# Seismic Resilience Evaluation Index System

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# PART 01
# Project Definition & Recent Progress

# Project definition & Recent progress

## Project Definition

Build an index system to assess community resilience to measure the present level of community resilience. Our target this semester is to finish the selection of all the indexes, and try to make their future quantization as easy as possible.

- What we did so far:
  - Framework from Mayunga (5×4)
  - Index selected based on various literature
  - Index adjustment based on Chinese literature

**Mayunga's framework**

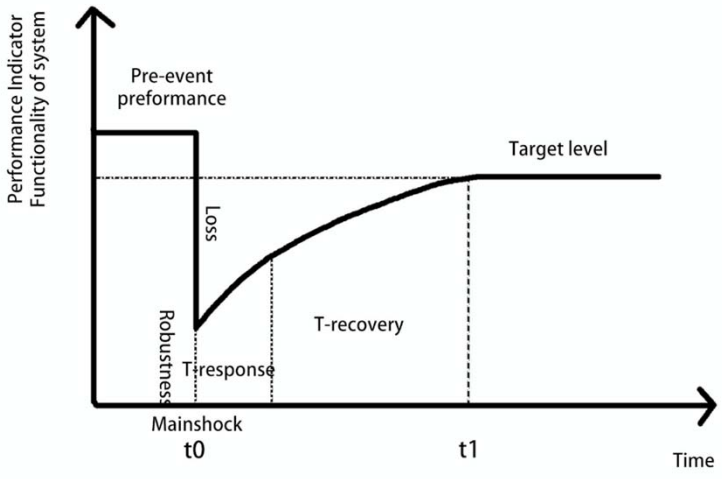
| | Mitigation | Preparedness | Response | Recovery |
|---|---|---|---|---|
| Social | … | | | |
| Economic | | … | | |
| Institutional | | | … | |
| Environmental | | | | … |
| Infrastructural | | | | … |

# Explanation of four phases

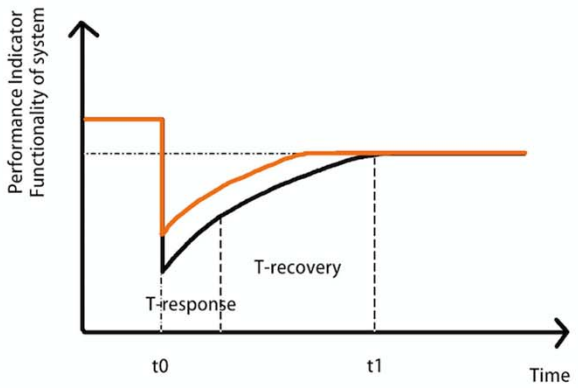
**Explanation of four phases**

| Disaster Phases | General definition | Example of activities |
|---|---|---|
| Hazard Mitigation | **Advance** actions taken to **reduce or eliminate** the **long term risk**. | • Building dams, levees, dikes, and floodwalls<br>• Strengthening buildings through building standards |
| Disaster Preparedness | Activities undertaken to protect human lives and property in conjunction with threats that **cannot be controlled by means of mitigation**. | • Designing and installing warning systems<br>• Developing plans for evacuation<br>• Training of emergency personnel |
| Emergency Response | Activities that are **conducted between the detection** of the event and the **stabilization** of the situation following the impact. | • Evacuation<br>• Search & Rescue<br>• Provision of medical care |
| Disaster Recovery | Actions taken to **repair, rebuild, and reconstruct** damaged properties and to **restore** disrupted social routines and economic activities | • Re-establishment of economic activities<br>• Provision of housing, clothing, and food<br>• Rebuilding of major structure |

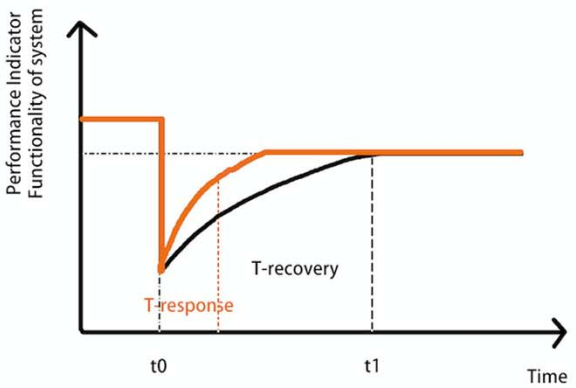
# A more clear explanation in the resilience model



