between model estimation and real data
(Estimated by COX hazard mosel with explanatory variables of economic growth rate)
(a)Wooden building, (b) Non-Wooden building
Data source: Ministry of Internal Affairs and Communications, Japan, Japan Cabinet Office

Miho Kamei, Kiyo Kurisu, Keisuke Hanaki, 2018

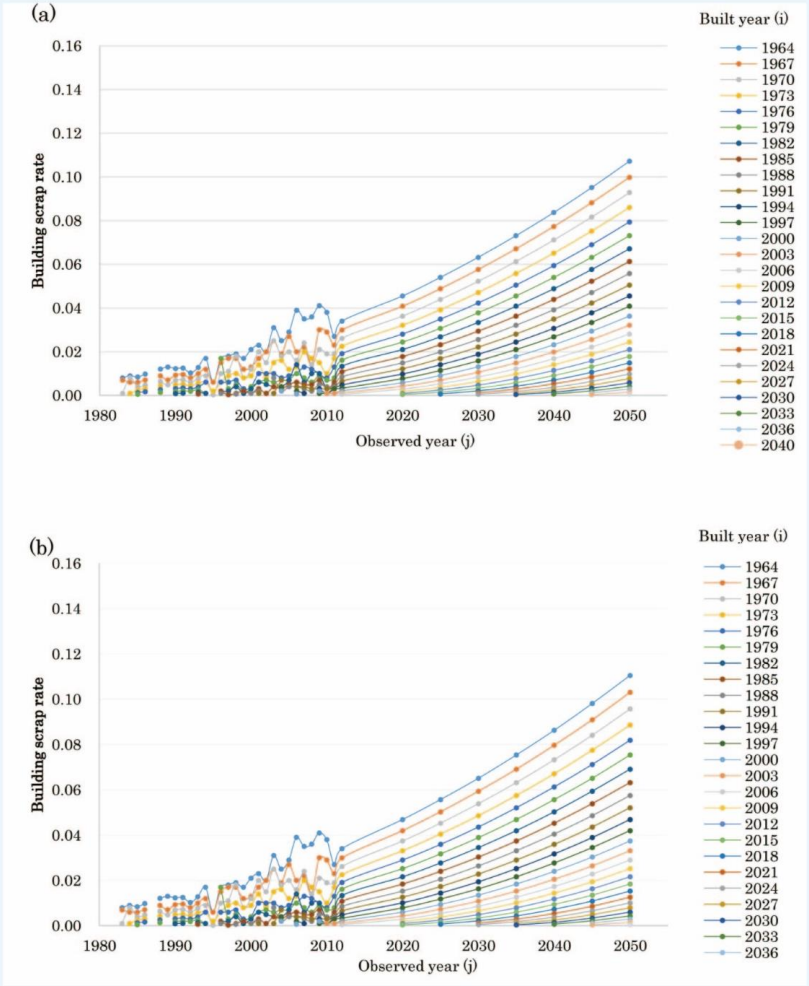
Projection of future building scrap rate based on the alternative Tokyo's SSPs

Wooden building



The projection of future building scrap rate in wooden building by 2050
(a)Economic growth rate 1% : (b) Economic growth rate 2%

Non-wooden building



The projection of future building scrap rate in non-wooden building by
(a)Economic growth rate 1% : (b) Economic growth rate 2%

