

Measuring and Monitoring Liveability and Well-Being for Smart Cities

Takehiko NAGUMO
Executive Managing Director, Smart City Institute Japan

January 12, 2022



Smart City
Institute Japan

Takehiko Nagumo



- **Currently, Executive Managing Director at Smart City Institute Japan, dedicated to designing policies and building strategic alliances for smart cities and digital government.**

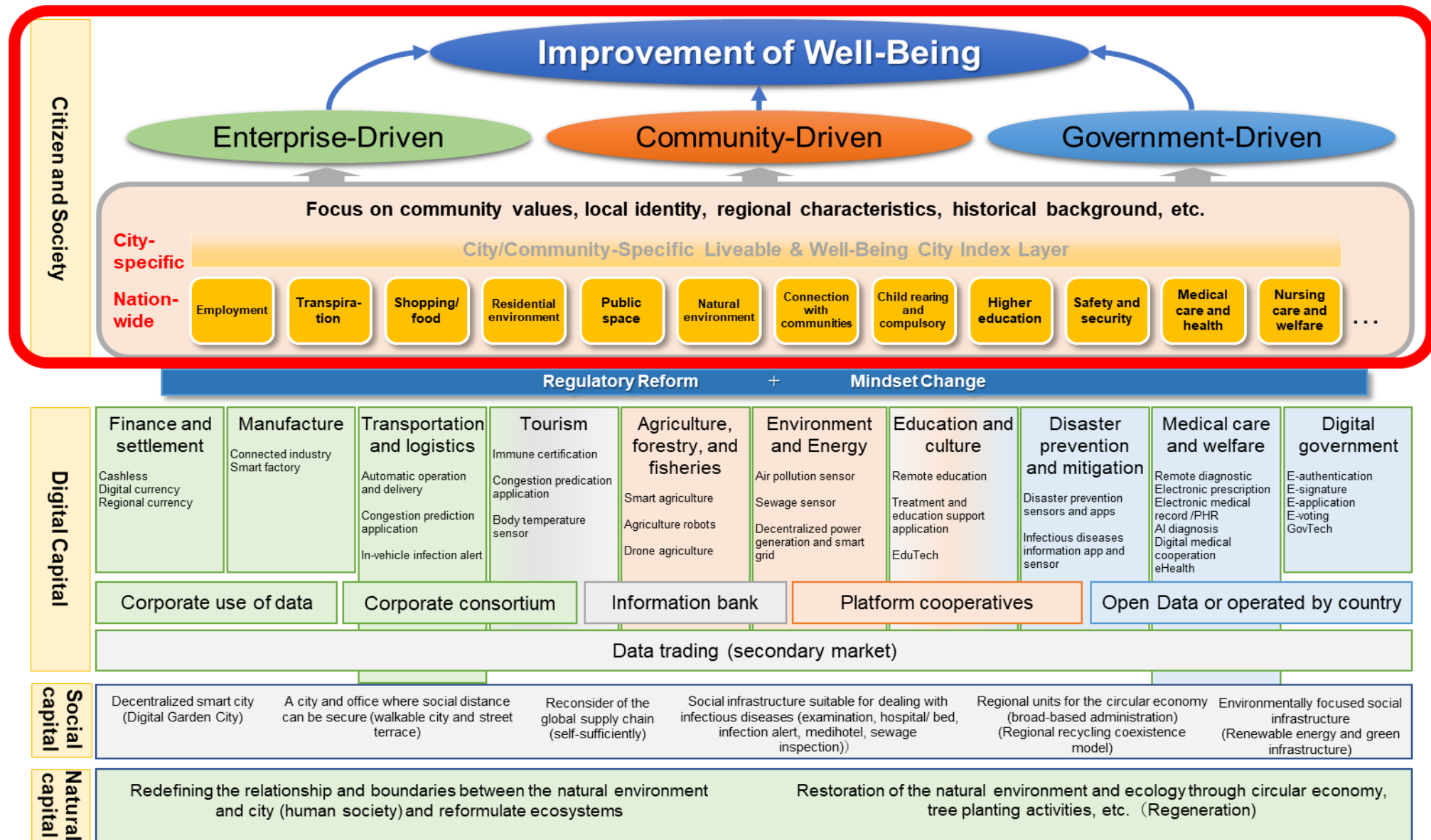
- **Concurrently,**
 - Senior Managing Executive Officer at Mitsubishi UFJ Research and Consulting, Ltd
 - Regulatory Reform Promotion Council Member, Japanese Government's Cabinet Office
 - Incorporated Administrative Agency Evaluation System Committee Member, Ministry of Internal Affairs and Communications
 - Advisory Board Member, Digital Architecture Design Center, Information-Technology Promotion Agency
 - Fellow, World Economic Forum The Fourth Industrial Revolution Japan Center
 - Smart City Advisor to local government of Tokyo, Kamakura, Hamamatsu, and Higashi-Hiroshima
 - Adjunct Professor at Kyoto University Graduate School of Management
 - Adjunct Professor at Tokai University
 - Adjunct Professor at Kanazawa Institute of Technology
 - Visiting Professor at Tallinn University of Technology in Estonia
 - Senior Industry Fellow at Royal Melbourne Institute of Technology
 - Senior Visiting Senior Fellow at Global Communication Center, International University of Japan

- **Earned Master of Business Administration from Georgetown University, Master of Science in Development Finance from University of London SOAS, and LL.B in Political Science from Keio University. Also completed Professional Fellow Program at Columbia University.**

- **Contact**
Email: takehiko.nagumo@murc.jp

- **Smart City Institute Japan (SCI-J)**
<https://www.sci-japan.or.jp/english/index.html>

Ultimate Goal – Improvement of Citizens' Well-Being



Framework for Measuring “Well-Being” of Citizens

【Maslow's Hierarchy of Need】

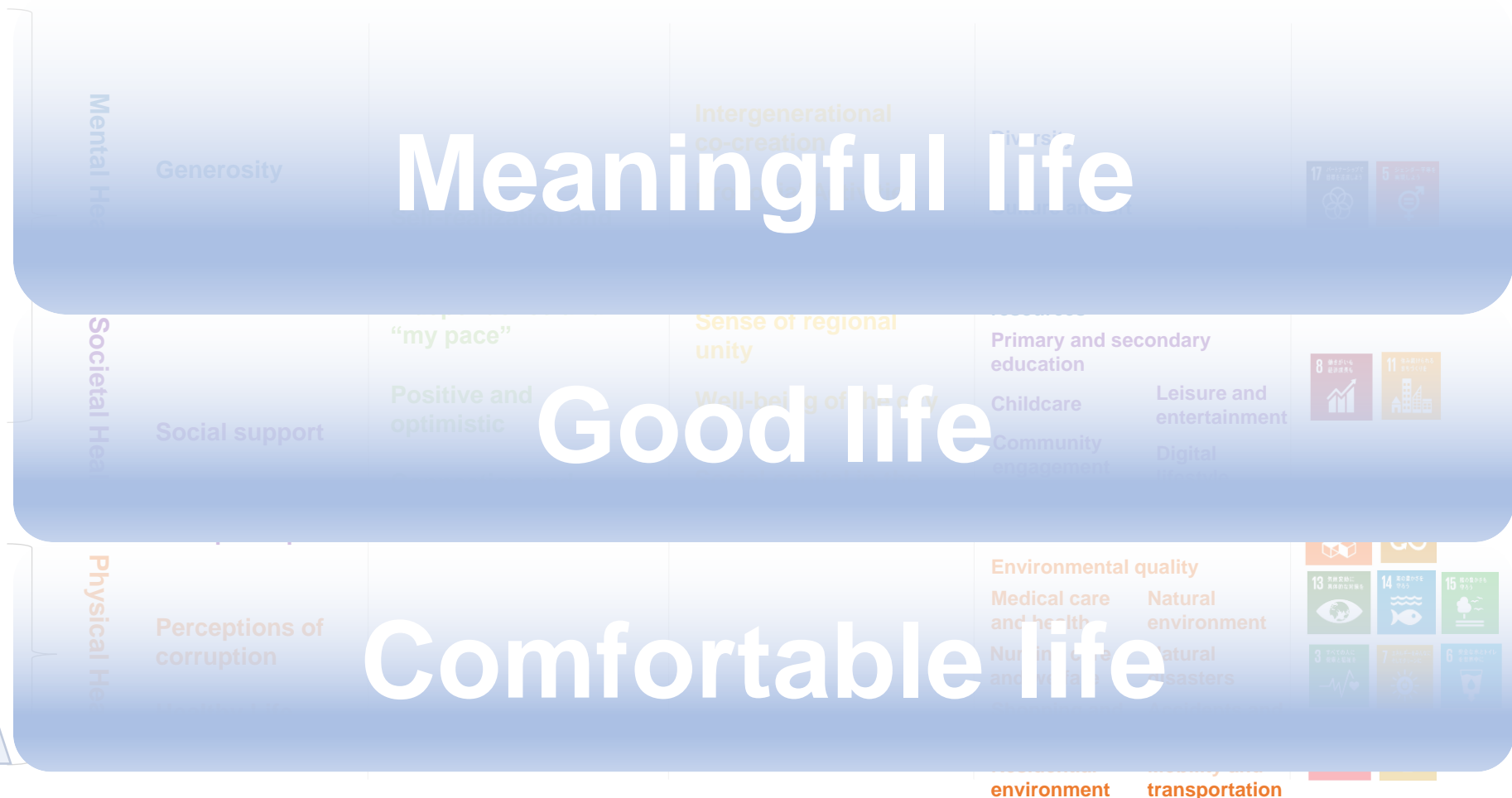
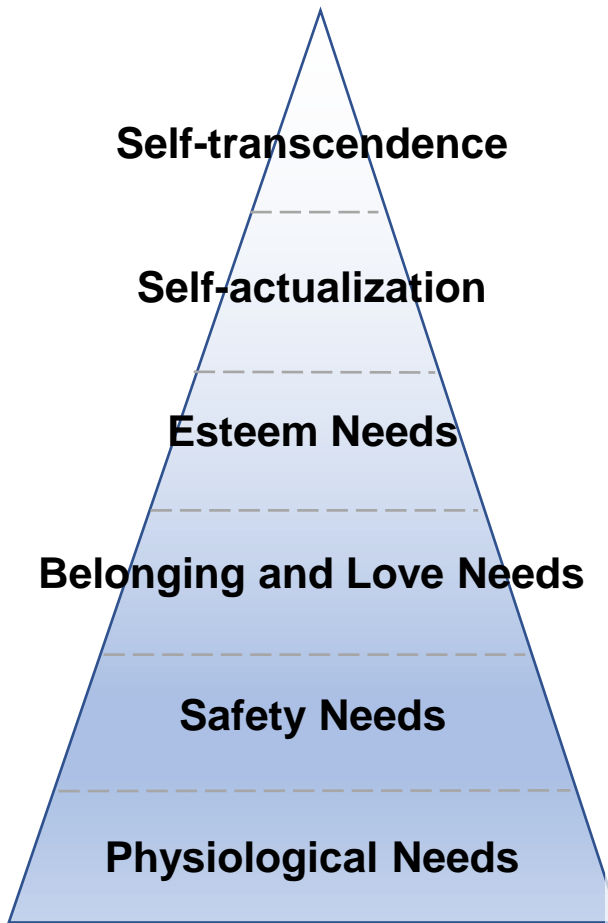
【UN Well-Being】

【Factors of Individual Well-Being】

【Interdependent Well-Being】

【Liveability】

【SDGs】



Implementing a sustainable smart city (holistic city development) based upon human-centricity