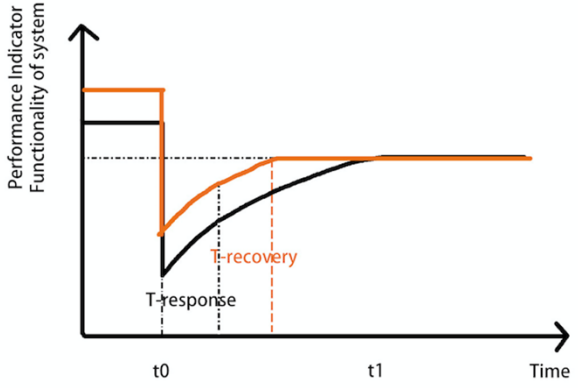

**Normal Resilience Model**



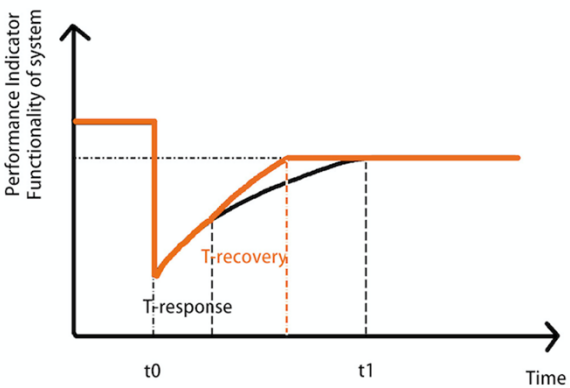

**Mitigation**




**Recovery**




**Preparedness**




**Response**

**Improved Resilience Model**

# Tsinghua's functional areas


- We identified Tsinghua's main functional areas, and colored it as the following graph. Due to the graph, Tsinghua's main functional areas include:

  - Accommodation areas
  - Living areas (include teaching area, market, canteen etc.)
  - Hospitals;
  - School (middle and primary)
  - Open areas (playground and green areas)
  - Lifelines (main road and pipes etc.)
  - ……

- As we already have some progress for infrastructure, we mainly focus on the other dimensions, including social, economic, environment and institutional.

# PART 02
# Literature Review

# References

## Stage One：Definition, Background and Theoretical basis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## Stage Two： Framework, Index selection and Adjustments

(Next page…)