Miho Kamei, Kiyo Kurisu, Keisuke Hanaki, 2018

Projection of building stock changes in existing buildings

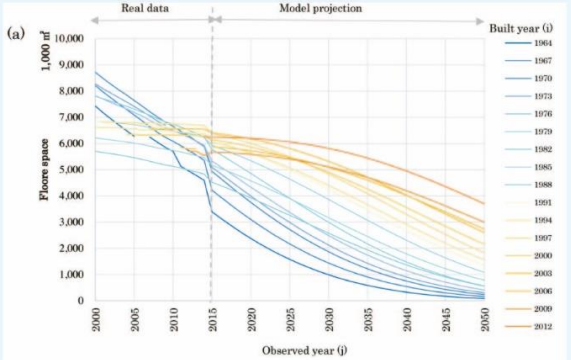
Wooden building

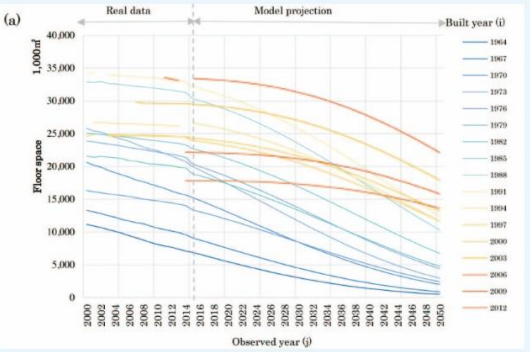
Non-wooden building

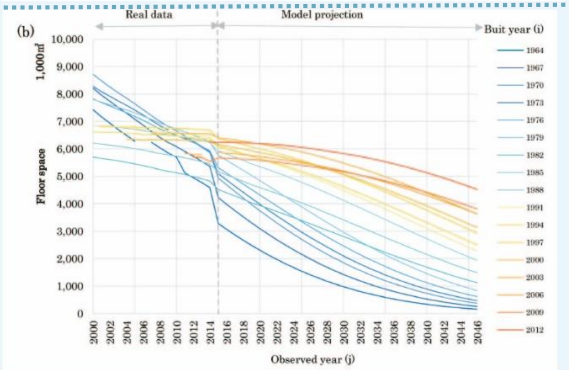
BAU scenario

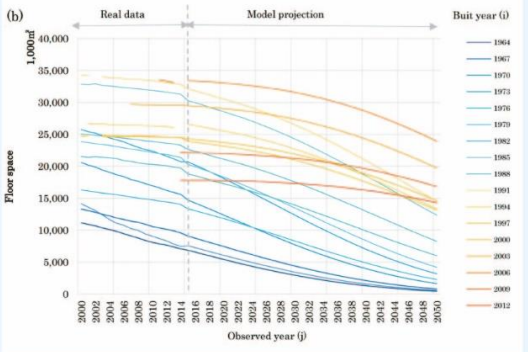
Local Vitality (Happiness) scenario

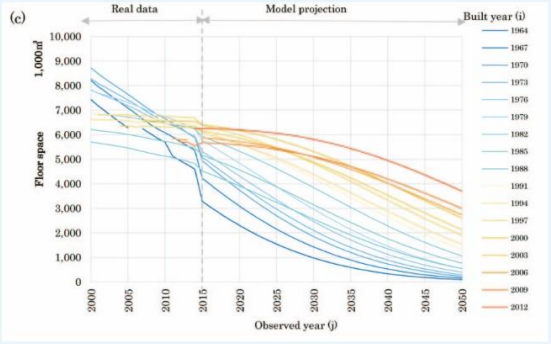
Efficiency scenario

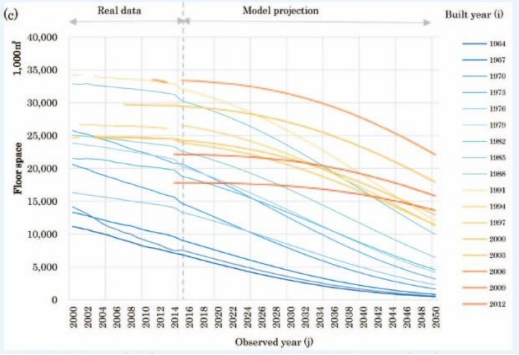






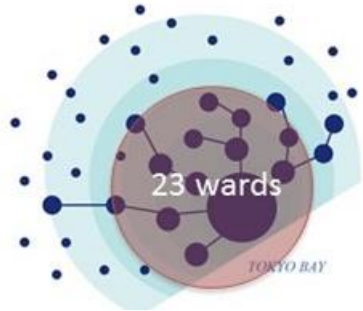






Miho Kamei, Kiyo Kurisu, Keisuke Hanaki, 2018

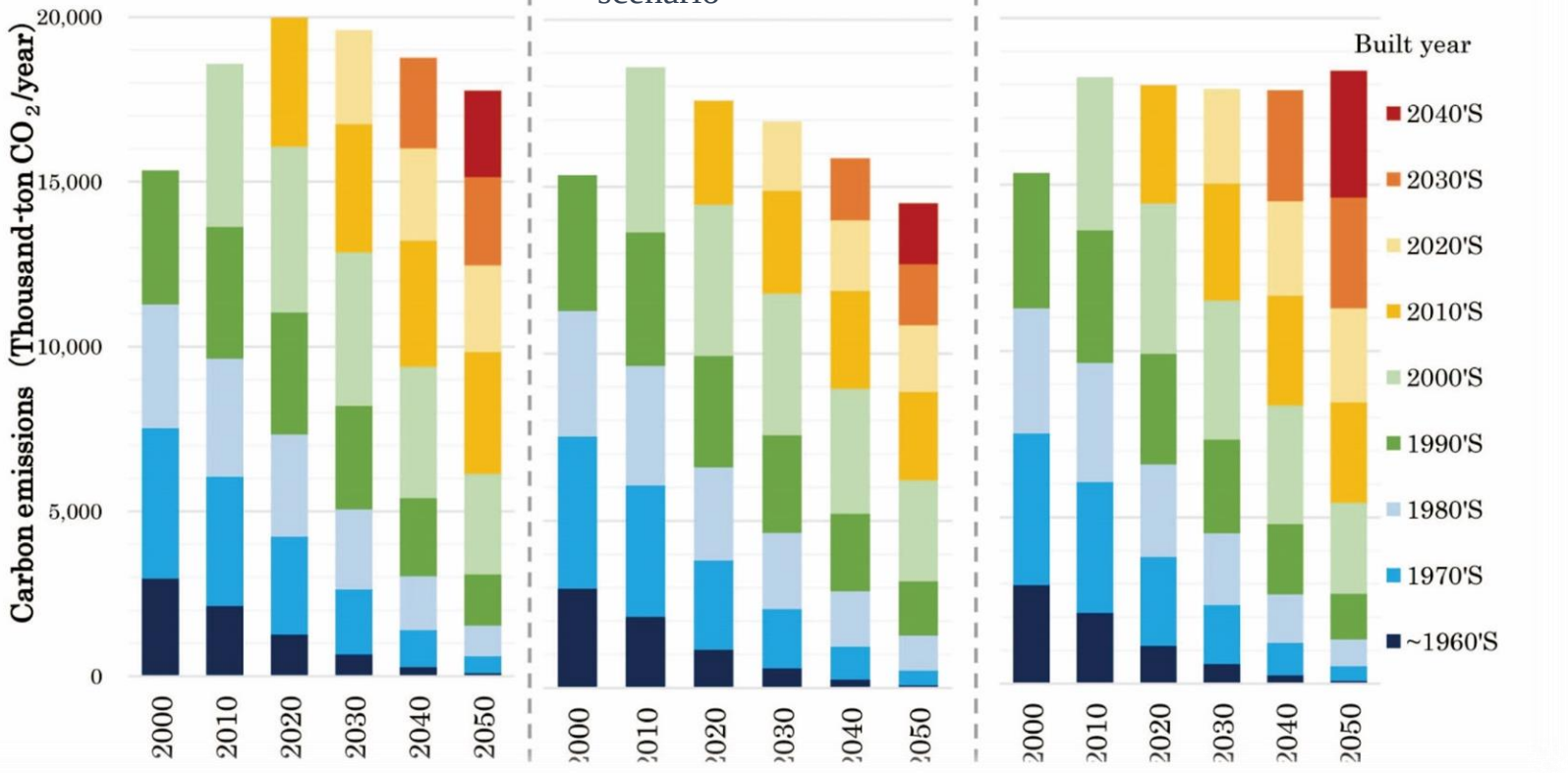
The projection of carbon emissions in alternative scenarios: Tokyo 23 wards by 2050