Framework for Measuring “Well-Being” of Citizens

【Maslow's Hierarchy of Need】

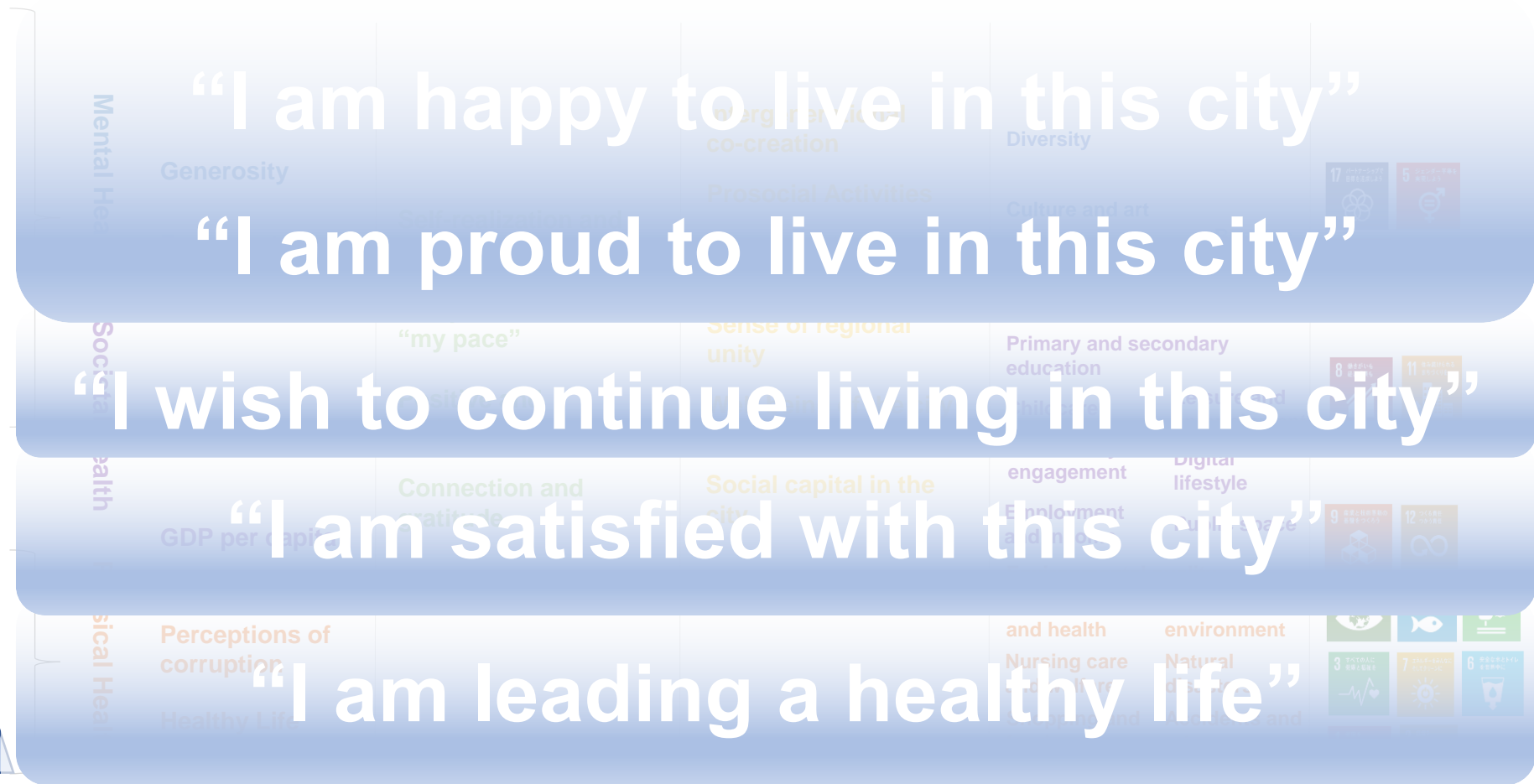
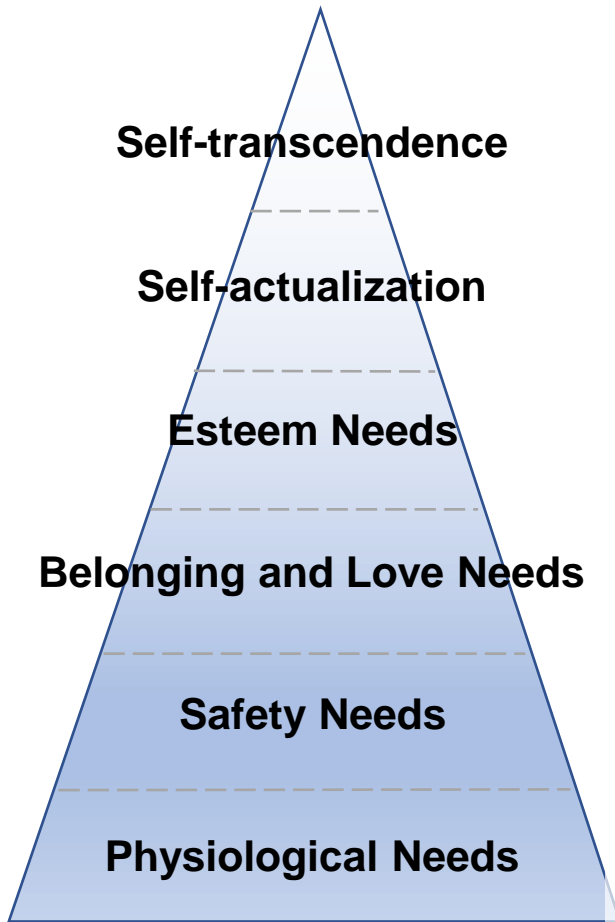
【UN Well-Being】

【Factors of Individual Well-Being】

【Interdependent Well-Being】

【Liveability】

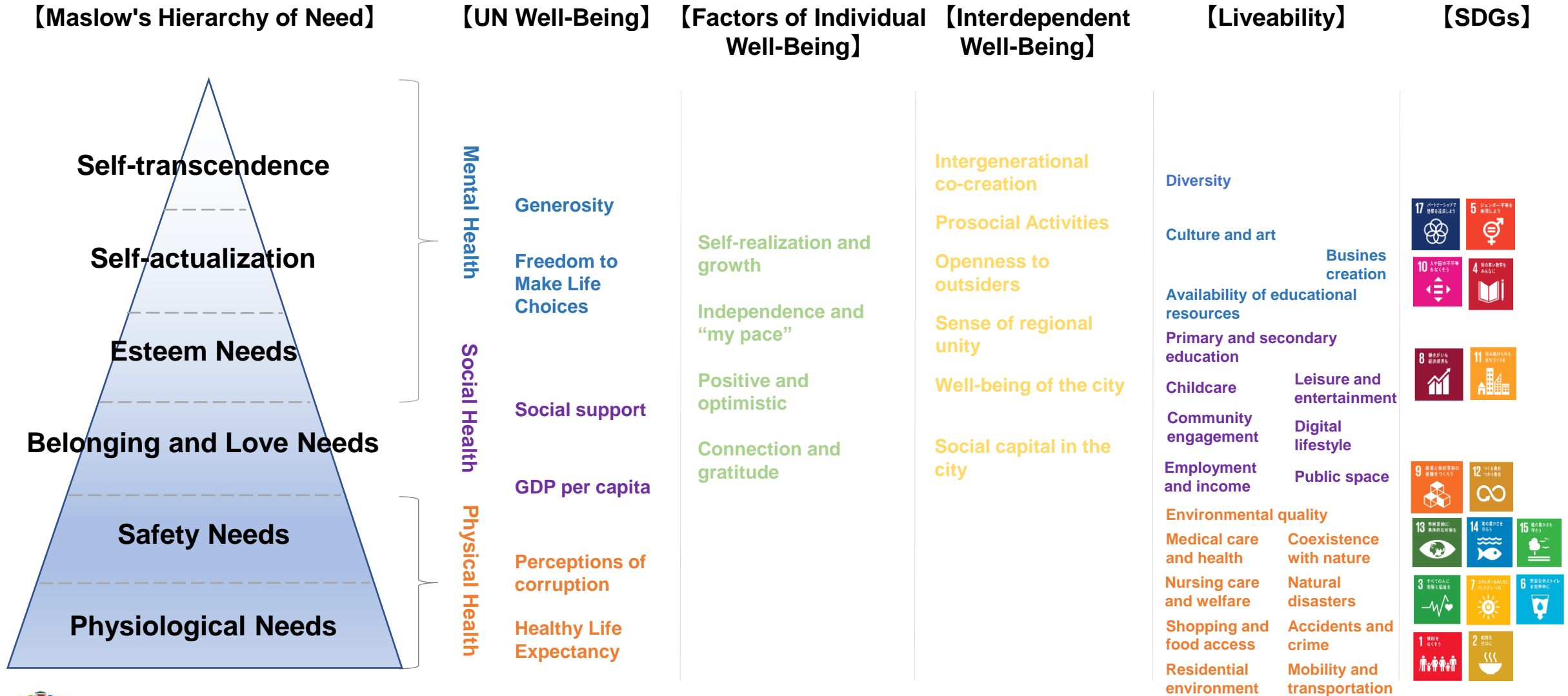
【SDGs】



environment transportation

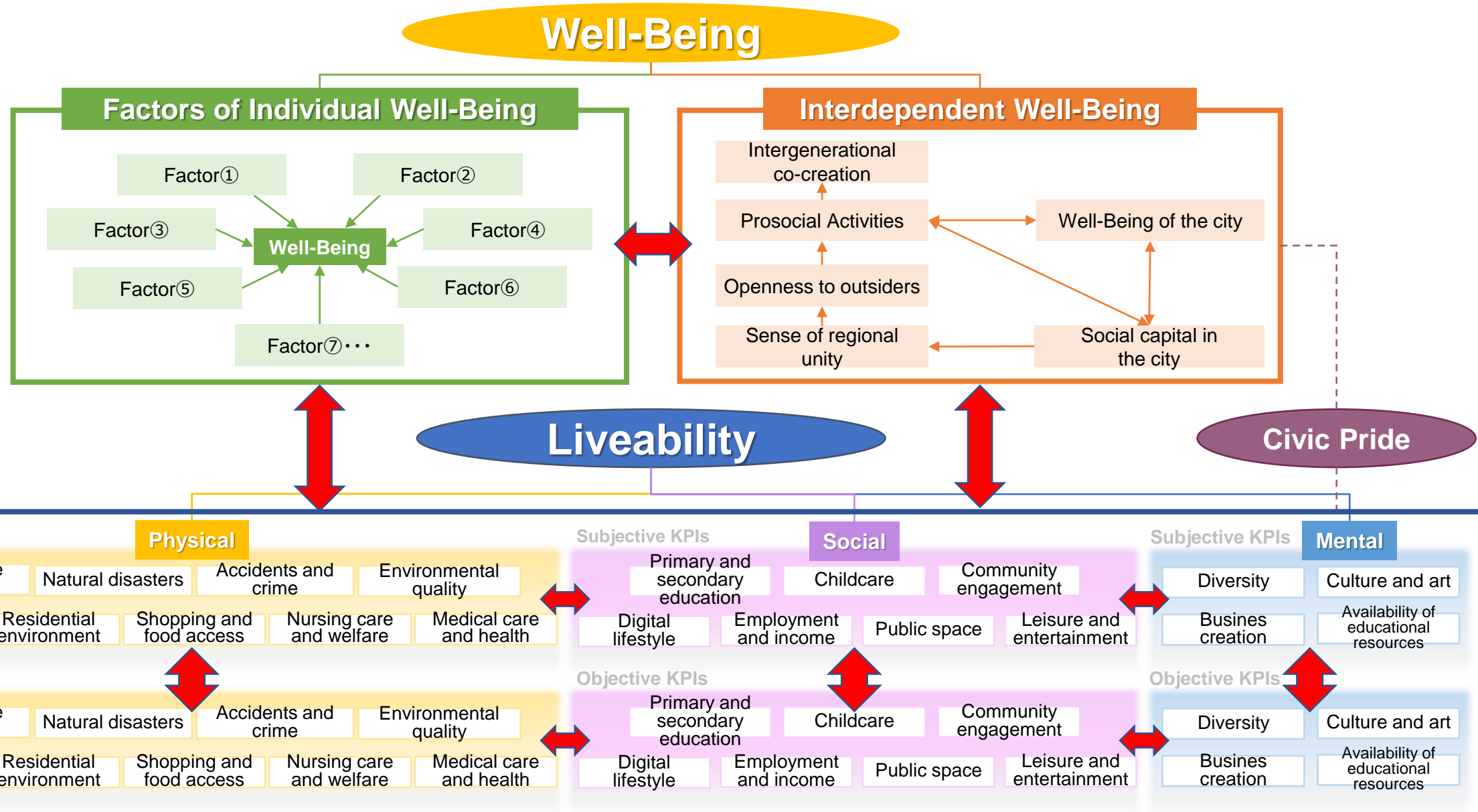
Implementing a sustainable smart city (holistic city development) based upon human-centricity