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# Literature Review

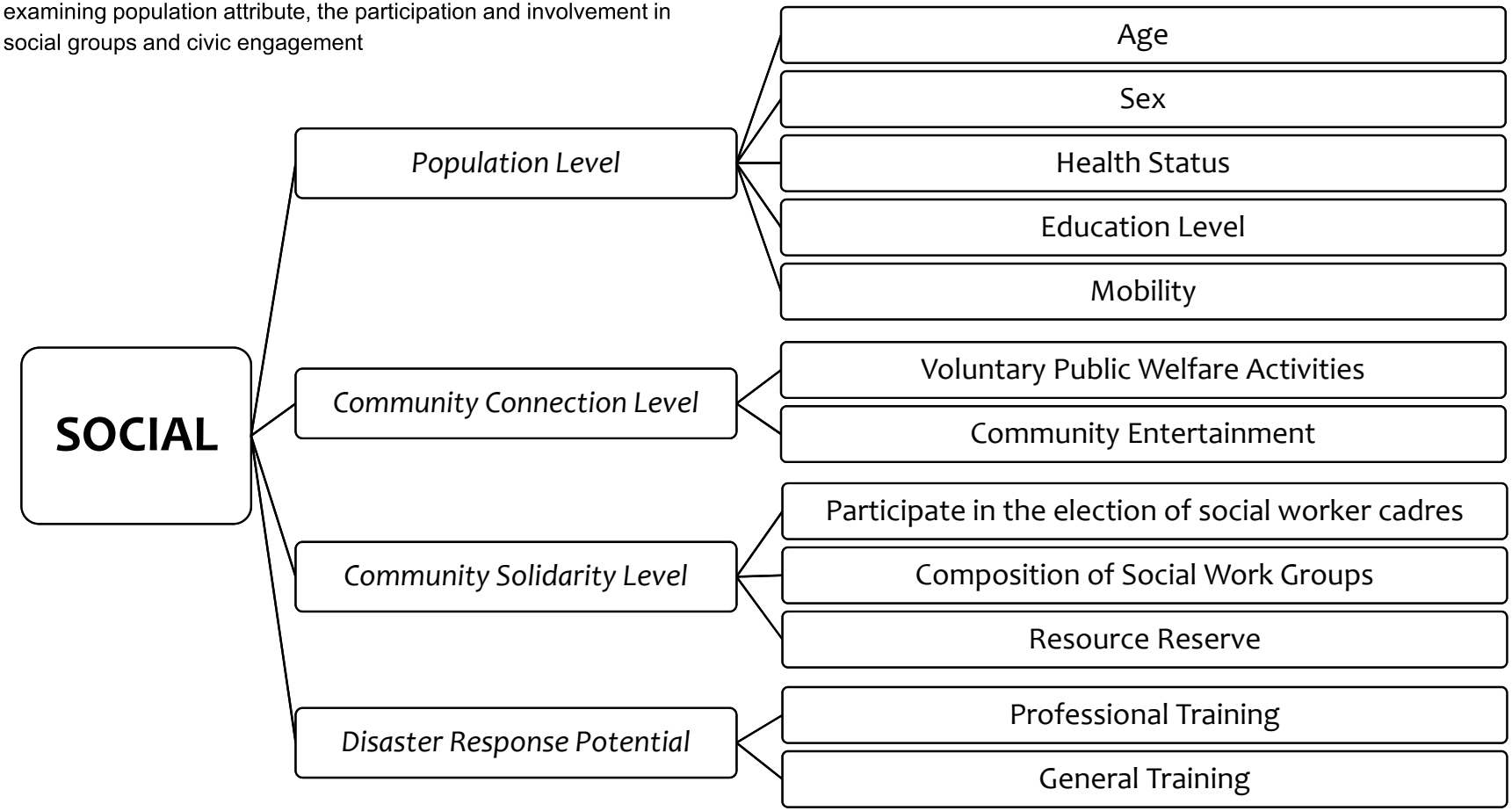
| Literature | Summary | What we quote |
|---|---|---|
| | A **conceptual model** based on **disaster phases' activities and community capitals** was developed in which indicators for measuring disaster resilience were identified. The index **was scored and applied** in the U.S. Gulf coast region | • **To assess resilience from 5 dimensions of capital** (social, economic, physical, and human) and 4 disaster phases' (Mitigation, Preparedness, Response, Recovery)<br>• **Identify activities in index relevantly to each disaster phase** |
| Top-down assessment of disaster resilience: A conceptual framework using coping and adaptive capacities | This paper introduced the design of an **Australian Natural Disaster Resilience Index (ANDRI)**, which takes a top-down approach using **indicators design based on coping and adaptive capacities** representing the potential for disaster resilience. | • Support to **select indicators** to assess resilience from specific dimension<br>• **Quantitative method of indicators**<br>• **Support to define sub-dimensions**<br>• More reference and theoretical basis |
| Developing a resilience index towards natural disasters in Indonesia | This paper developed **a framework** to assess the resilience of disaster-prone areas in Indonesia towards natural disasters, by establishing **an index from dimensions including social, economic, community capacity, institutional and infrastructure.** | |
| An inclusive and adaptive framework for measuring social resilience to disasters （supplements） | This paper presents an inclusive and adaptive **'5S' social resilience framework** that was **developed based on 172 critical review** literatures. The proposed framework consists of five sub-dimensions of social resilience, namely, social structure, social capital, social mechanisms, social equity, and social belief. | |
| 韧性城市规划理论与方法及其在我国的应用 ——以合肥市市政设施韧性提升规划为例 | Based on foreign theories and methods of planning about 'resilient city', this article focus on introducing the connotation and planning method of 'National Resilience' planning in Japan and **then take practice about the resilient planning of municipal infrastructure in Hefei** as an example. | • **Support us to adjust the index to China's specific situation** |

# PART 03
# Index System

Social/ Economic/ Institutional/ Environmental

# SOCIAL Dimension

examining population attribute, the participation and involvement in social groups and civic engagement