BAU scenario

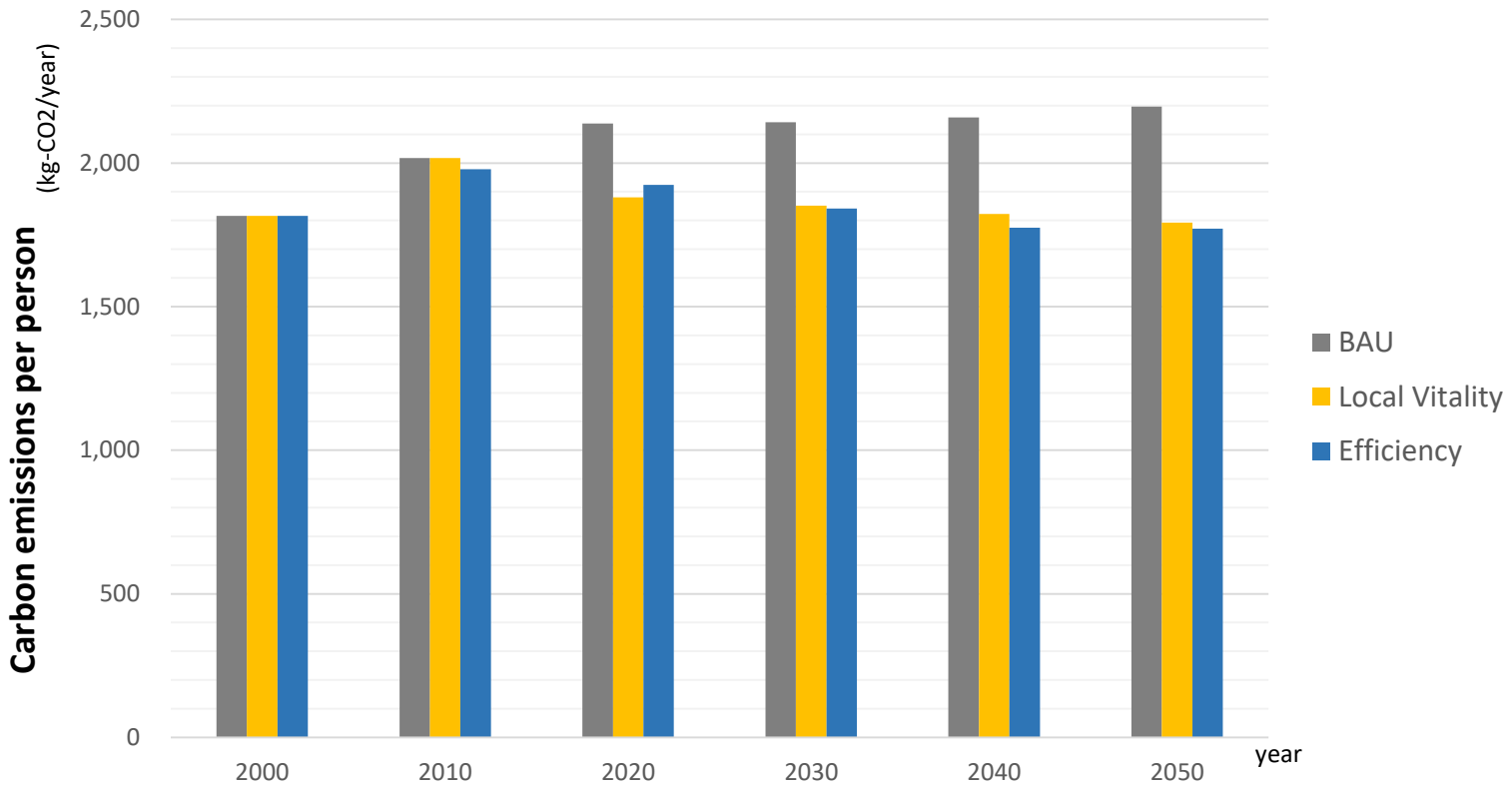
Local Vitality (Happiness) scenario

Efficiency scenario



Miho Kamei, Kiyo Kurisu, Keisuke Hanaki, 2018

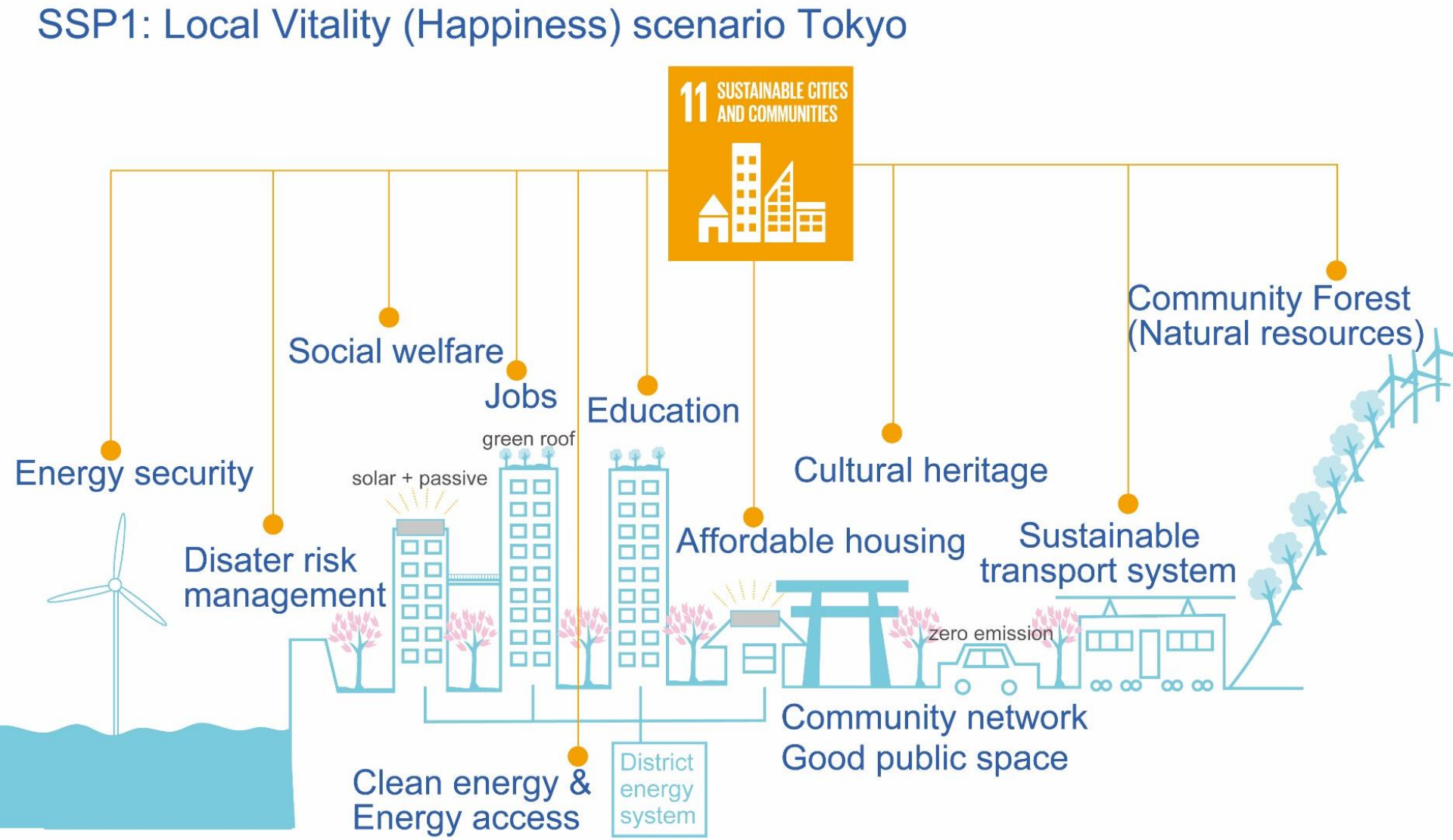
Carbon emissions per person: Tokyo 23 wards by 2050



