

What is Climate Adaptation Living Lab,

Why it matters, and how do we apply it?



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Lab)

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Profile: Principal Investigator

Yonsei University

Corporate
Living Lab

Prof.
Taedong Lee

(Yonsei University,
Political Science and Diplomacy)

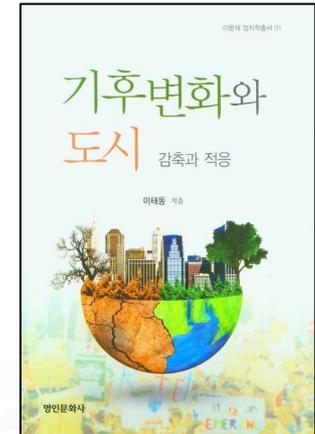
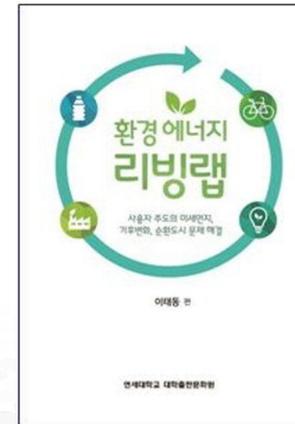


Career

- 2024. 9- PI, Transformative Climate Research & Education
- 2025. 4- Committee, Presidential Carbon Neutral Commission
- 2022. 5- Committee, National Congress Climate Change Forum
- 2019. 9- 26. 8 Yonsei Underwood Distinguished Professor, 연세대 언더우드 특훈 교수
- 2019.5- 2022.5 National Council on Climate and Air Quality International Relations Deputy Director
- 2010.-2013 City University of Hong Kong, Assistant Professor

Major Research Performance

- Journal Articles(2020-25): 18 SSCI articles, 19 KCI articles, 13 books (3 monographs)
- Leading Seodaemun-gu and Yonsei University energy saving and efficiency projects through Living Lab
- Patent Climate Disaster Message
- National Academy of Sciences Award(3 times), Award by Minister of Environment, Sejong Academic Book Award, etc.



01

Climate Change Science

: present condition and prospects

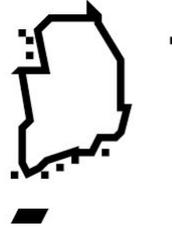


Climate Change Science through numbers



About 60 billion tons

Total global greenhouse gas emissions per year



About 0.7 billion tons

Total South Korea greenhouse gas emissions per year



460 billion tons

= About 40 billion tons from human activity per year

Amount of greenhouse gases Can be emitted for 1.5°C goal

2050 Net-Zero

Net emissions – Net absorptions = 0

IPCC 2023 AR6



11 Years

Carbon Budget

Effect of 1.5°C increase

1.5°C 2050

Category	1.5°C	2°C	
Native ecosystems & human systems	High Risk	Extremely high risk	
Mid-latitude: heat wave day temperatures	3°C increase	4°C increase	
High latitude: extreme day temperatures	4.5°C increase	6°C increase	
Coral reefs further decline in coral reefs	70-90%	99%	Up to 29% WORSE
Climate impact/poverty vulnerable populations	Up to hundreds of millions more by 2050 from 2°C warming Globla Wariming		
water shortage population	Up to 50% increase at 2°C		
Others	Increased average temperatures (most places), extreme high temperatures (most places), heavy rainfall and drought (some places)		
Terrestrial ecosystems	Medium Risk	High Risk	
Percentage of habitat that will be reduced by more than half	Insects 6% Plants 8%, Vertebrates 4%	Insects 18%, Plants 16%, Vertebrates 8%	2X WORSE
Area converted to other types of ecosystems	6.5%	13.0%	2X WORSE
Large-scale anomalies	Medium Risk	Medium –High Risk	
Sea level rise	0.26-0.77m	0.30-0.93m	· Approximately 10cm difference · 10 million people out of danger from sea level rise.
SEA-ICE-FREE ARCTIC Number of ice-free summers	At Least 1 Every 100 years (restorable)	At Least 1 Every 10 years (hard to restore)	Antarctic sea ice and Greenland ice sheet loss at 1.5°C exceedance

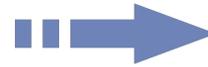
02

Why Adaptation Matters?