# SOCIAL Dimension

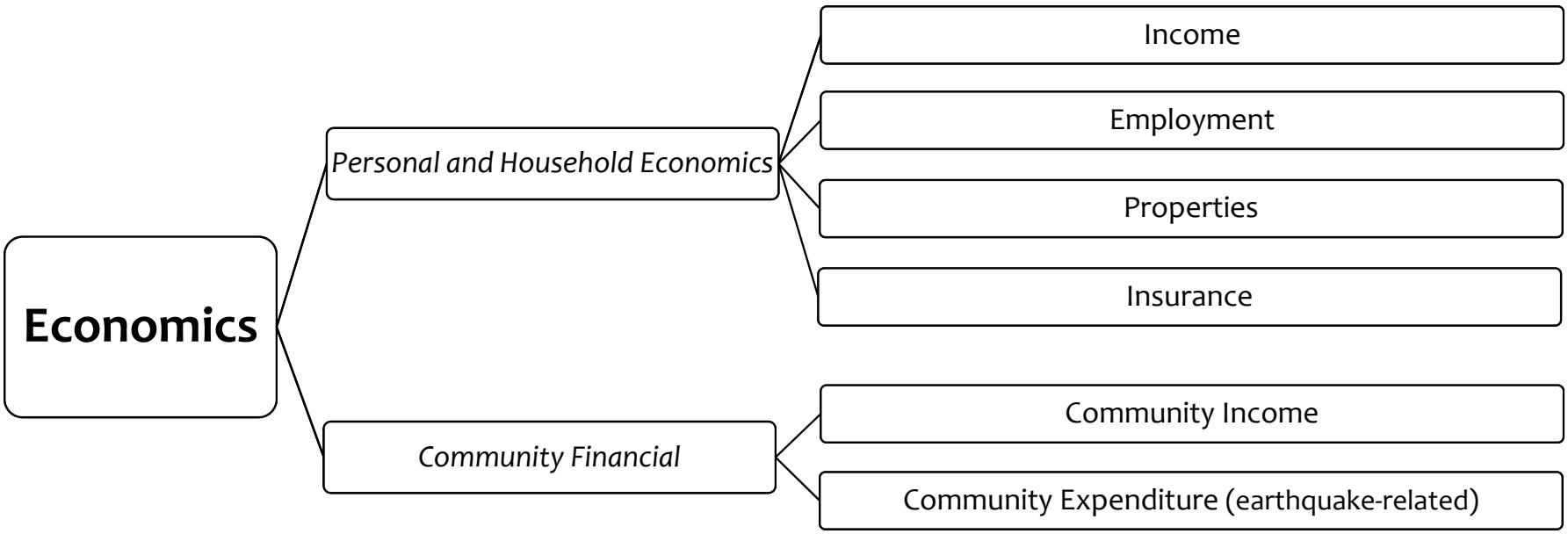
examining population attribute, the participation and involvement in social groups and civic engagement

| Dimension | Level 1 | Level 2 | Level 3 | Level 4 | Mitigation | Preparedness | Response | Recovery |
|---|---|---|---|---|---|---|---|---|
| Social | Population Level | Age | age distribution | Proportion of population in all ages | 1 | 1 | 1 | 1 |
| | | Sex | sex distribution | Female population ratio | 1 | 1 | 1 | 1 |
| | | | marital status | Proportion of marital status | 1 | 1 | 1 | 1 |
| | | Health Status | health level | Life expectancy | 1 | 1 | 1 | 1 |
| | | | | Incidence of tuberculosis and other diseases | 1 | 1 | 1 | 1 |
| | | Education Level | education level | Proportion of College Students | 1 | 1 | 1 | 1 |
| | | Mobility | fixed housing | percent Permanent housing a | 1 | 1 | 1 | 1 |
| | | | population flow | Resident population ratio | 1 | 1 | 1 | 1 |
| | Community Co | | organization | Youth Apartment/ Public Rental Housing | 1 | 1 | 1 | 1 |
| | | | n | OFO/School bus/ Campus bus | 1 | 1 | 1 | 1 |
| | | | l organization | Neighborhood committee/Community medical treatment | 1 | 1 | 1 | 1 |
| | | | | Number of Societies/ number of participants | 1 | 1 | 1 | 1 |
| | | | | Number of activities and participants | 1 | 1 | 1 | 1 |
| | | | | Advertising readings | 1 | 1 | 1 | 1 |
| | | | | Voting capacity per 1000 people | 1 | 1 | 1 | 1 |
| | Community S | | on | Organization participation per 1000 people | 1 | 1 | 1 | 1 |
| | | | | Trained volunteers per 1000 people | 1 | 1 | 1 | 1 |
| | | | | Special skills talents | 1 | 1 | 1 | 1 |
| | | | | Safety and disaster reduction education and training | 1 | 1 | 1 | 1 |
| | | Professional Training | Degree of attention | Professional training participation per 1000 people | 1 | 1 | 1 | 1 |
| | Disaster Response Potential | | Training effect | Professional qualification certification per 1000 people | 1 | 1 | 1 | 1 |
| | | | Degree of attention | Safety education and training person-time per year | 1 | 1 | 1 | 1 |
| | | General Training | Training effect | Questionnaire survey on the safety consciousness of ordinary people | 1 | 1 | 1 | 1 |