Both sustainability pathways (Local Vitality & Efficiency) can achieve more than 15 percent carbon reductions by 2050 compared to BAU case with applying different urban transitions.

⇒Synergies and trade-offs discussions can be developed based on the scenario story lines.
⇒Analysis of other factors is essential. (SSPs can be a platform of analysis and discussions.)

Miho Kamei, Kiyo Kurisu, Keisuke Hanaki, 2018



Source: Miho Kamei in *TWI2050*, 2018

2. Case study of Bhutan

Bhutan's fundamentals for happiness

Miho Kamei, Tashi Wangmo (Bhutan), Shuzo Nishioka

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Urbanisation prospects: Bhutan SSPs – Fundamentals for Happiness

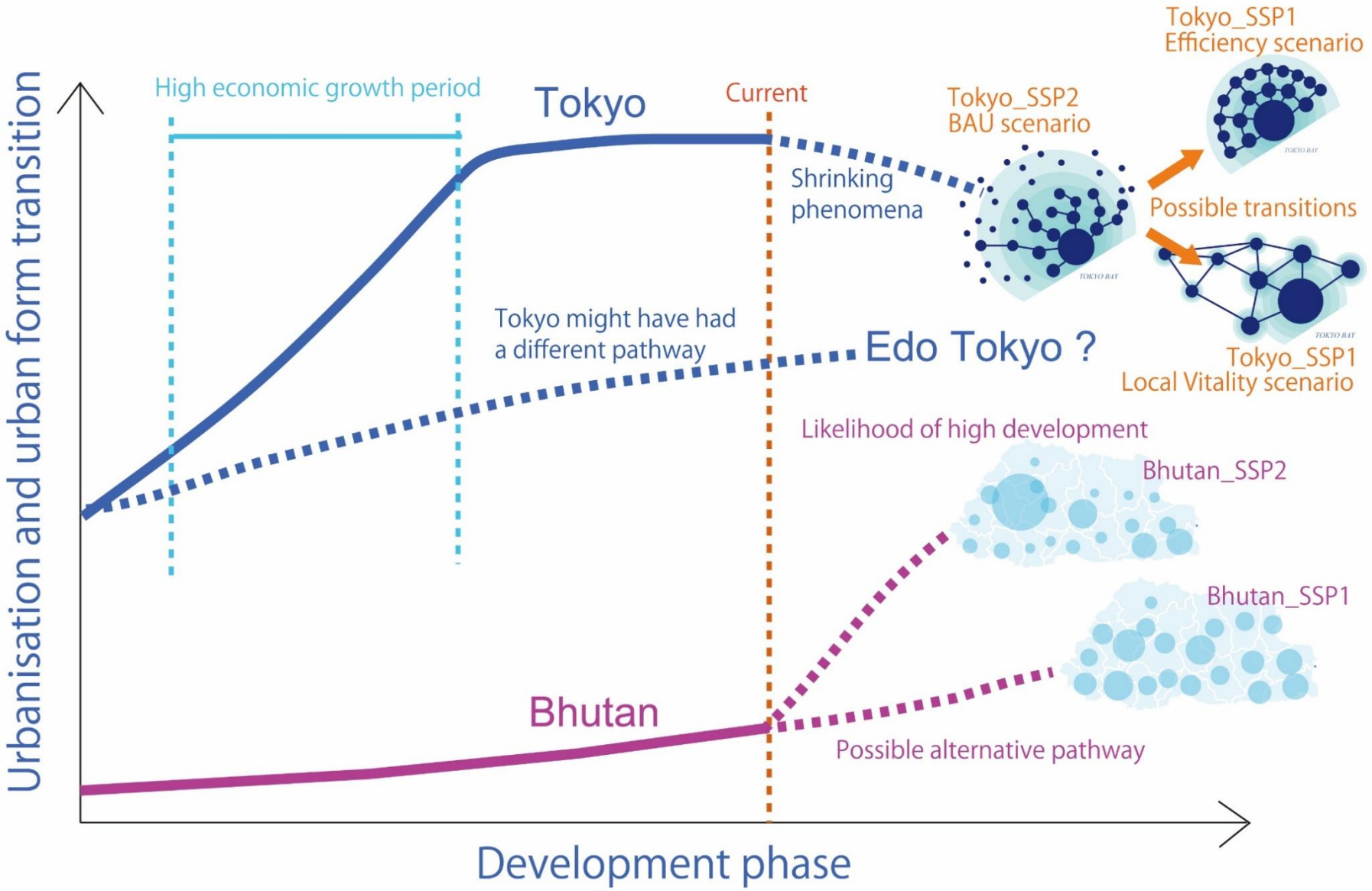