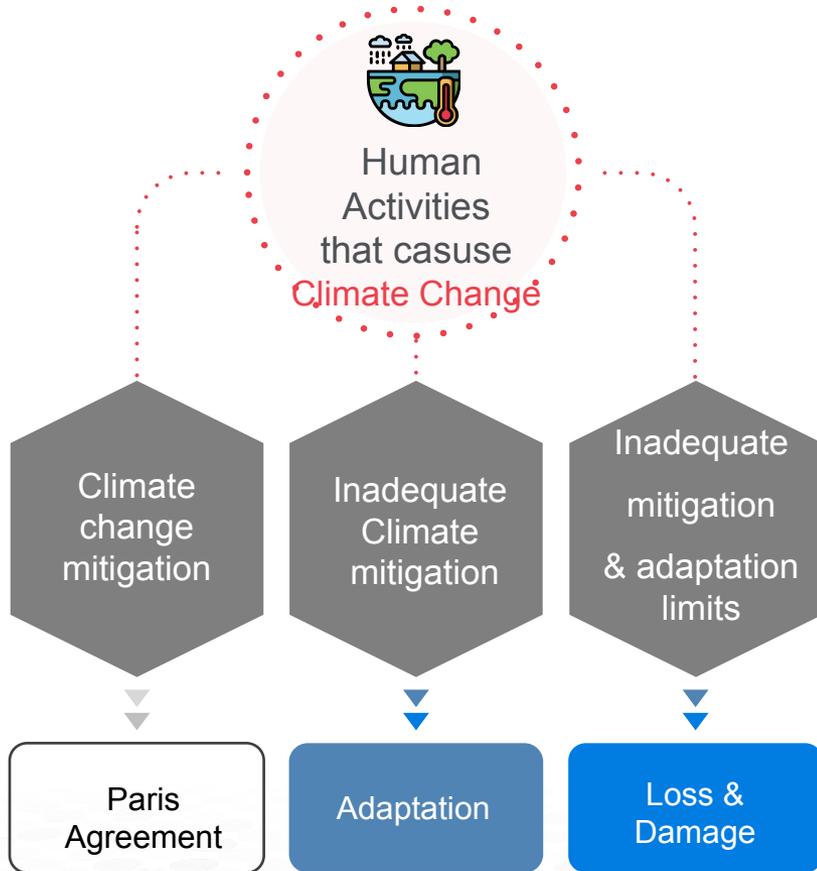


Exceeding adaptation limits due to accelerating Climate Change

Lack of mitigation and limitations of adaptation



"Inevitability of transformative adaptation"



Adaptation Sectors



Industry-Energy

- I03 Damage to the Construction Industry due to Abnormal Weather
- I06 Changes in consumer consumption patterns
- I10 Reduced transmission/substation efficiency due to rising temperature, heat waves, strong winds



Territory

- L13 Heat Stress Increase in residential areas due to heat wave
- H04 Increase in Health Diseases caused by rising temperatures and heat waves
- H13



Water Manage

- W01 Increased flood damage in rivers & basins by heavy rain
- W03 Dry Stream, Drought
- W06 Lower water supply capacity by drought



Health

- H02 Increase in Waterborne diseases
- H03 Increased incidence of new infectious diseases due to environmental changes
- H08 Respiratory System and Allergic disease caused by air pollution



Shore

- L02 Increased risk of collapse of slope in residential area (Heavy Rain)
- L05 Increased Urban Inundation damage
- L14 Increased risk of flooding in coastal areas by Tsunami, Waves, Rising Sea Levels



Ecosystem

- E01 Changes in Plant species, colonies, plant seasons, distribution
- E03 Increase in Exotic Species and disease (land animals/plants, marine outpatients, Harmful organisms)
- E18 Increasing and Enlarging of the occurrence of Forest Disasters(landslide, forest fire)