- **Number of societies**
  社团数量
- **Advertising readings**
  推送阅读量
- **Organization participation per 1000 people**
  每千人参与学生会等学生组织人数

# ECONOMICS Dimension

financial resources that people use to support their livelihoods



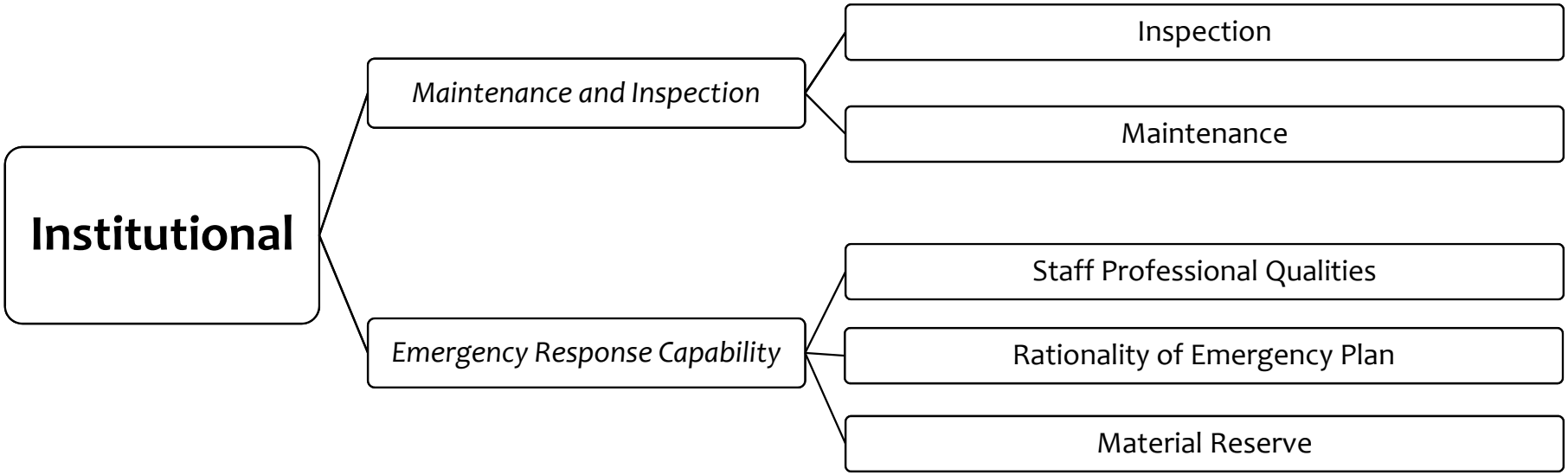
# ECONOMICS Dimension

financial resources that people use to support their livelihoods

| Dimension | Level 1 | Level 2 | Level 3 | Level 4 | Mitigation | Preparedness | Response | Recovery |
|---|---|---|---|---|---|---|---|---|
| Economics | Personal and Household Economics | Income | income level | community average income/ region average income | 0 | 0 | 1 | 1 |
| | | | income diversity | income variation | 0 | 0 | 1 | 1 |
| | | Employment | total employment | Employment/population ratio | 0 | 0 | 1 | 1 |
| | | | | occupation diversity | 0 | 0 | 1 | 1 |
| | | Properties | land and home ownership | median value of housing units | 0 | 0 | 0 | 1 |
| | | | | houses owned per person | 0 | 0 | 1 | 1 |
| | | | vehicle ownership | vehicle owned per person | 0 | 0 | 1 | 0 |
| | | Insurance | health insurance | % of health insurance | 0 | 0 | 0 | 1 |
| | | | property insurance | % of property insurance | 0 | 0 | 0 | 1 |
| | | Community Income | inner community income | property fee | 1 | 1 | 1 | 1 |
| | | | | rent | 1 | 1 | 1 | 1 |
| | | | outer community income | fiscal appropriation | 1 | 1 | 1 | 1 |
| | Community Financial | Community Expenditure （earthquake- related) | community service expenditure | emergency response workers expenditure | 0 | 1 | 0 | 0 |
| | | | | safety education expenditure | 0 | 1 | 0 | 0 |
| | | | | emergency funds | 0 | 1 | 0 | 0 |
| | | | community infrastructure expenditure | emergency response facility expenditure | 0 | 1 | 1 | 0 |
| | | | | infrastructure recondition expenditure | 1 | 0 | 0 | 0 |