All pictures were taken by Miho Kamei

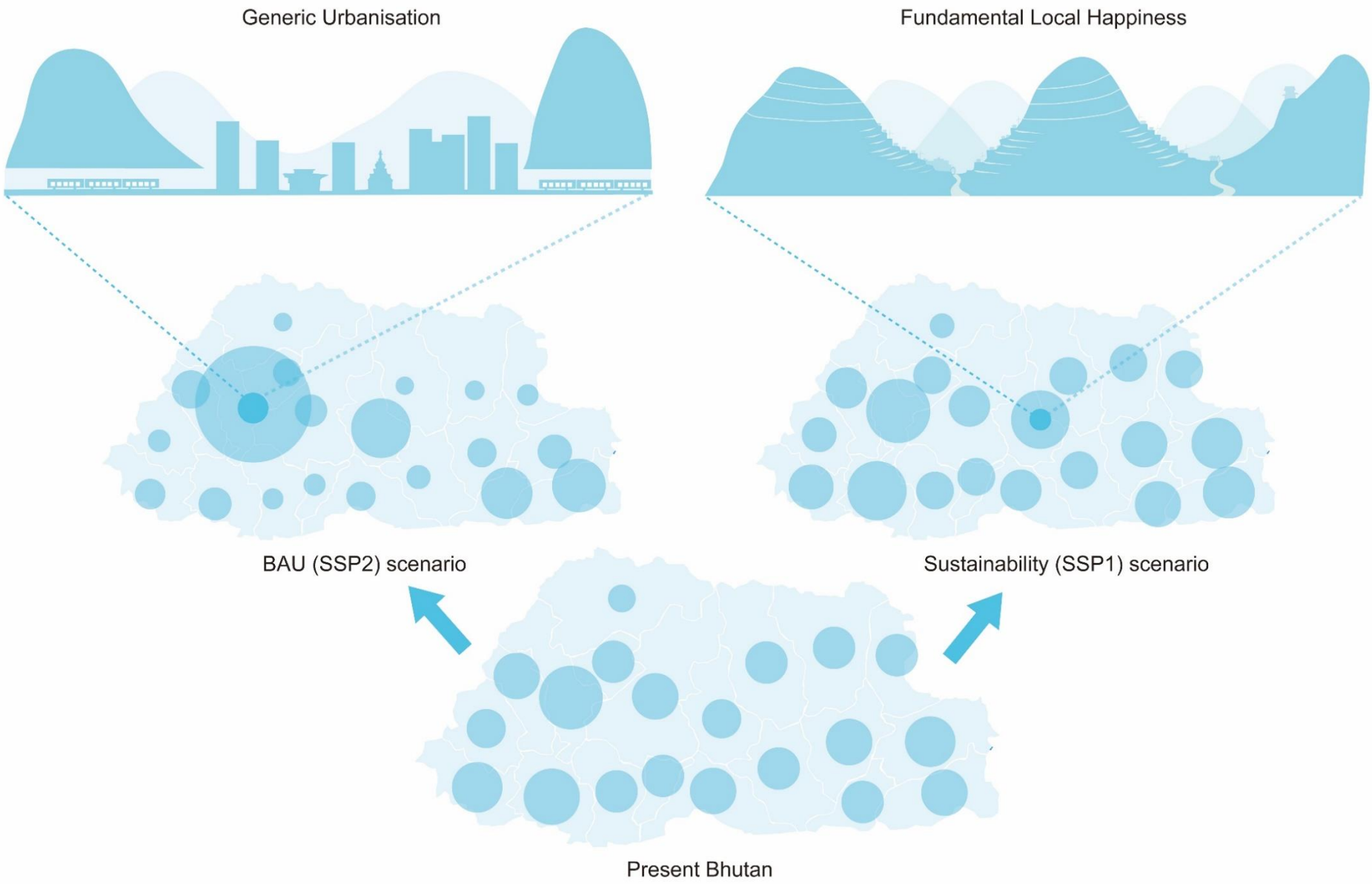
- Bhutan is literally popular in terms of developing and adopting a unique Gross National Happiness (GNH) index for national policy strategies.

- However, rapid urbanization is beginning to occur, which may lead to a number of large developments and densely populated areas. This may also cause the expansion of social disparity and social segregation, along with the destruction of natural resources and local identities.

Long-term urbanization pathways – comparison of Tokyo and Bhutan



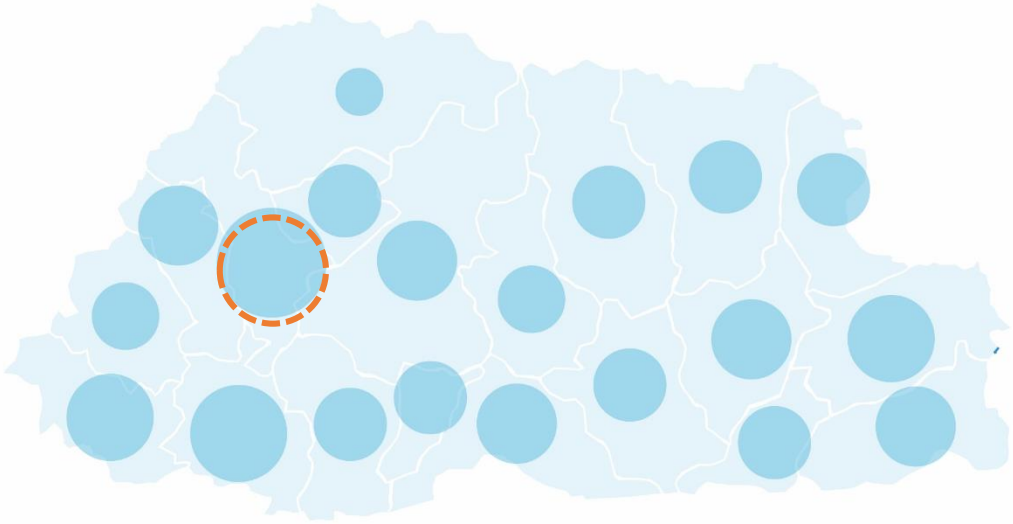
Long-term urbanization pathways



Miho Kamei, Tashi Wangmo (Bhutan), Shuzo Nishioka

Bhutan BAU scenario (SSP2)