03

Research on Climate Adaptation Living Labs



Research Overview

Name of unit
enterprise

Environmental Technology Development Project for the
Response to New Climate Regime

Research
Subject

Development of user-specific decision support systems for local climate
change adaptation path based on Living Lab and Spatial Planning

Research period

2023.04.01. ~ 2028.12.31. (69months total)

Research period
(current year)

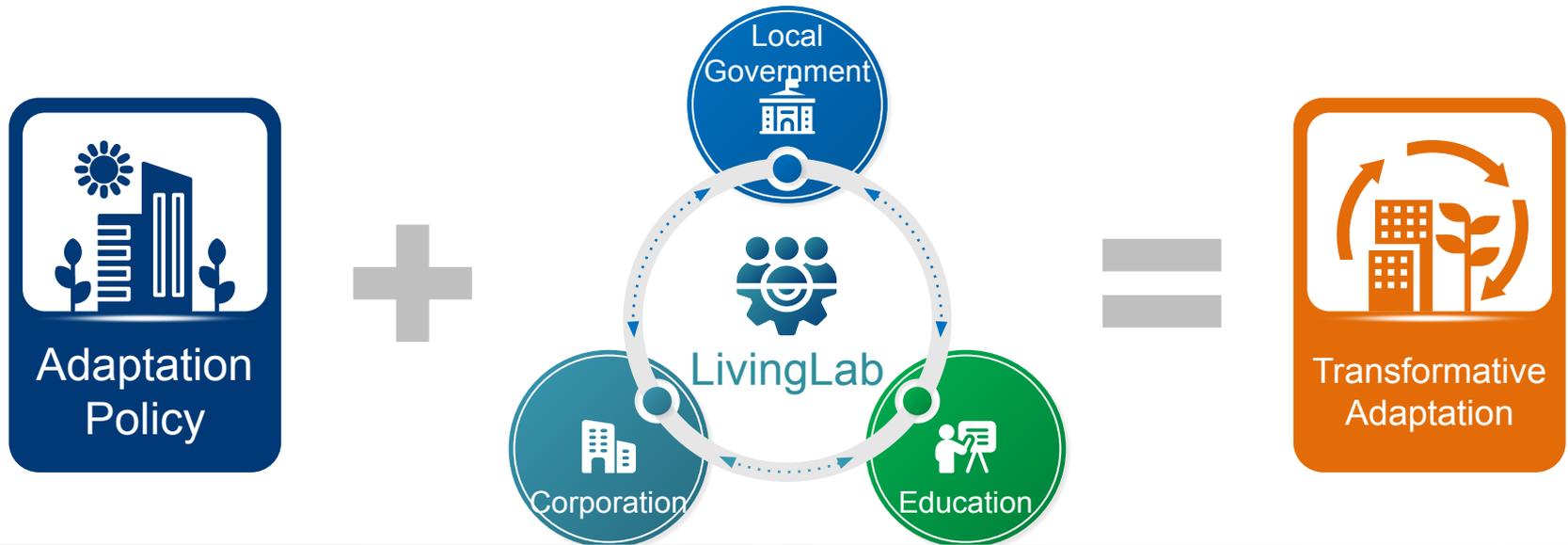
2025.01.01. ~ 2025.12.31 (Third year)

Participating
institution

Yonsei University, University of Seoul

Transformative Adaptation using Living Lab

user-specific decision support systems for local climate change adaptation path based on Living Lab and Spatial Planning