# INSTITUTIONAL Dimension

the performance of community leaders and administration departments in terms of disaster-related management before earthquake strikes

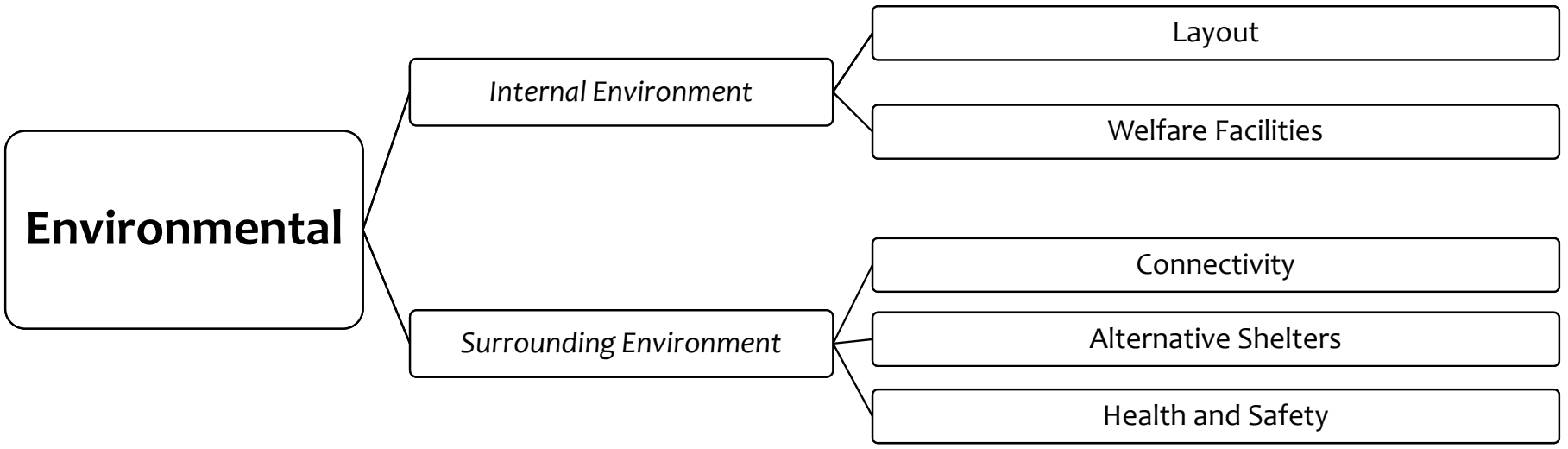


# INSTITUTIONAL Dimension

the performance of community leaders and administration departments in terms of disaster-related management before earthquake strikes

| Dimension | Level 1 | Level 2 | Level 3 | Level 4 | Mitigation | Preparedness | Response | Recovery |
|---|---|---|---|---|---|---|---|---|
| Institutional | Maintenance and Inspection | Inspection | infrastructure condition check frequency | infrastructure condition check frequency | 1 | 1 | 0 | 0 |
| | | | population employed in infrastructure inspection agency | population employed in infrastructure inspection agency | 1 | 1 | 0 | 0 |
| | | | infrastructure recondition frequency | infrastructure recondition frequency | 1 | 1 | 0 | 0 |
| | | Maintenance | population employed in infrastructure recondition agency | population employed in infrastructure recondition agency | 1 | 1 | 1 | 1 |
| | | | Repairment Technology Matuirity | Repairment Technology Matuirity | 1 | 1 | 1 | 1 |
| | Emergency Response Capability | Staff Professional Qualities | disaster management training experience | Percentage of population exposed to disaster management education/ socialization | 0 | 0 | 1 | 1 |
| | | | | Number of disaster management education/socialization activities per year | 1 | 1 | 1 | 1 |
| | | | specific emergency response skill level | percent population with specific emergency response skills | 1 | 1 | 1 | 1 |
| | | | reflection and research awareness | existence of regular emergency service reflection and research | 1 | 1 | 0 | 1 |
| | | Rationality of Emergency Plan | Detailedness level of emergency plan | Detailed level of emergency plan | 0 | 1 | 1 | 1 |
| | | Material Reserve | reserve of relief item | reserve of relief item | 0 | 1 | 1 | 1 |