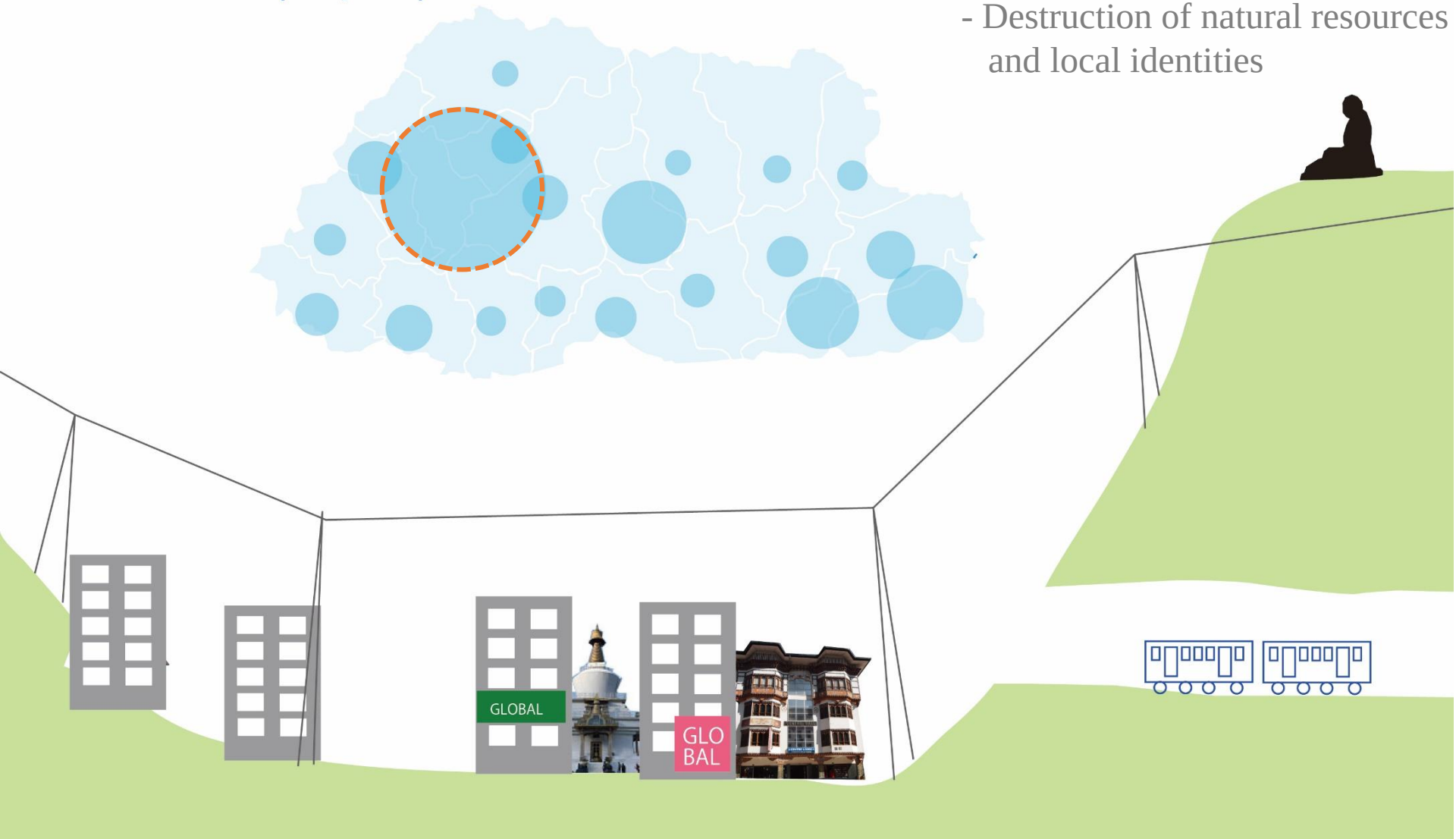
BAU Bhutan (Capital)



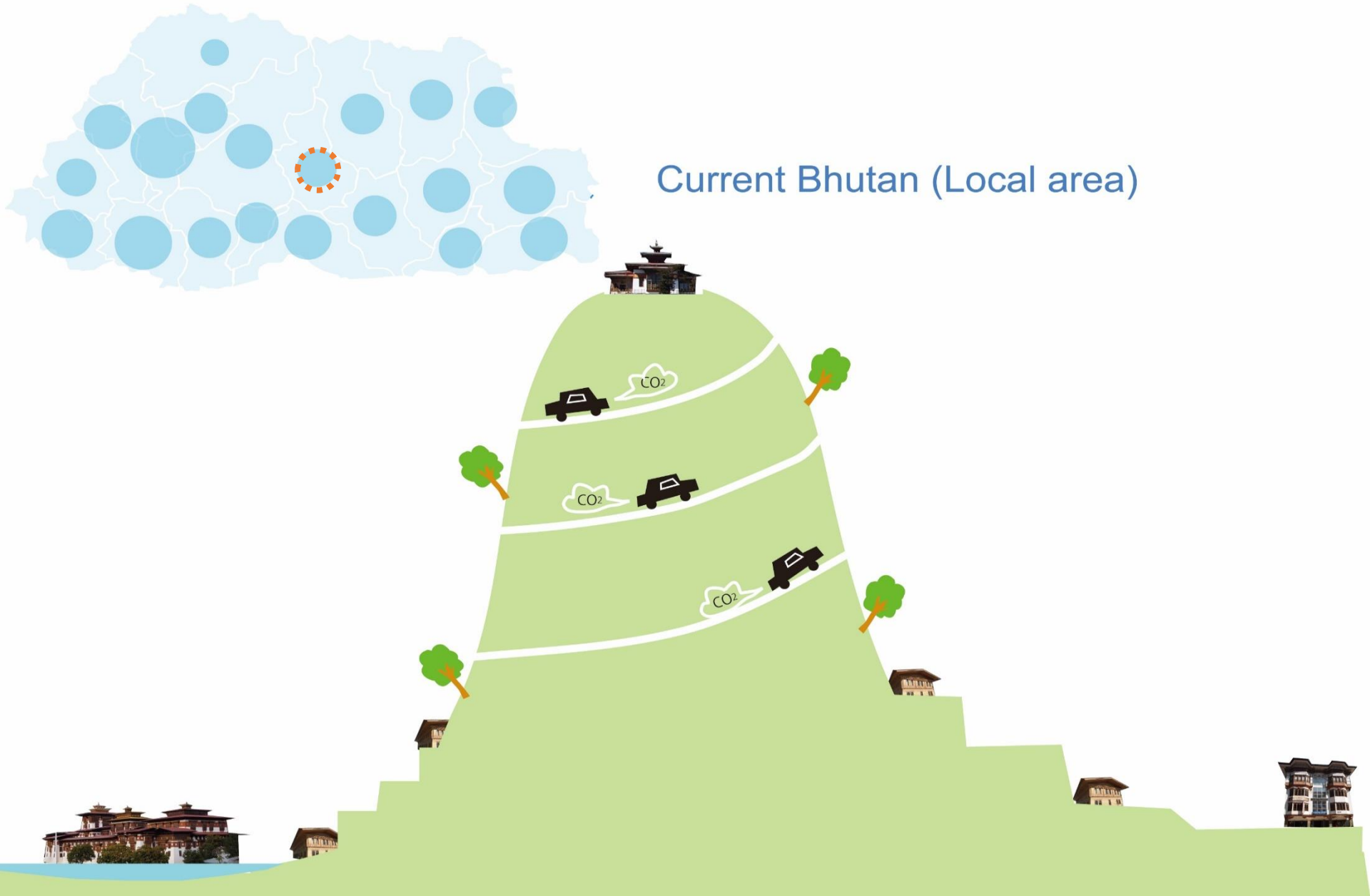
Bhutan BAU scenario (SSP2)