Process

Climate
Adaptation
Inventory



Living lab Experiment



Tool & System
Development

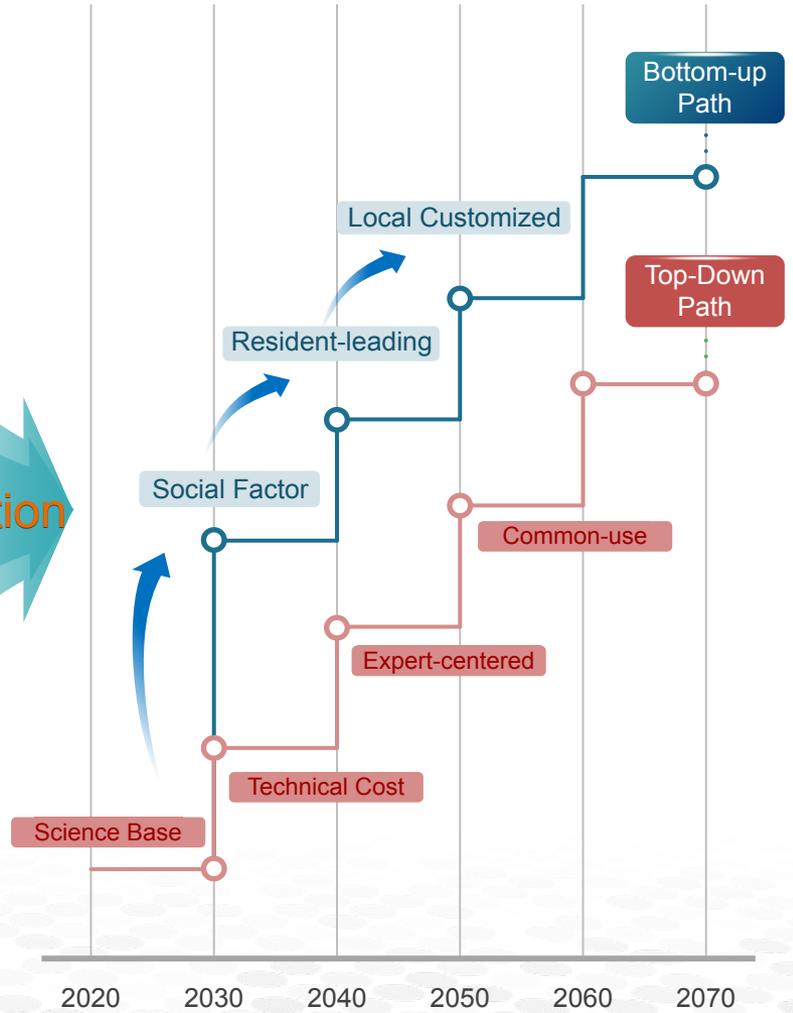
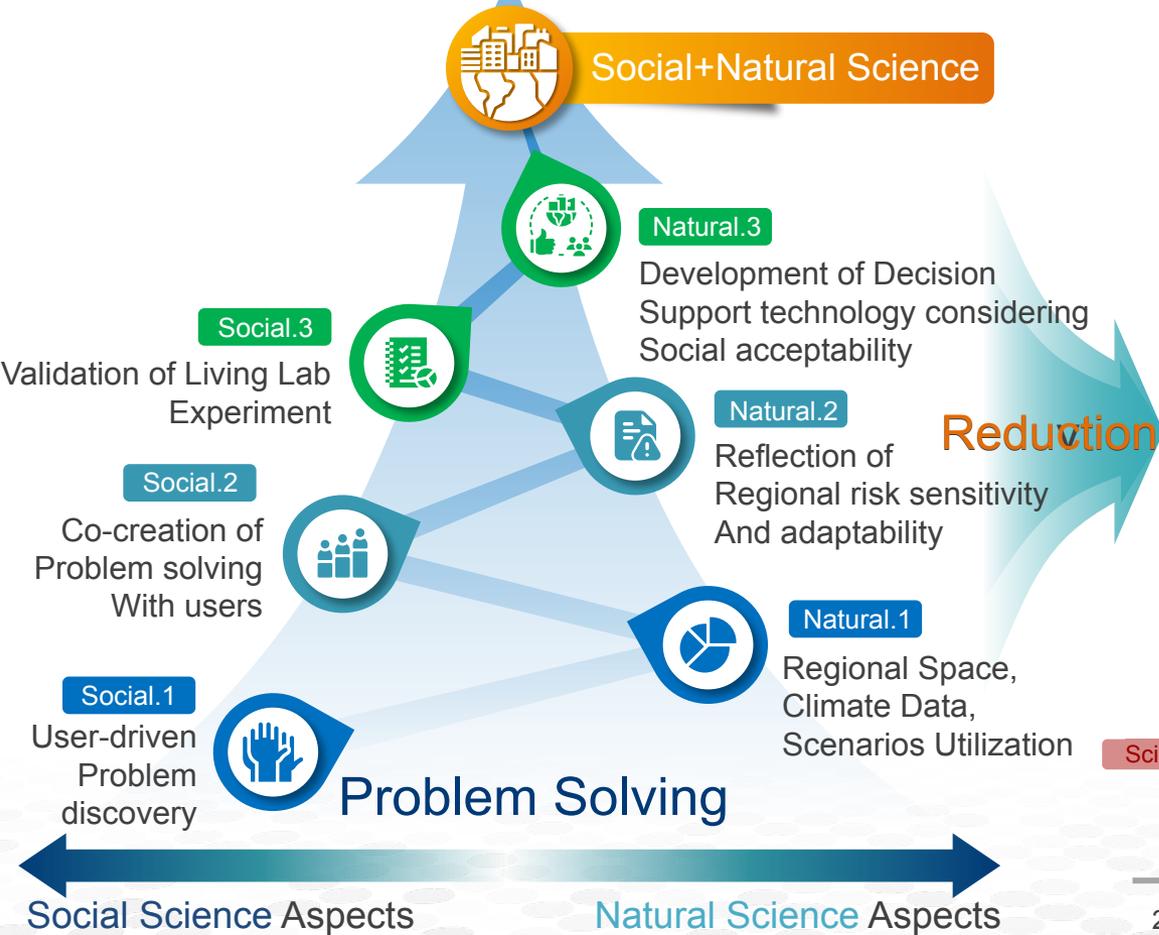