# ENVIRONMENTAL Dimension



# ENVIRONMENTAL

Consult Beijing Earthquake Agency

Do field investigation

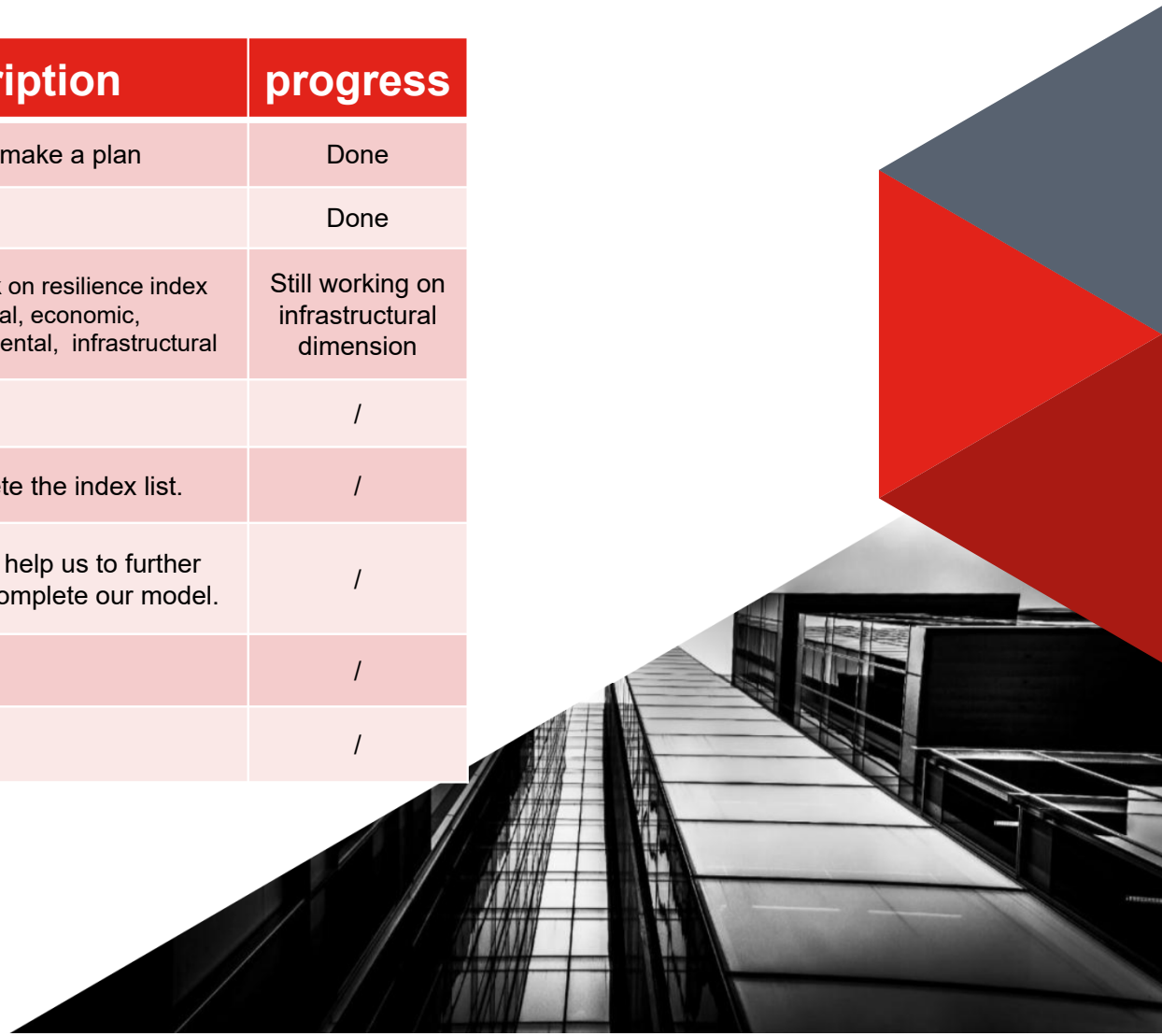
| Dimension | Level 1 | Level 2 | Level 3 | Level 4 | Mitigation | Preparedness | Response | Recovery |
|---|---|---|---|---|---|---|---|---|
| Environmental | Internal Environment | | building density | plot ratio | 0 | 0 | 1 | 1 |
| | | | | building interval | 0 | 0 | 1 | 1 |
| | | | emergency shelter area | emergency shelter area per capita | 0 | 1 | 1 | 0 |
| | | | | road area per capita | 0 | 0 | 1 | 1 |
| | | | internal transportation | percent unoccupied area of evacuation roads | 0 | 0 | 1 | 1 |
| | | | | percent evacuation signs coverage outside buildings | 0 | 1 | 1 | 1 |
| | | Welfare Facilities | healthcare service | yes or no | 0 | 1 | 1 | 1 |
| | | | Licensed child care facilities | yes or no | 0 | 1 | 1 | 1 |
| | | | nursing homes | yes or no | 0 | 1 | 1 | 1 |
| | | Connectivity | transportation access | distance to nearest major highway | 0 | 0 | 1 | 1 |
| | | | | number of community gates | 0 | 0 | 1 | 1 |
| | | | | distance to nearest subway station | 0 | 0 | 1 | 1 |
| | | | rescue force access | Distance to Nearest Fire Station from Tract Center | 0 | 0 | 1 | 1 |
| | | | | Distance to Nearest Police Station from Tract Center | 0 | 0 | 1 | 1 |
| | Surrounding Environment | | medical service access | distance to nearest hospital | 0 | 0 | 1 | 1 |
| | | Alternative Shelters | city emergency shelter | distance to nearest city emergency shelter | 0 | 0 | 1 | 1 |
| | | | Hotels/motels capacity | Hotels/motels rooms in 1 km radius per capita | 0 | 0 | 1 | 1 |
| | | | noxious chemicals | yes or no in 1 km radius | 1 | 0 | 1 | 1 |
| | | | crime | crime rate | 0 | 0 | 1 | 1 |
| | | | hosiptal capacity | number of sick beds in 1 km radius | 0 | 1 | 1 | 1 |