might cause ... - Expansion of social disparity
- Social segregation
- Destruction of natural resources and local identities

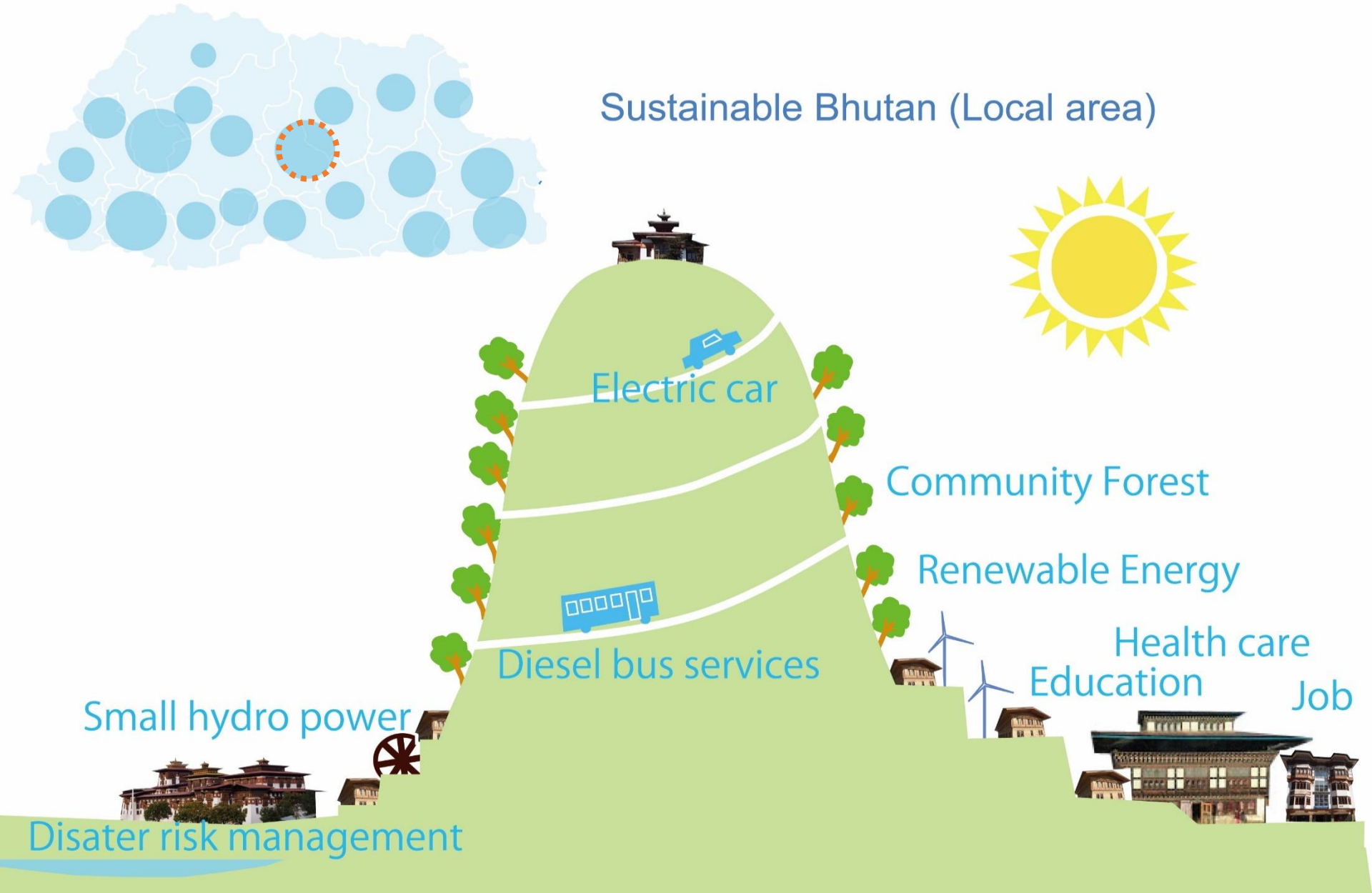
BAU Bhutan (Capital)