Application
&
Expansion

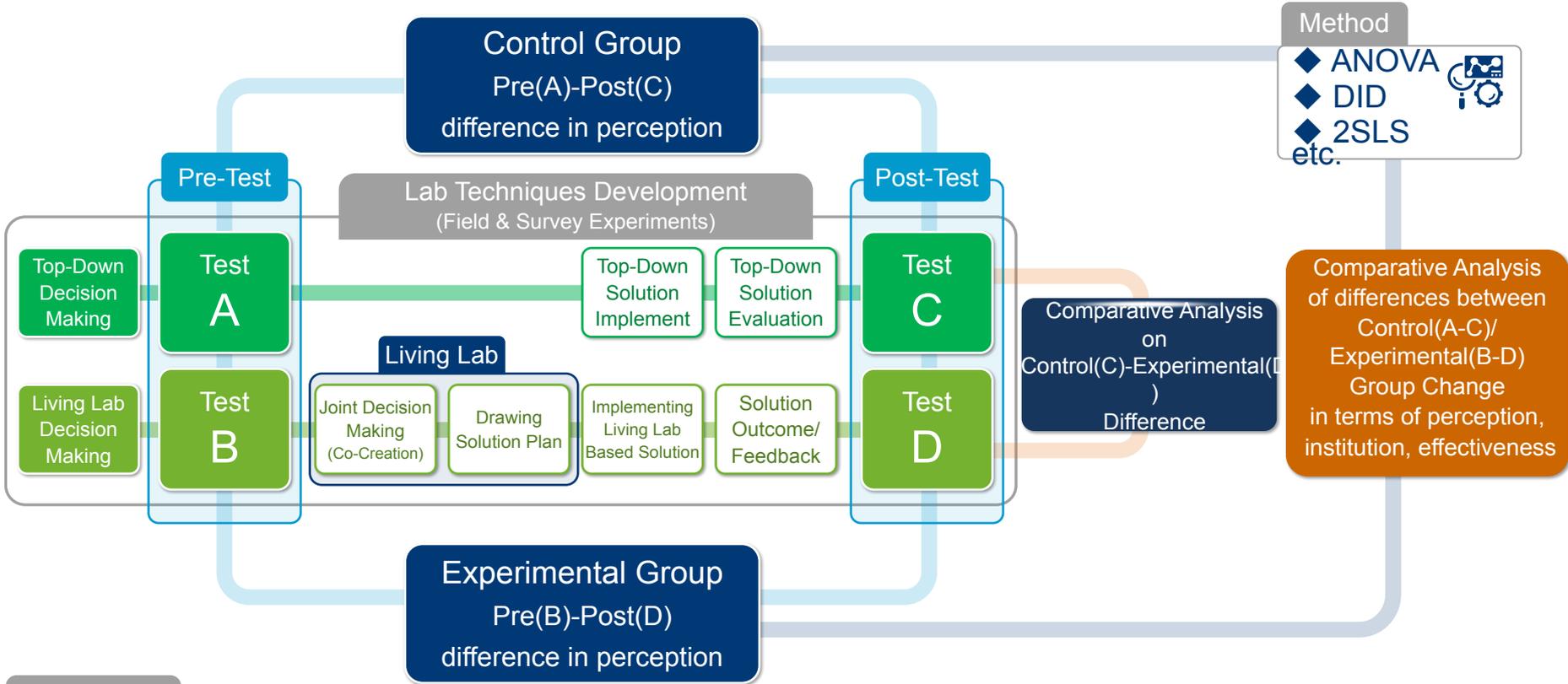


Living Lab Process

Local Customized Transformative Climate Change Adaptation Through Living Lab



Research Method



Variables

Local Government

- Adaptation Attitude
- Resilience
- Policy Effectiveness
- Institution (Ordinance, Program))

Corporation

- Sales
- Corporate Image Change
- Social Value
- Strategy (Policy)

Education

- Problem Recognition
- Problem-solving Capacity
- Living Lab Expandability

Climate Influence Factor

- Air Pollution Information
- Heat Wave days
- Rainfall Intensity
- Climate Environment Assessment

System

- System Utility
- Convenience
- Effectiveness
- Expandability

Final Goals of R&D

Final Goals

Development of Climate Adaptation Living Lab techniques
and Decision-Making Support System



Details

01

Living Lab technique Development

For Climate Change Adaptation Holders

02

Establishing a Decision Support System

For Integration of Adaptation Sectors and Stakeholders

Climate Adaptation Living Lab

Local Government Living Lab 

Corporation Living Lab 

Education Living Lab 

Science Living Lab 

Lab Technique Development

Test Operation

Validation/Spread

Technical Goals

Reflection of the feature
By sectors or holders

Living Lab Technique

Climate Effect
Information
Production Technology

Adaptation Science

Decision Support System

Decision Support Tool

Outcomes

Build a Decision Support System for integration between adaptation
sectors/stakeholders