Framework for Measuring “Well-Being” of Citizens



Implementing a sustainable smart city (holistic city development) based upon human-centricity

LWCI = Well-Being + Subjective and Objective Assessments of Liveability



Liveability Indicator: Objective Part

Liveability

Physical

Coexistence with nature

- Percentage of uninhabitable area (+)
- Amount of automobile CO2 emission per person (-)
- Recycling rate (+)
- Coexistence with Nature Index (+)
 - SDGs Future City
 - 2050 Zero Carbon Cities
 - Policy on Green Public Procurement
 - Participation in the Japan Climate Initiative

Accidents and crime

- Number of traffic accident per 1,000 persons (-)
- Percentage of pedestrian streets (+)
- Housing vacancy rate (-)
- Number of reported Penal Code offenses per 1,000 persons (-)

Mobility and transportation

- Percentage of population within walking distance from train station or bus stop (+)
- Population density 800m from a train station or 300m from a bus station (-)
- Per capita mileage of compact vehicles (-)
- Proportion of commuters not using cars, motorcycles, or taxi (+)
- Percentage of commuting time within 30 minutes (+)

Shopping and food access

- Percentage of population within walking distance of commercial facilities (+)
- Population density within walking distance of commercial facilities (-)
- Residential area / number of restaurants (-)
- Number of restaurants (per 1,000 population) (+)

Natural disasters

- Risk of earthquakes
- Risk of flood

Environmental quality

- Concentration of NOx (-)
- Concentration of PM2.5 (-)

Residential environment

- Gross floor space per house (+)
- Average residential land value (-)
- Rent per square meter of residence (-)
- Percentage of house ownership (+)
- Percentage of residents living in the city for over 20 years (+)

Nursing care and welfare

- Percentage of population within walking distance of welfare facilities (+)
- Population density within walking distance of welfare facilities (-)
- Number of child welfare facilities (per 100,000 persons) (+)
- Number of facilities for those with disabilities (per 100,000 persons) (+)

Medical care and health

- Healthy life expectancy (male) (+)
- Healthy life expectancy (female) (+)
- Percentage of population within walking distance of medical facilities (+)
- Population density within walking distance from medical facilities (-)
- Average cost of medical fees of those under the National Health Insurance (-)
- Average cost of medical fees of those 75 years old and older (-)
- Percentage of residents who receive annual medical check-ups (+)

Social

Primary and secondary education

- Number of elementary schools (per habitable area) (+)
- Number of students per elementary school (-)
- Number of junior high schools (per habitable area) (+)
- Number of students per junior high school (-)
- Number of high schools (per habitable area) (+)
- Number of students per high school (-)

Community engagement

- Number of suicides per 100,000 persons (-)
- Percentage of extended family households (+)
- Percentage of those 15 and over who have married (+)
- Percentage of elderly single-person household (-)
- Participation rate in a neighborhood association (+)
- Number of political, economic or cultural organization per 100,000 persons (+)
- Number of religious organization per 100,000 persons (+)
- Number of NPOs per 100,000 persons (+)
- Voter turnout in mayoral election (+)
- Voter turnout in local assembly election (+)

Employment and income

- Unemployment rate (-)
- Youth unemployment rate (-)
- Percentage of regular employees (+)
- Employment rate of seniors (+)
- Ratio of high school graduates who have yet to decide their career path (-)
- Percentage of residents working within the city (+)
- Business entry rate (+)
- Average taxable income per taxpayer (+)

Childcare

- Percentage of residences within 1km of nearest day care center (+)
- Number of kindergartens (per habitable area) (+)
- Number of children per kindergarten (-)
- Share of public expenditure on education (+)
- Total fertility rate (+)

Digital lifestyle

- Usage rate of My Number Card (+)
- Percentage of online responses to the census (+)
- Digital Environment Index (+)
 - Cities partaking in MLIT Plateau Project
 - "Code for " organization in the city
 - Fab Lab in the city
 - CoderDojo in the city
 - Local IoT Acceleration Lab in the city
 - ICT related department in a university
 - College of technology in the city
 - Open data scheme by the local government
- Number of cellular carrier shops (per 100,000 persons) (+)
- Penetration rate of 5G

Public space

- Percentage of population living within walking distance of a park (+)
- Percentage of houses located within 500m radius of a park (+)

Leisure and entertainment

- Number of entertainment facilities (per 100,000 persons) (+)

Mental

Diversity

- Proportion of women in managerial positions in the local government (+)
- Proportion of female assembly members in the local assembly (+)
- Foreign residents (per 100,000 persons) (+)

Culture and art

- Number of libraries (per 100,000 persons) (+)
- Number of museums (per 100,000 persons) (+)
- Number of theaters and concert halls (per 100,000 persons) (+)
- Number of National Treasures and Important Cultural Properties (structures) (+)
- Number of "Japan Heritage" sites (+)

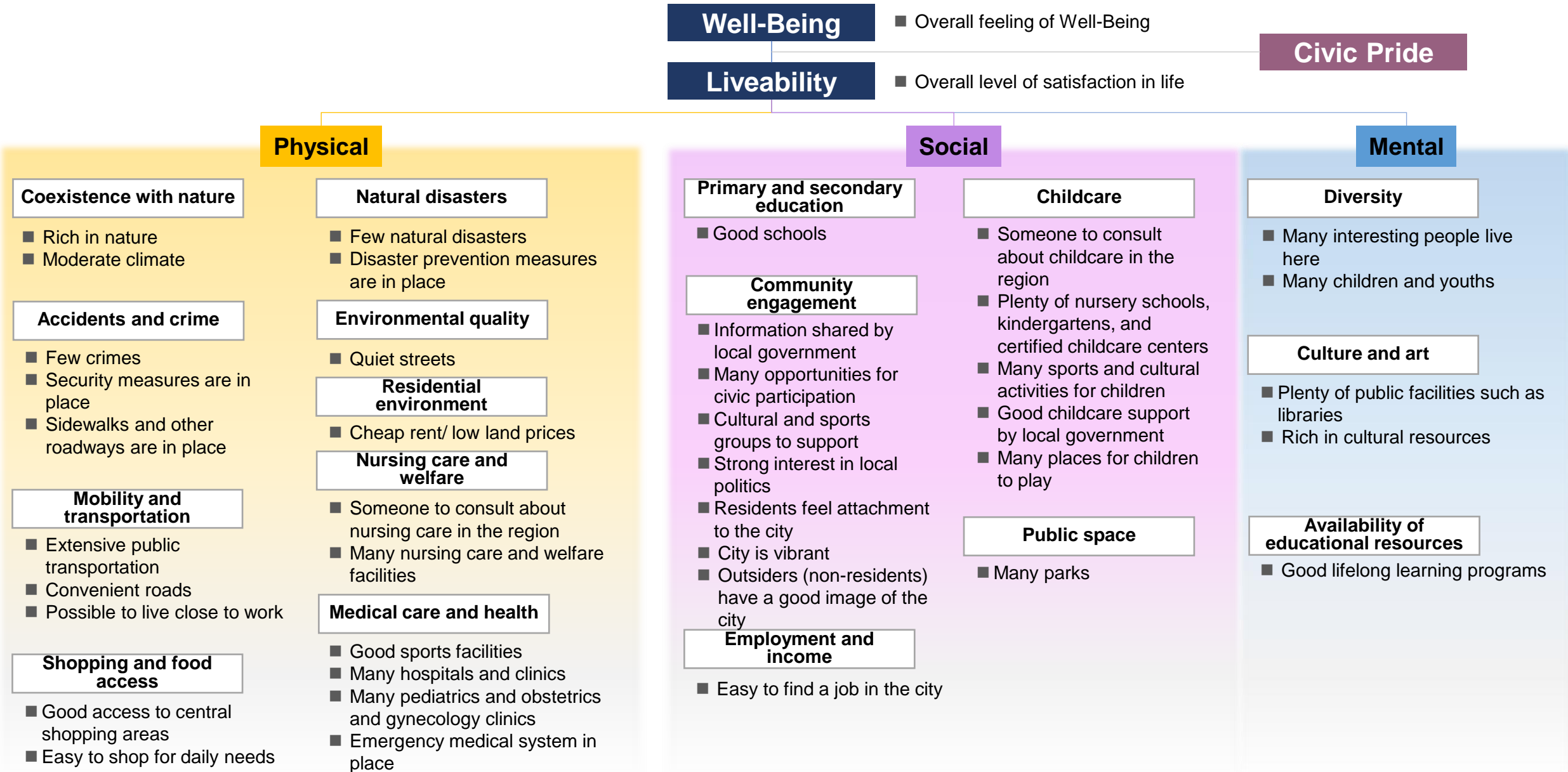
Business creation

- Proportion of offices/ facilities in the creative industry (+)
- Proportion of newly established corporations (+)
- Number of Startup Accelerators (+)
- Number of coworking space (per 100,000 employees) (+)

Availability of educational resources

- Percentage of college graduates (+)
- Number of universities and junior colleges (per residential area) (+)
- Number of national and private combined junior high and high schools (per residential area) (+)

Liveability Indicator: Subjective Part



Three-layer Design for Realizing “Inclusive Future City”

- Kamakura Super City has a total design that organically links three layers toward the realization of “Inclusive Future City.”