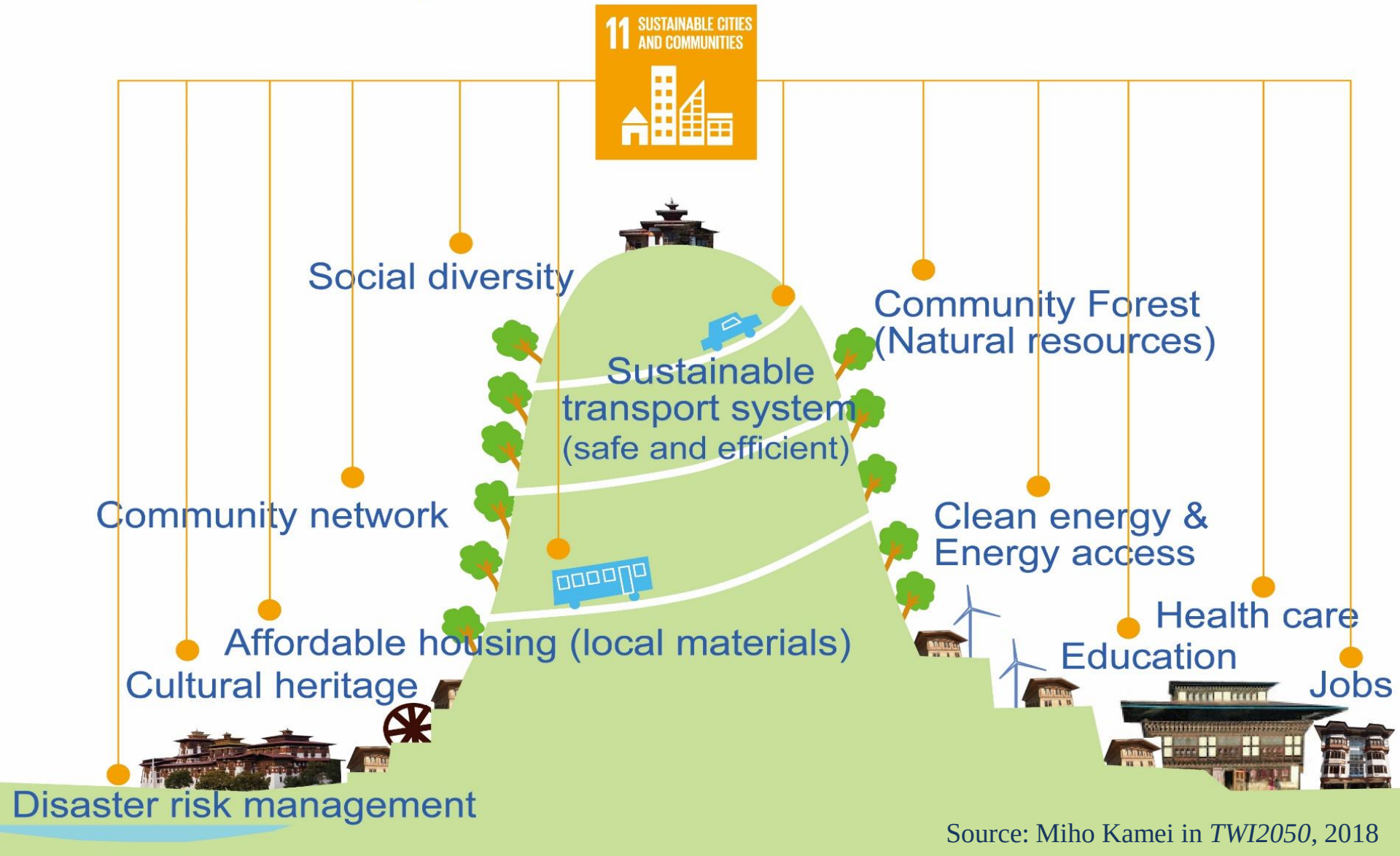
Bhutan Sustainability scenario (SSP1)



Bhutan Sustainability scenario (SSP1)



SSP1: Sustainability scenario Bhutan



Source: Miho Kamei in *TWI2050*, 2018

Gross National Happiness Index (2015 Survey + Scenario Assumptions)

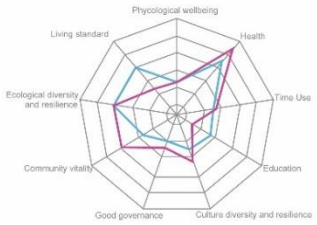
Gross National Happiness (GNH) elements - 9 domains	Present Bhutan (2015 GNH Survey)			Business-as-usual scenario (SSP2) - Generic Urbanisation			Sustainability scenario (SSP1) - Fundamental Local Happiness		
	Summary	Urban	Rural	Scenario assumption	Urban	Rural	Scenario assumption	Urban	Rural
Psychological wellbeing	Same level in Urban and Rural			Overall slightly decrease			Overall increase		
Health	Rural is higher Country level is sufficient			Decrease (Less walking, Increased			Increase (Balanced life styles)		
Time Use	Both are relatively efficient			Both are relatively efficient			Overall efficient with appropriate technologies)		
Education	Urban has higher quality			Increase of quality Concentration in capital			Increase diversity and capacity building		
Culture diversity and resilience	Rural has more diversity			Decrease of culture diversity Increase of rural vulnerability			Well maintained and evolved Increased resilience		
Good governance	Rural participates more			More centralised			Good governance in both		
Community vitality	Rural has stronger community than Urban			Overall decrease			Significant increase		
Ecological diversity and resilience	Both are relatively good			Decrease (Lack of local maintainance)			Increase and well-maintained by local inhabitants		
Living standard	Urban has higher income And better housing			Increase in Urban Decrease in Rural			Overall increase to achieve sufficient level		

The percentage contribution of sufficiency of each domain.

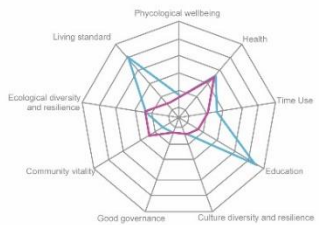
Low — High

Urban

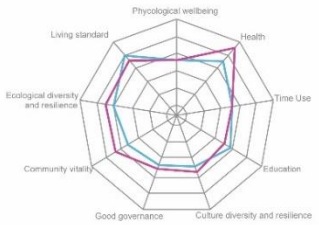
Rural



Total GNH = 1



Total GNH < 1



Total GNH >1

Miho Kamei, Tashi Wangmo (Bhutan), Shuzo Nishioka

3. Case study of Da Nang (Viet Nam)

Partnership SSP1

Miho Kamei, Pham Ngoc Bao, Yasuhiko Hotta, Mikiko Kainuma

This project is partly funded by S-16 project (MOEJ)

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Ministry of the Environment

Da Nang's SSPs + two satellite cities (Hoi An & Hue)

Royal Palace

All pictures were taken by Miho Kamei

Beach town

Da Nang SSP2 (Business As Usual)

Shrinkage of population & economy

Become more vulnerable to flooding & other risks.

Collapse of historical heritage and value.

Separation

More development will be accelerated.

Increase of environmental roads and risks (waste & pollutions etc).

Da Nang SSP1 (Sustainability - Partnership)

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Thank you for listening.

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