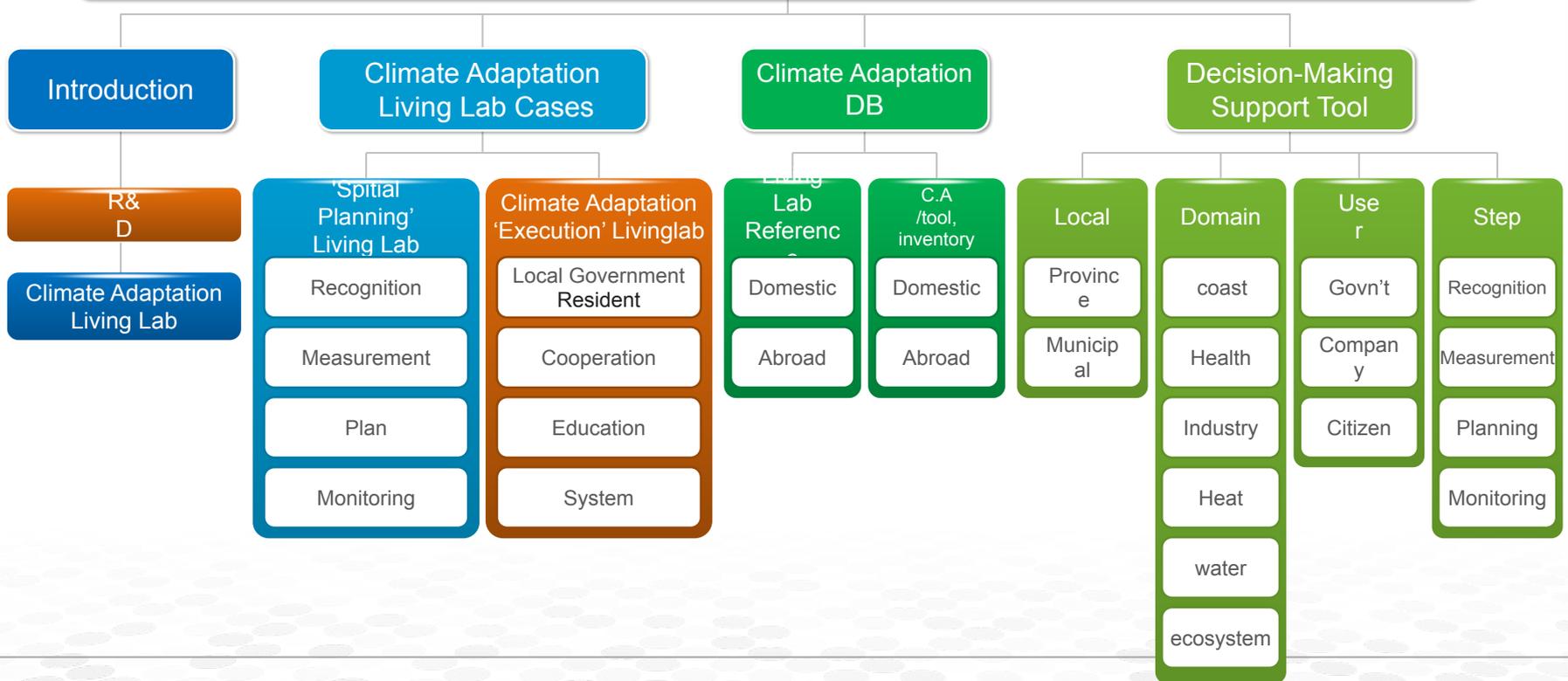


Living Lab Climate Adaptation Decision-Making System

Open system for case, inventory, decision-making supporting system

➔ Living Lab: User Co-creation & Experiment 

Climate Adaptation Living Lab techniques and Decision-Making Support System



Adaptation Decision Support System

Introduction

Inventory

Climate Adaptation

Support Tool

Main Agent

- Local Gov - Regional
- Local Gov - Basic
- Corporation
- Resident

Stage

- Problem Recognition
- Current Situation Measurement
- Program
- Monitoring/ Assessment

Support tool Download

Division	Content
Location	Sinchon-dong
Period	'22.01 ~ '22.12(1년)
Project	Heavy rain plan
Method	Using citizen data collection to identify flood risk areas