Citizen participation layer

Co-create Well-Being



Digital layer

Solve problems digitally

Open API

Open API



Kamakura City's concept of digital twin for Liveability and Well-Being

Creation of Kamakura, the world's best region in the Well-Being

Kamakura, a City Coexisting with Nature, Does Well in “Coexistence with Nature” and “Community Engagement” and with Strong Civic Pride, Its Government and Citizens Together Implement Measures on Sustainability

Overview

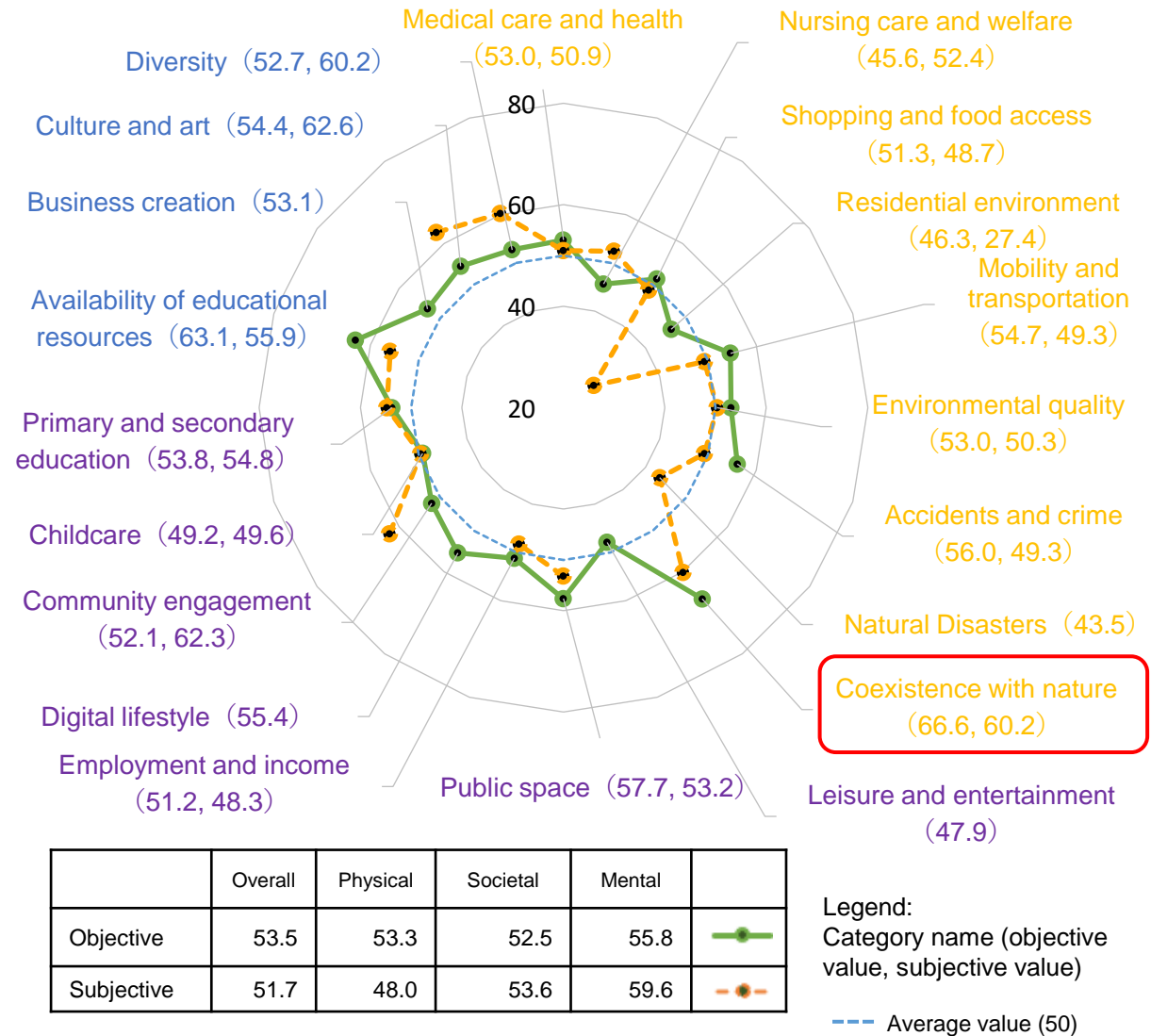
| | | | |
|----------------------------|---|--------------------------|-----|
| Population | Around 173,000 | Percentage of seniors | 31% |
| Population density | 6,450/km ² | Daytime population ratio | 97% |
| Characteristic of the city | With 700 years of history since the Kamakura Shogunate and its rich nature, Kamakura is one of Japan’s most prominent tourist destinations. Companies are attracted by its nature and culture, and the old and new are in harmony in the city. Ofuna station and National Route 134 connects the Shonan area with the rest of the prefecture. | | |
| Future vision | A city that maintains the dignity of the ancient capital while creating the joy of living and new charm | | |

Summary

- With the highest recycling rate in Japan and being selected as a SDGs Future City, citizens and the government of Kamakura are actively working together to realize a sustainable society. These efforts and a factor analysis of them could be useful for other cities inspiring to be a city coexisting with nature.
- A reason the residents’ high consciousness regarding sustainable society is their strong civic pride, which is motivated by their attachment to the city and a history of civic activities. The strong civic pride can be seen through the questionnaire results and the high participation rate in neighborhood associations. It can be inferred that the source of this is Kamakura’s civic pride as the ancient capital.
- The civic pride of citizens may have different sources depending on a citizen’s duration of residence and regional bonds, and it can be inferred that each of Kamakura’s 5 regions have a distinct lifestyle.
- Besides “coexistence with nature,” Kamakura also has strengths in “Availability of educational resources,” “mobility and transportation” and “community engagement.” It has issues with land prices and natural disasters.





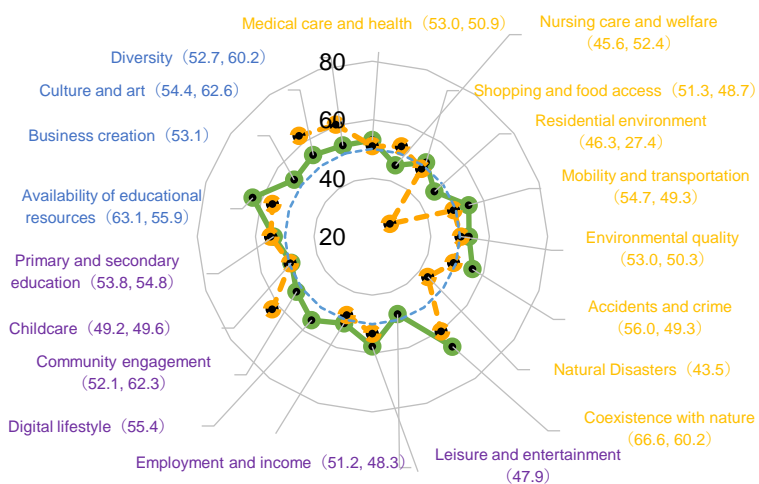
Deviation value by category



| | Overall | Physical | Societal | Mental | |
|------------|---------|----------|----------|--------|-----|
| Objective | 53.5 | 53.3 | 52.5 | 55.8 | —●— |
| Subjective | 51.7 | 48.0 | 53.6 | 59.6 | -●- |

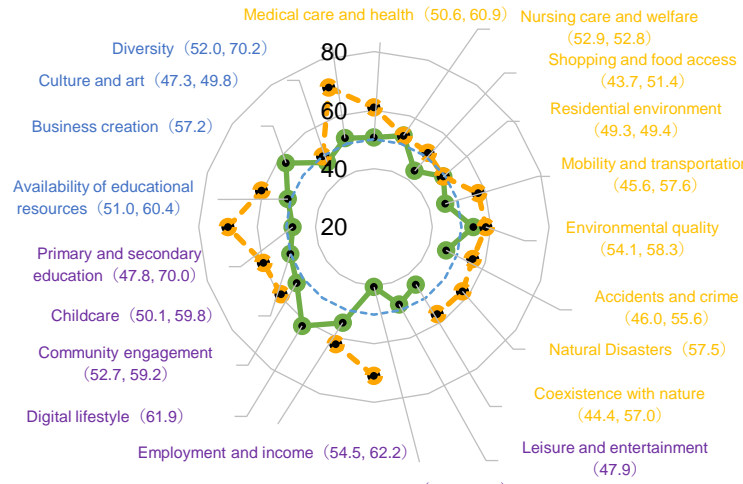
Cities that Kamakura Is Compared to Include Fujisawa, Odawara, Zushi, Setagaya-ku, Musashino, Mitaka, Kunitachi, Nagareyama, Inzai, Kawagoe, Tsukuba, Takarazuka, Nishinomiya, Kyoto and Sapporo

*Legend:
Objective 
Subjective 



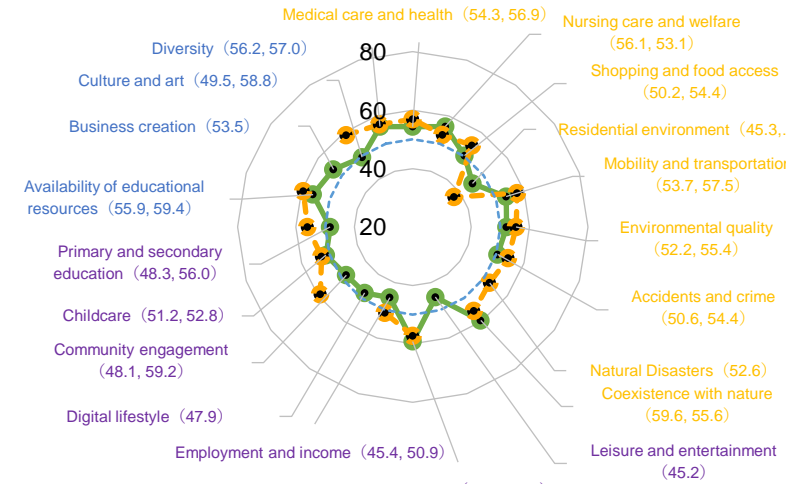
| | |
|------------------|------|
| Objective score | 53.5 |
| Subjective score | 51.7 |

Kamakura



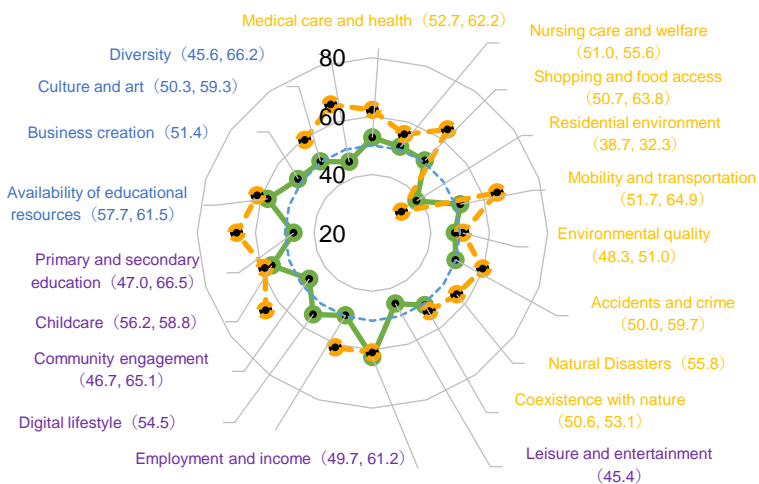
| | |
|------------------|------|
| Objective score | 50.0 |
| Subjective score | 59.0 |

Tsukuba



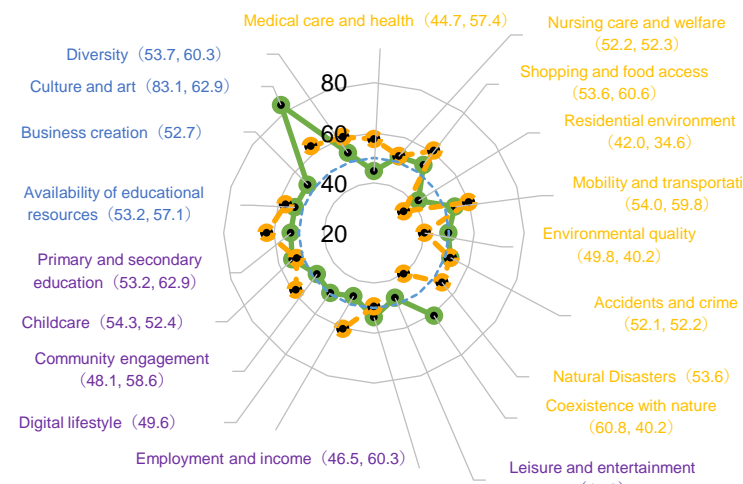
| | |
|------------------|------|
| Objective score | 51.7 |
| Subjective score | 54.6 |