# PART 04
# Future Plan

Schedule process
Problems arise
Future plan

# Schedule

| Time | Task | Description | progress |
|---|---|---|---|
| **Week 3** | The 1st meeting | Meet Dr. Wang and make a plan | Done |
| **Week 4** | The 1st presentation | | Done |
| **Week 5-6** | Literature review | Review previous work on resilience index over dimensions: social, economic, institutional, environmental, infrastructural | Still working on infrastructural dimension |
| **Week6-7** | Finish the first draft of the index list | | / |
| **Week 8** | The 2nd meeting | Discuss and complete the index list. | / |
| **Week 9** | Expert review | Over 50 experts will help us to further select indices and complete our model. | / |
| **Week 10** | Finish reports | | / |
| **Week 11** | Prepare for the final presentation | | / |



# Problems for further discussion

What we always focus on

**Are indicators appropriate?**

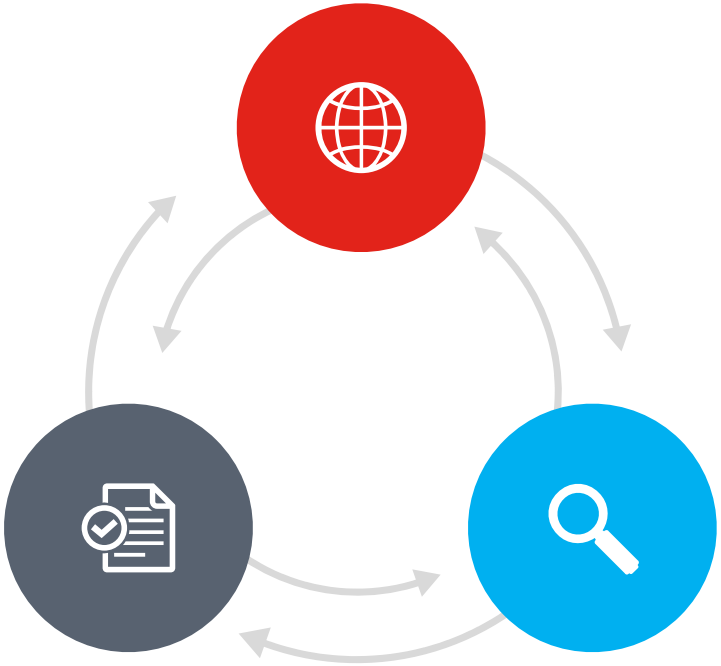
**Are we missing any specific indicators?**

**How should we measure these indicators?**

**Do indicators really affect different stages of earthquake occurrence?**

# Plan for the coming 2 weeks

A few questions that need help from teachers and experts.



## Group efforts

Compile the infrastructure dimension, and finish the first draft of the entire index system

## Teacher

Give guidance and advice for our work done. More explicit requirements for the final outcome of course design.

## Experts

Help us revise the contents of the system framework we have completed from a professional earthquake management perspective.

## GROUP 3

# Thank you for listening

Yikun Liu; Jingqiu Liao; Jian Tang; Weixuan Chen; Yinan Hu