Takarazuka



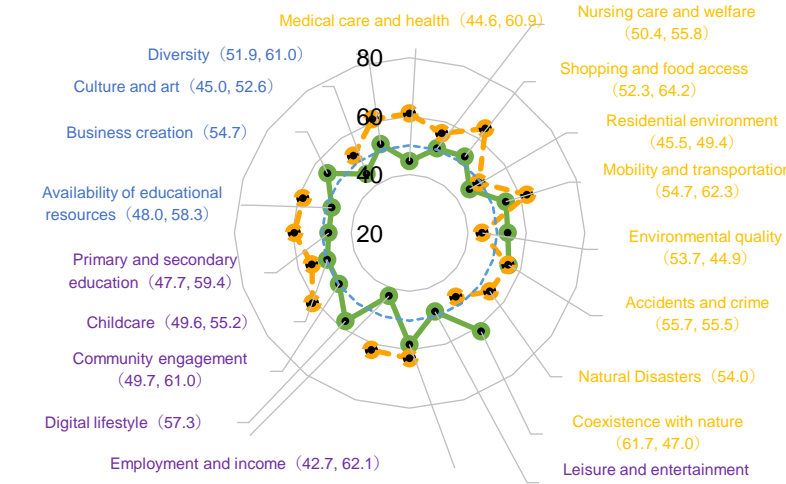
| | |
|------------------|------|
| Objective score | 50.6 |
| Subjective score | 58.7 |

Nishinomiya



| | |
|------------------|------|
| Objective score | 52.9 |
| Subjective score | 53.8 |

Kyoto



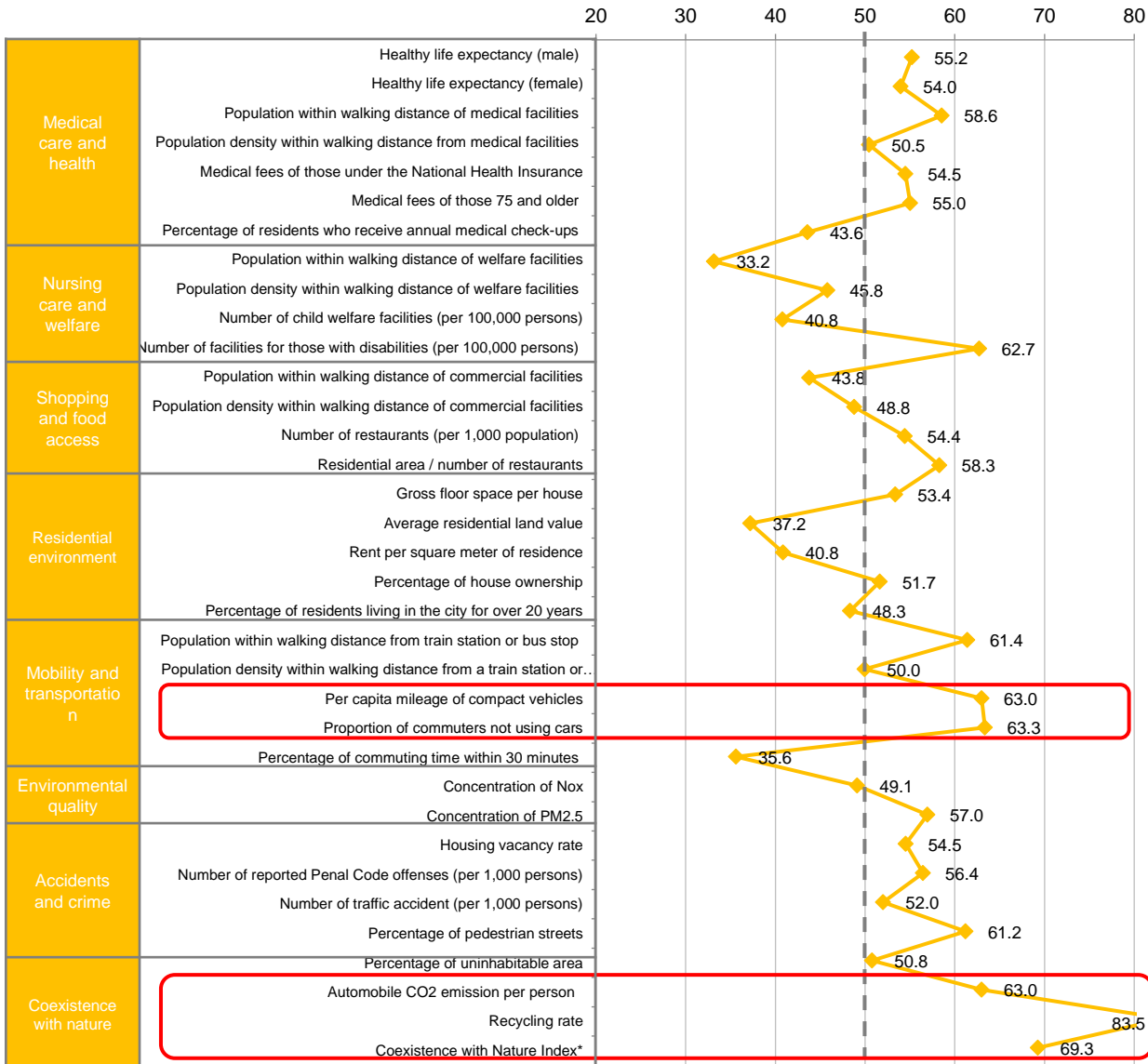
| | |
|------------------|------|
| Objective score | 51.1 |
| Subjective score | 56.9 |

Sapporo

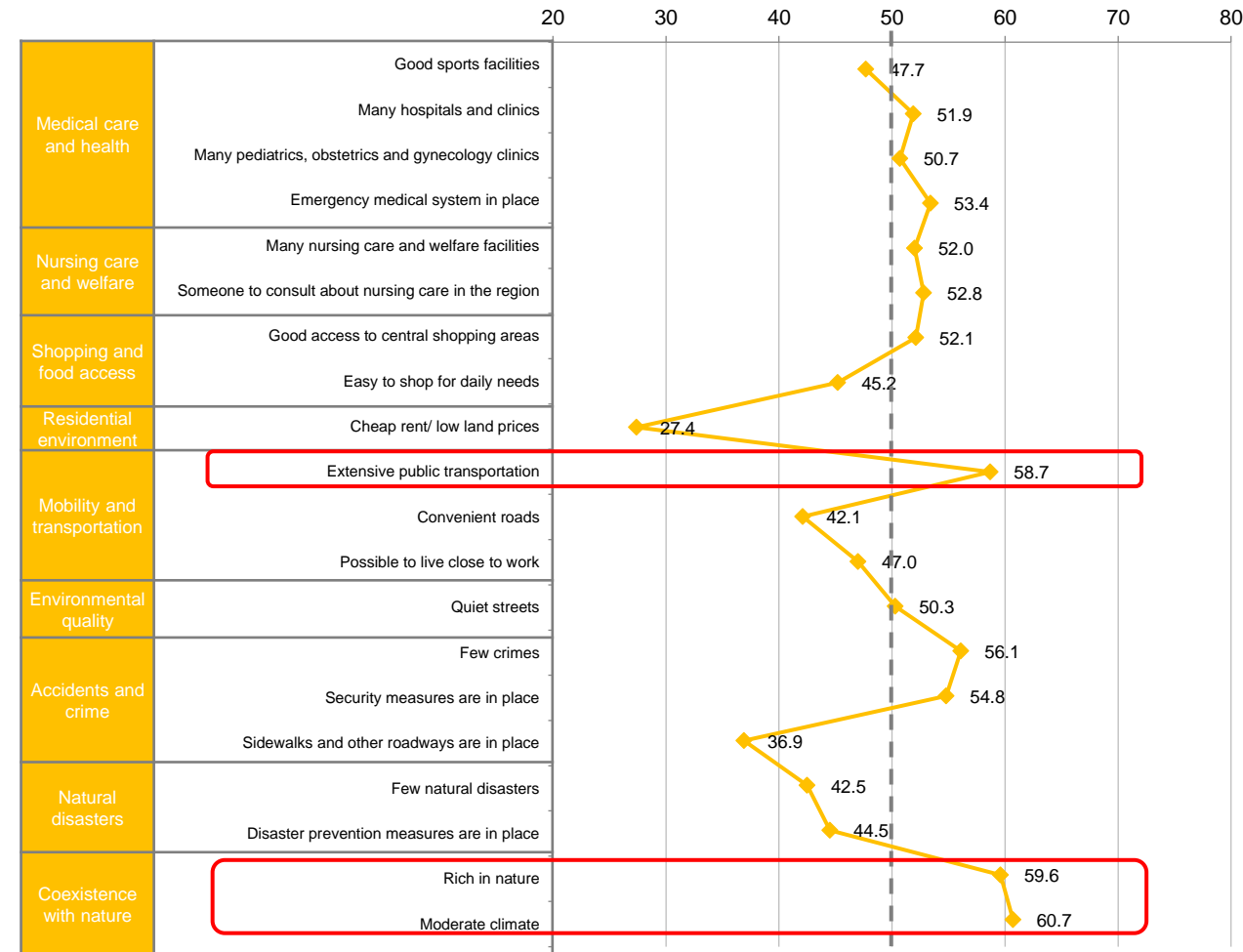
[Physical Health] With Its Abundant Nature, High Recycling Rate and Restrain of Car Use, Kamakura's Most Notable Characteristic Is Its Realization of a Circular and Decarbonized Society

| | |
|------------|------|
| Objective | 53.3 |
| Subjective | 48.0 |

Objective



Subjective



*Coexistence with Nature Index: : Index that holistically assesses the initiatives implemented by the city

■ KPIs composing the Index

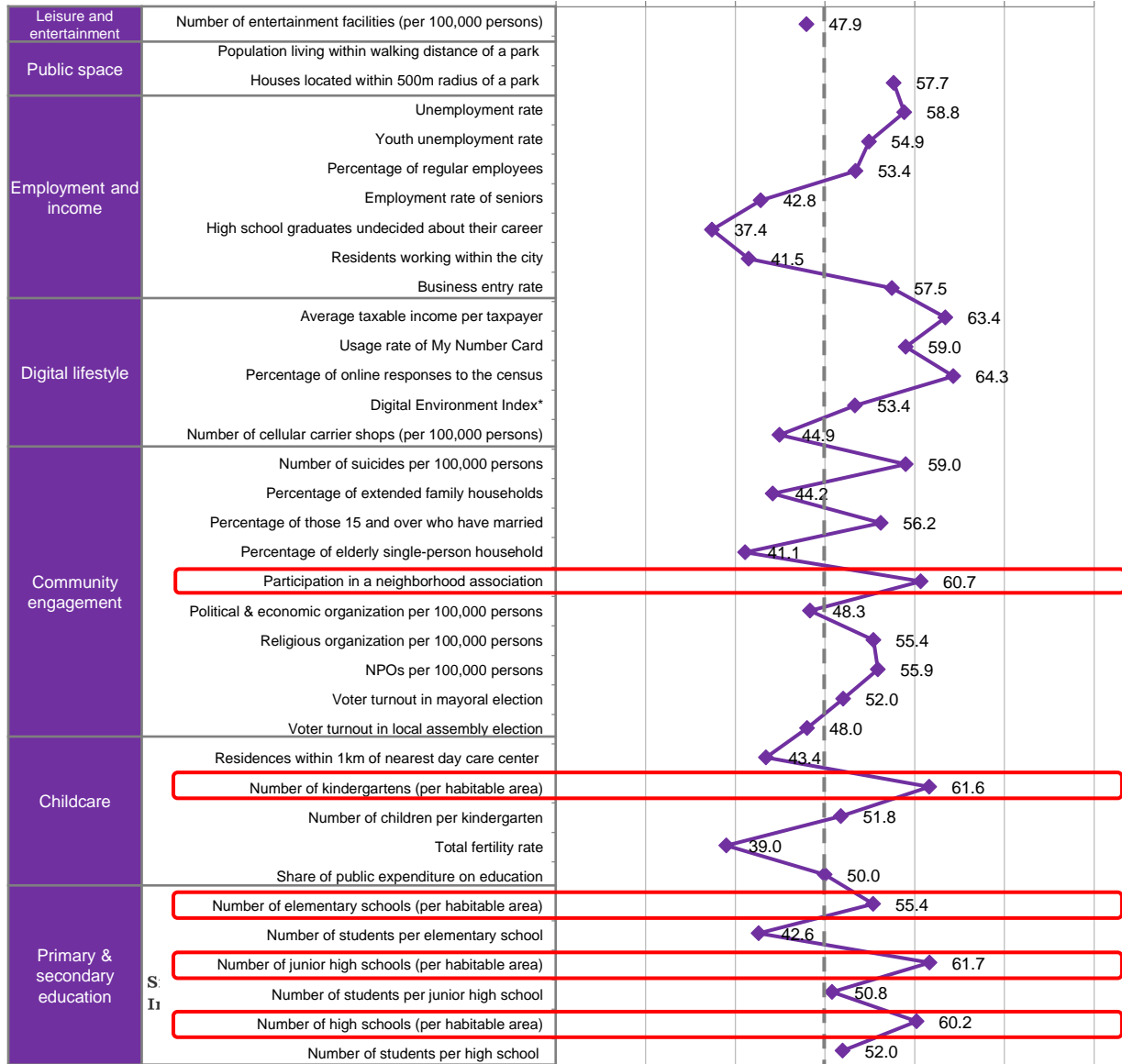
- SDGs Future City
- 2050 Zero Carbon Cities
- Policy on Green Public Procurement
- Participation in the Japan Climate Initiative

[Social Health] Participation Rate in Neighborhood Association Is High and Residents Have Strong Affection to the City and a Strong Sense of Civic Pride. Education Facilities May Be Overcrowded in Certain Areas

| | |
|------------|------|
| Objective | 52.5 |
| Subjective | 53.6 |

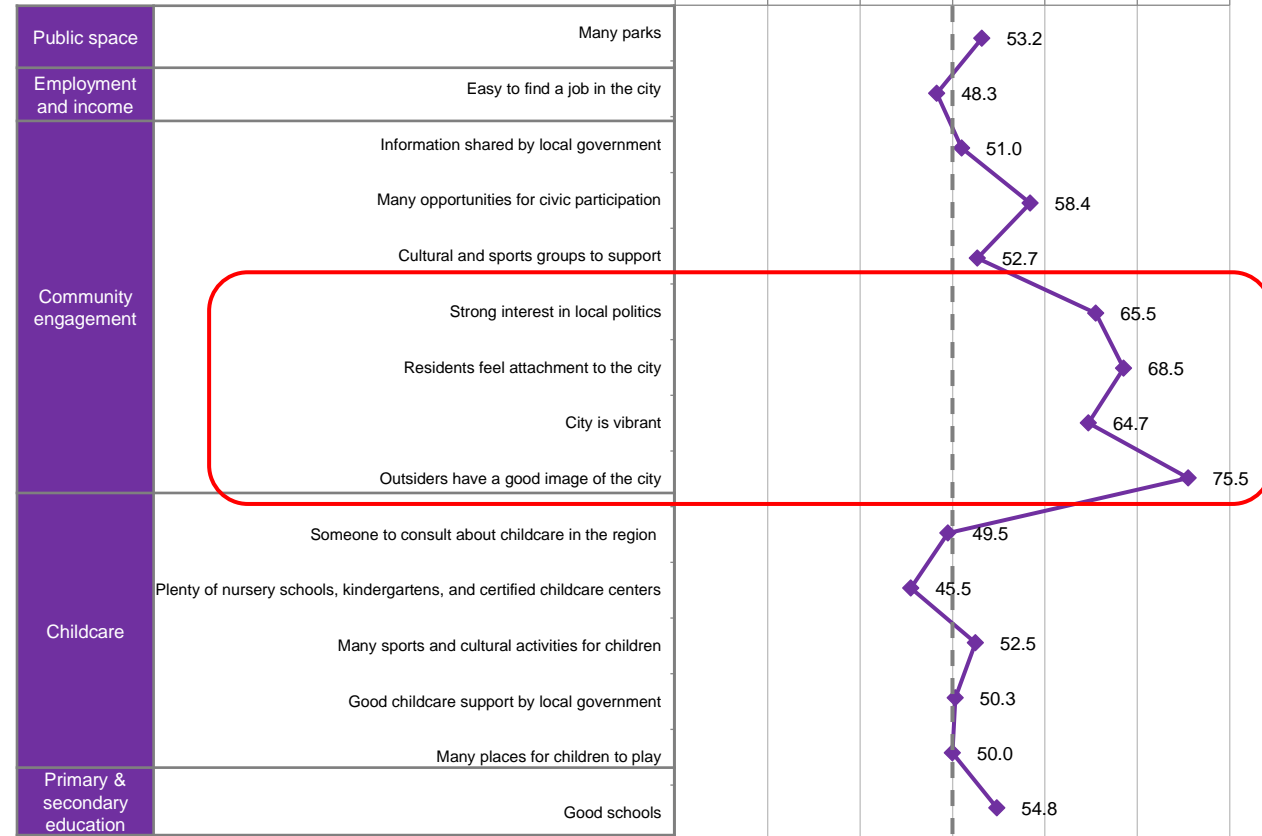
Objective

20 30 40 50 60 70 80



Subjective

20.0 30.0 40.0 50.0 60.0 70.0 80.0



(*) Digital Environment Index: Index that holistically assesses the digital environment of a city

■ KPIs composing the index

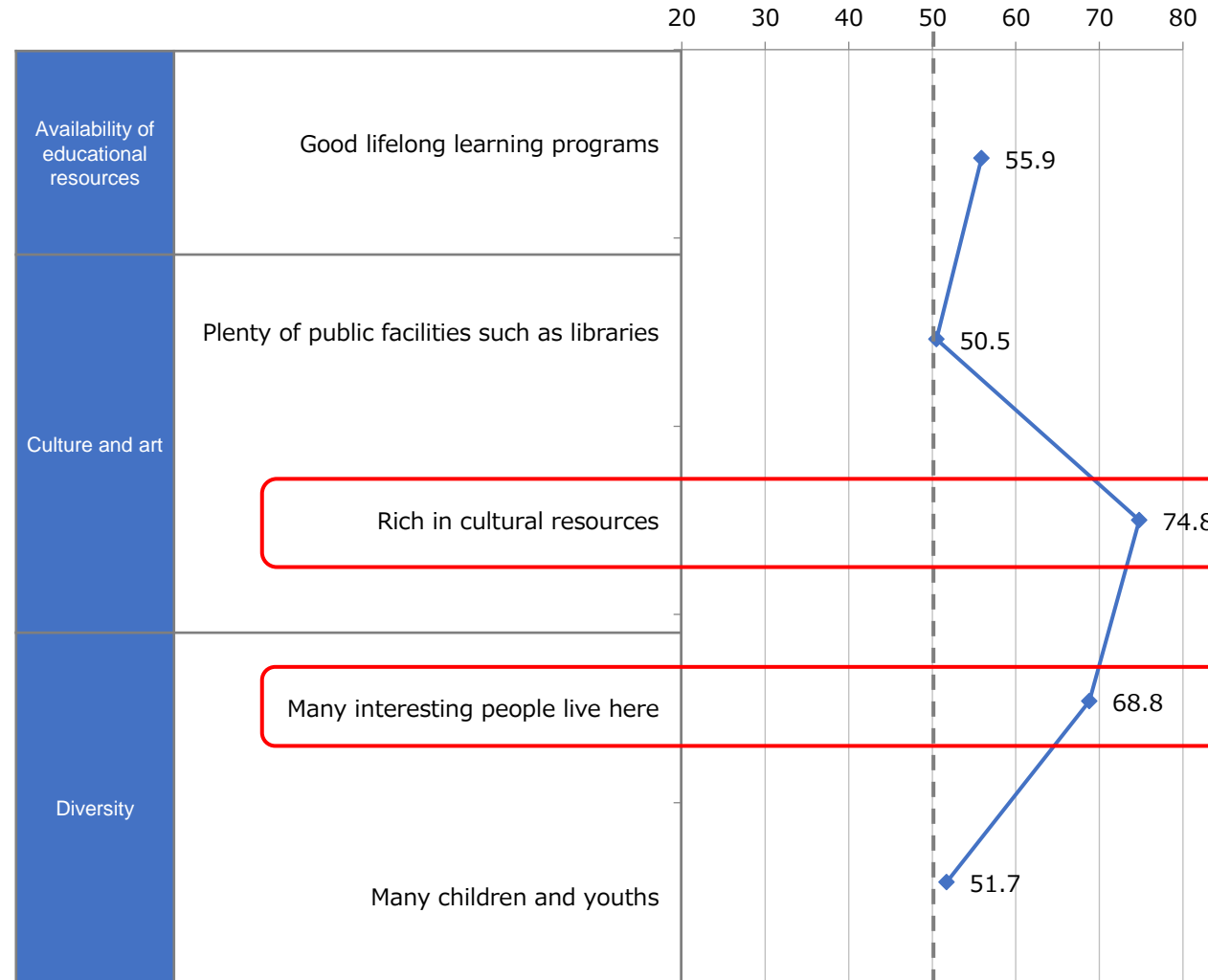
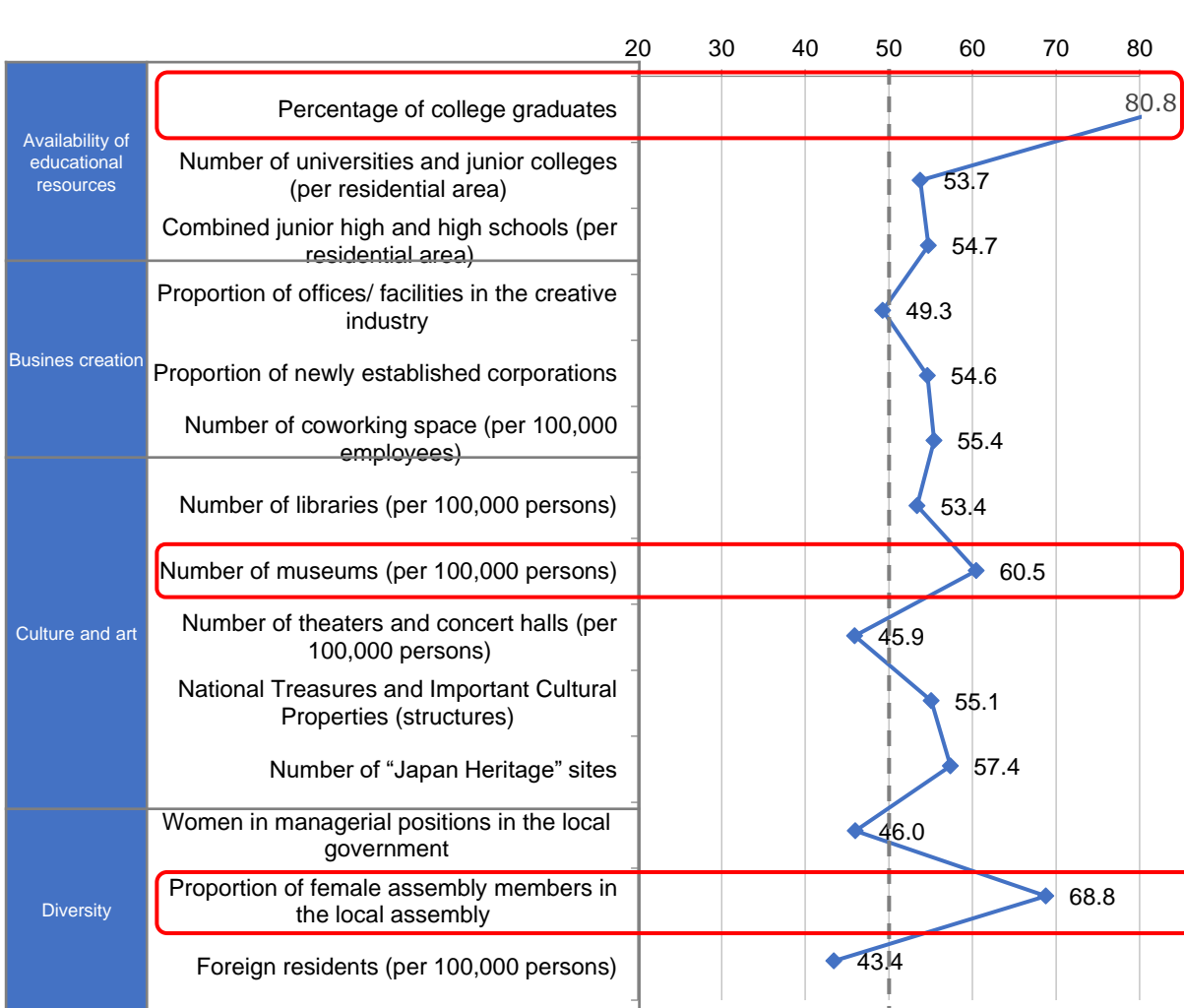
- Cities partaking in MLIT Plateau Project
- Local IoT Acceleration Lab in the city
- Open data scheme by the local government
- "Code for " organization in the city
- ICT related department in a university
- Fab Lab in the city
- College of technology in the city
- CoderDojo in the city

【Mental Health】 Cultural Resources Is Abundant and Residents Feel the Benefits. Having a High Proportion of Female Assembly Members and Many Interesting People, Kamakura Is a Diverse City

| | |
|------------|------|
| Objective | 55.8 |
| Subjective | 59.6 |

Objective

Subjective



Citizens of Kamakura Value Policies Related to “Coexistence with Nature,” “Natural Disasters,” “Culture and Art,” “Primary and Secondary Education” and “Childcare”

<Kamakura City Citizen Survey (FY 2019) >

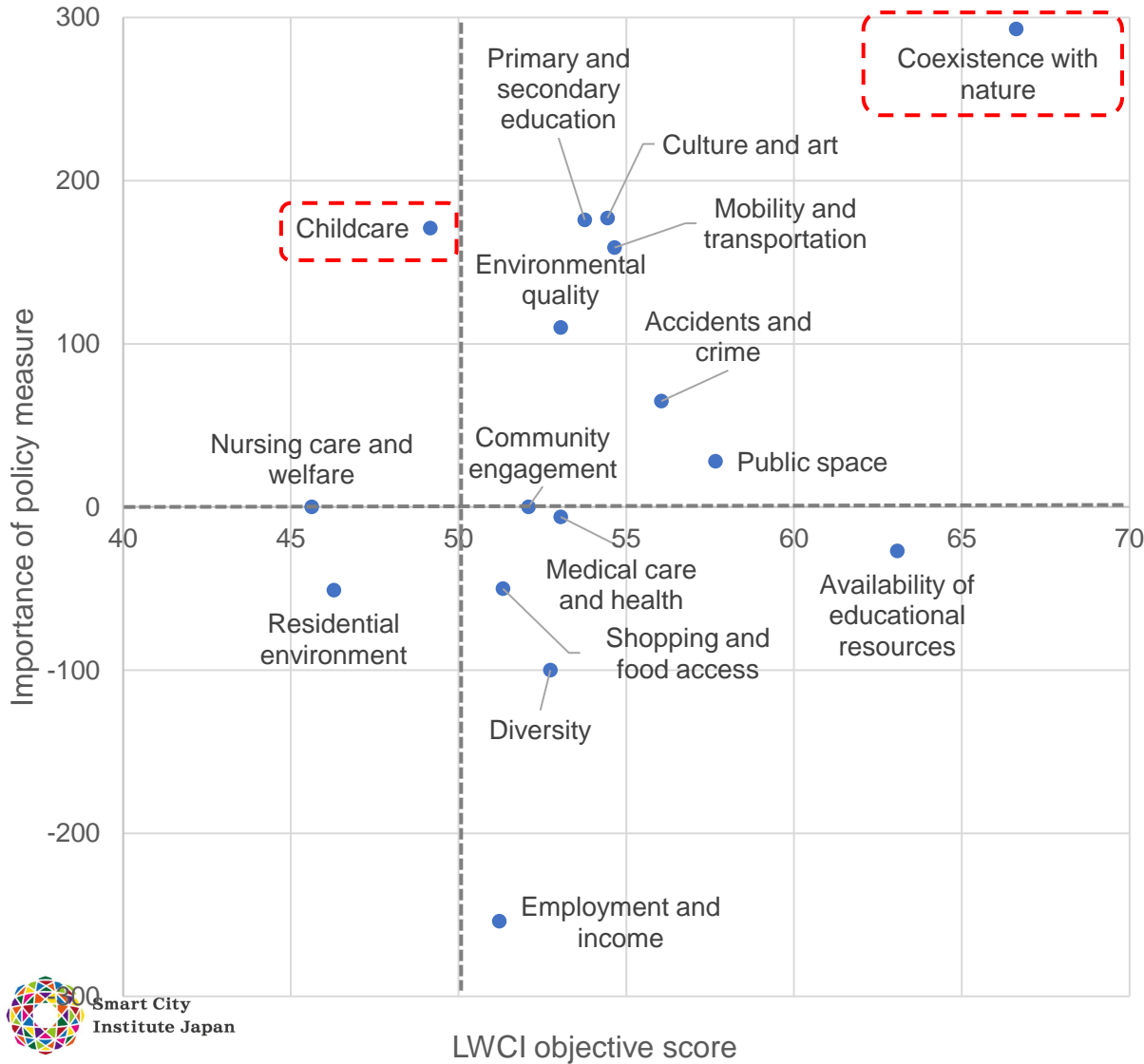
| Rank | LWCI category | Net Promoter Score of policy measures |
|------|---------------------------------------|---------------------------------------|
| 1 | Coexistence with nature | 293 |
| 2 | Natural disasters | 233 |
| 3 | Culture and art | 177 |
| 4 | Primary and secondary education | 176 |
| 5 | Childcare | 171 |
| 6 | Mobility and transportation | 159 |
| 7 | Environmental quality | 110 |
| 8 | Accidents and crime | 65 |
| 9 | Public space | 28 |
| 10 | Nursing care and welfare | 0 |
| 11 | Community engagement | 0 |
| 12 | Medical care and health | -6 |
| 13 | Availability of educational resources | -27 |
| 14 | Shopping and food access | -50 |
| 15 | Residential environment | -51 |
| 16 | Diversity | -100 |
| 17 | Employment and income | -254 |

Characteristics

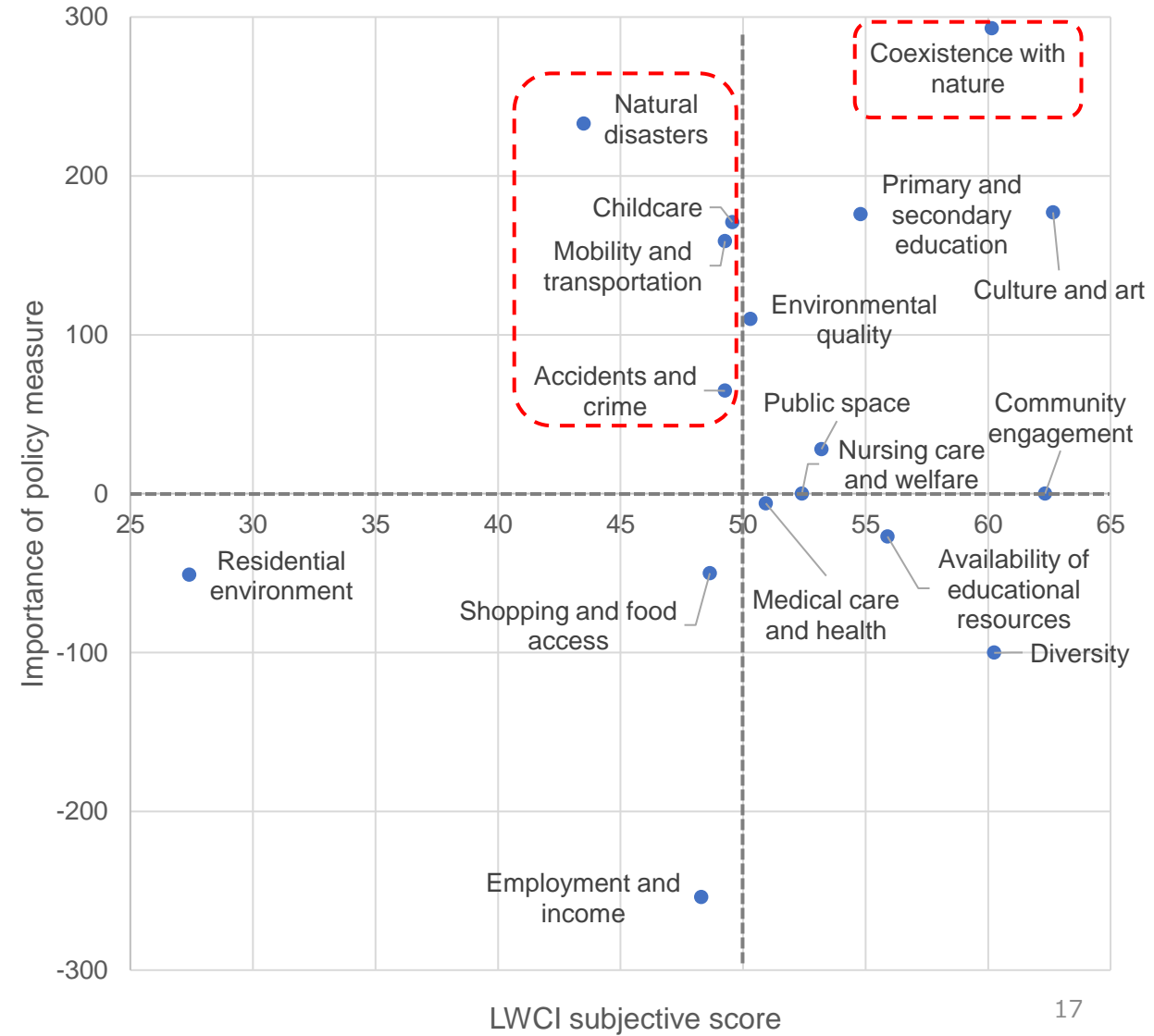
- Of the top 20 policy measures that Kamakura citizens value, 3 are related to “Coexistence with nature”.
- In particular, “Promotion of 3R and proposal disposal of trash” is ranked second after “Improvement of measures on earthquake, storm and flood”. It can be inferred that this high interest is the reason Kamakura is ranked first in the nation in recycling rate.
- When all the policy measures are categorized according to the LWCI categories and the Net Promoter Scores (NPS) are calculated, the “Coexistence with nature” category has the highest score.
- Out of “Natural disasters,” the second highest category, the “Improvement of measures on earthquake, storm and flood” is rated extremely high, suggesting that there is a widespread sense of crisis concerning tsunami or an extreme weather event.
- Regarding “Culture and art,” the third highest category, 3 of the top 20 most important policy measures are in this category and residents are eager to protect the rich culture and art of Kamakura.
- From above, it can be inferred that citizens believe the culture and natural environment of Kamakura is essential for their lifestyle and are motivated to protect these.
- The high consciousness of citizens may be the reason for the high standard of Kamakura as a city coexisting with nature.

“Coexistence with Nature” Is Important for Citizens, and Its Objective and Subjective Scores Are High. “Childcare,” “Natural Disasters,” “Mobility and Transportation” and “Accidents and Crime” Are Important but Require More Action

LWCI Objective Score vs. Importance of Policy Measure



LWCI Objective Score vs. Importance of Policy Measure



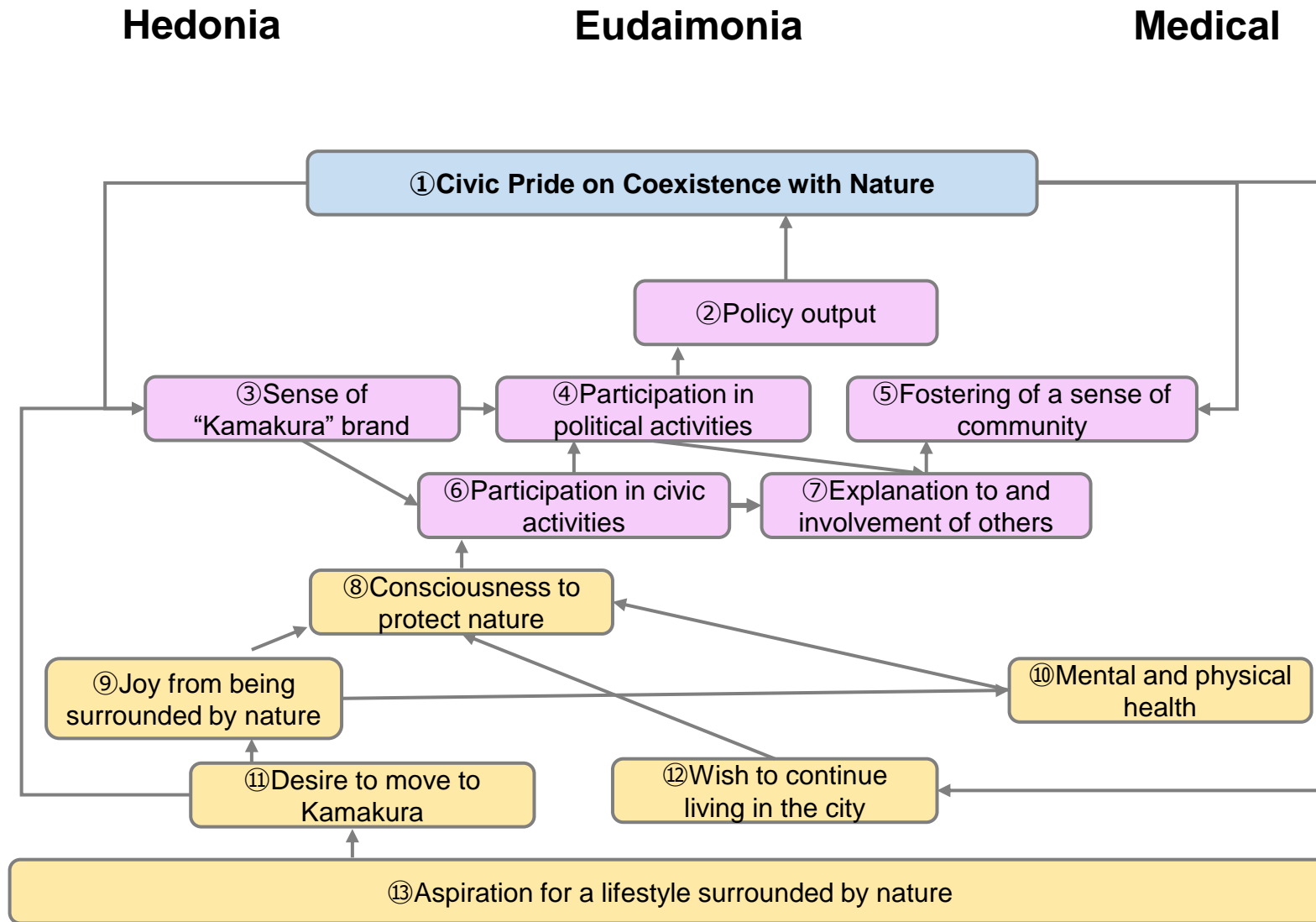
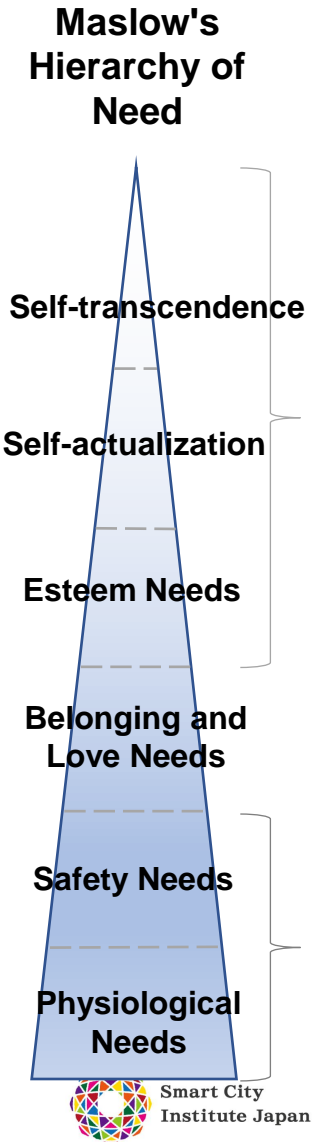
【Coexistence with Nature】 The Desire for a Lifestyle Surrounded by Nature Encourages Civic and Political Activities to Preserve Nature, which in turn Increases Civic Pride

Green: Objective
Orange: Subjective

*KPIs composing the Coexistence with Nature Index are SDGs Future City, 2050 Zero Carbon Cities, Policy on Green Public Procurement, and Participation in the Japan Climate Initiative

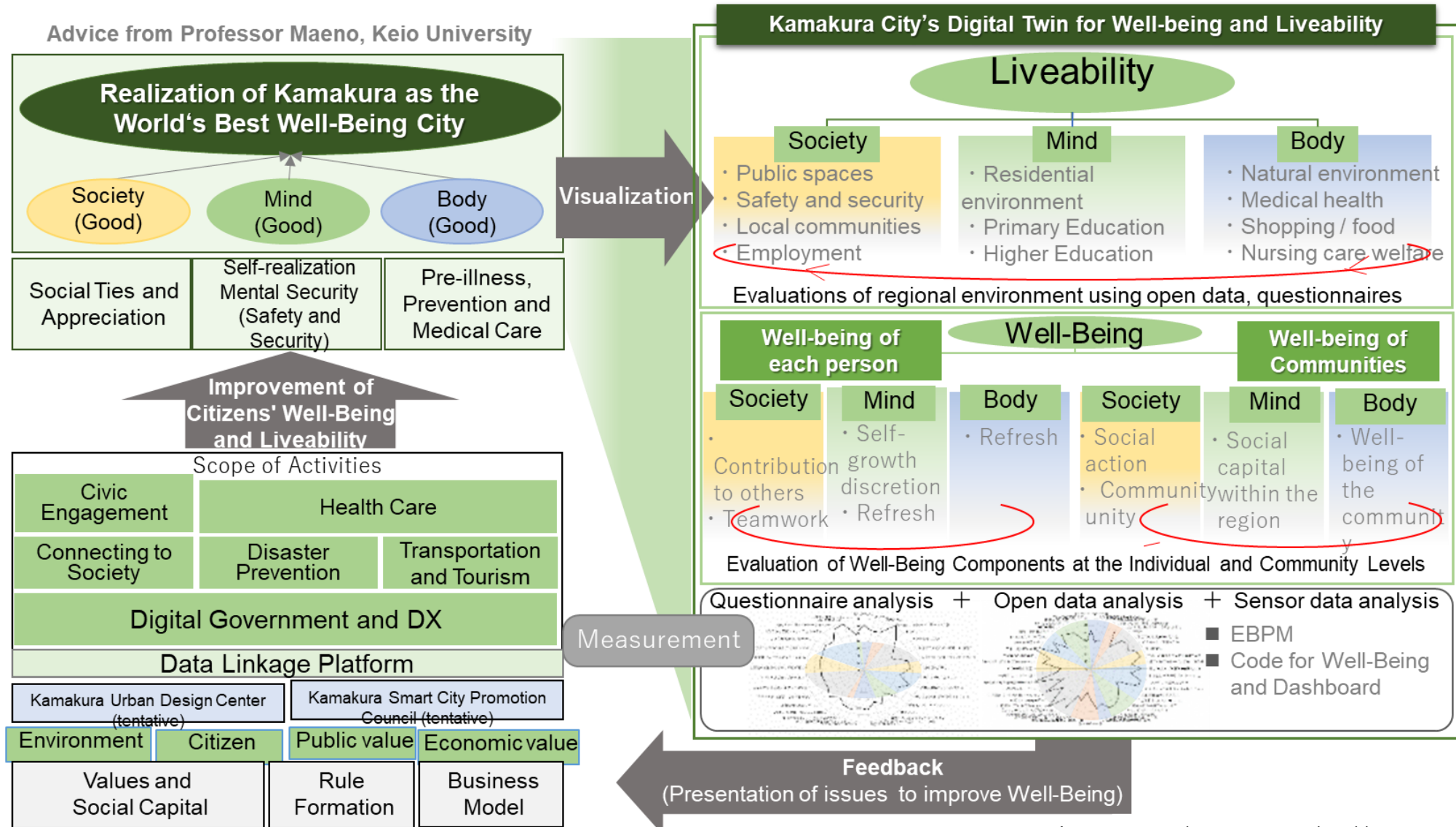
Corresponding KPIs

- ① Residents feel attachment to the city
- ② Recycling rate
- ② Coexistence with Nature Index*
- ③ Outsiders have a good image of the city
- ④ Strong interest in local politics
- ④ Voter turnout in mayoral election
- ④ Voter turnout in local assembly election
- ⑥ Many opportunities for civic participation
- ⑥ NPOs per 100,000 persons
- ⑥ Participation rate in a neighborhood association
- ⑩ Healthy life expectancy (male)
- ⑩ Healthy life expectancy (female)
- ⑫ Percentage of residents living in the city for over 20 years
- ⑬ Rich in nature
- ⑬ Percentage of uninhabitable area



Measure and Share Well-Being & Liveability KPIs to Co-Create Smart City

- Continuously evolving supercities by visualizing Well-Being based on Kamakura's culture and history and quantitative evaluations.



Conclusion

- Under the Kishida administration, Japan has embarked on “Digital Garden City Initiative” to accelerate digital transformation of the country from regions.
- Implementing Liveability and Well-Being City Indicators (LWCI) is the key component of the Digital Garden City Initiative as a way of ensuring technology realizes well-being of citizens.
- LWCI consists of subjective and objective assessment of liveability of the city and well-being of citizens at the municipality level.
- LWCI is an essential tool to bridge smart technologies and civic engagement
 - Lessons Learned: Tech-driven approach is NOT enough to meet citizens’ needs/wants.
- Smart City Institute Japan is open to collaborate with cities or organizations abroad who are interested in the designing and implementing the LWCI.

Thank you – Questions?