Living Lab Climate Adaptation

Seodaemun-gu

Living Lab

Urban flood risk areas identified through living labs

Data Initialization

PRINT

EXPOR

Sector

- Shore
- Health
- Industry, Energy
- Territory
- Water Management
- Ecosystem

Adaptation Option

- Recognition
- Institution
- Adaptation Effect
- Technical Case

Improvement of Climate Change Adaptation Effect

Improvement of Adaptation Option Information Accuracy

Civil Sentiment/Option Reflection

물 관리 부문 적용옵션 예시	
속성정보 1: 불우수출	적용기술
속성정보 2	
속성정보 3	

생태계 부문 적용옵션 예시	
속성정보 1: 생태연적	적용기술
속성정보 2	생태계 보강 사업
속성정보 3	

Improvement of Evaluation Accuracy of Impact in Space Planning

Civil Sentiment/Option Reflection

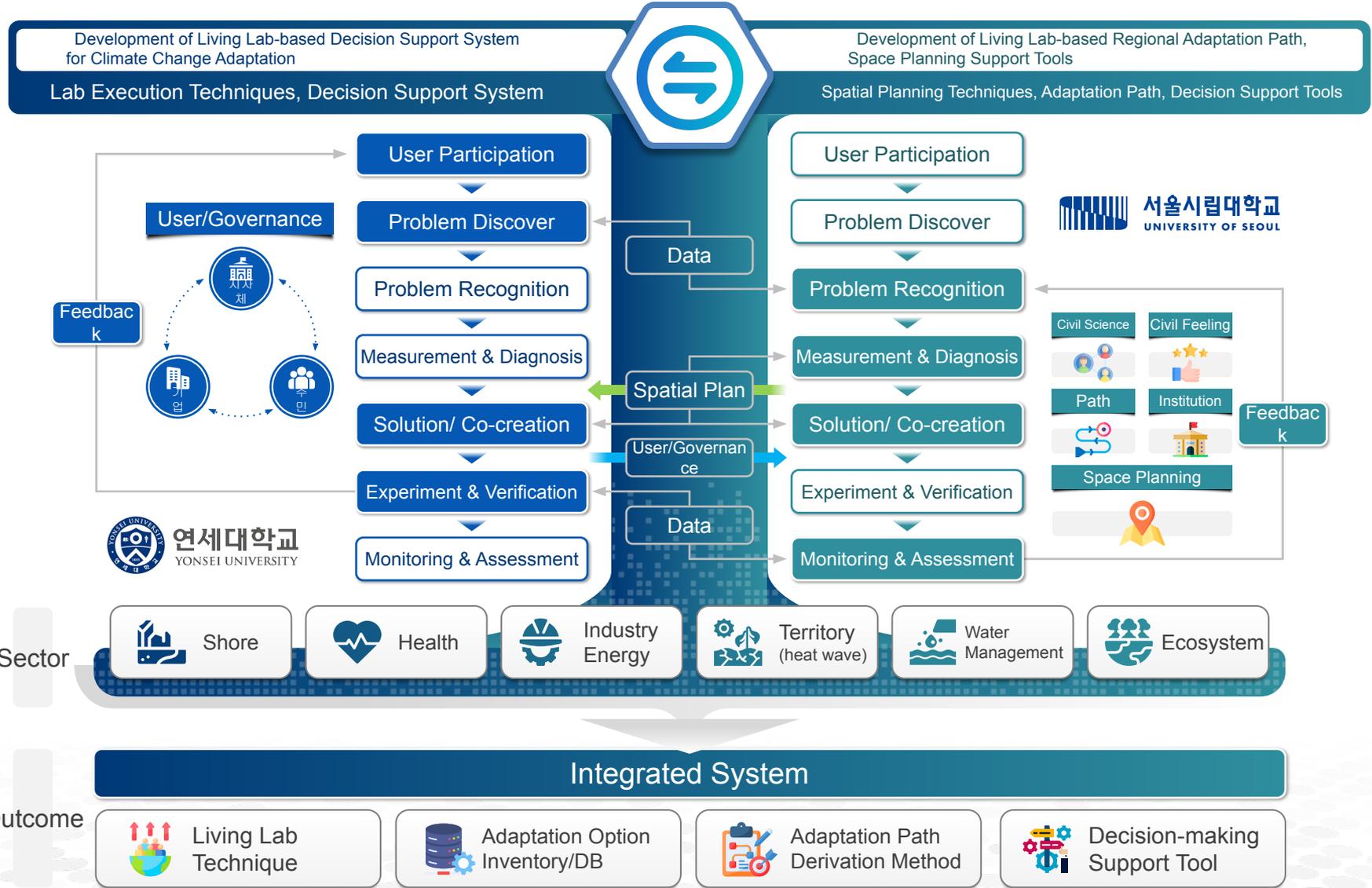
모델에서 평가된 공간계획의 적용효과

시민참여에 따른 적용효과

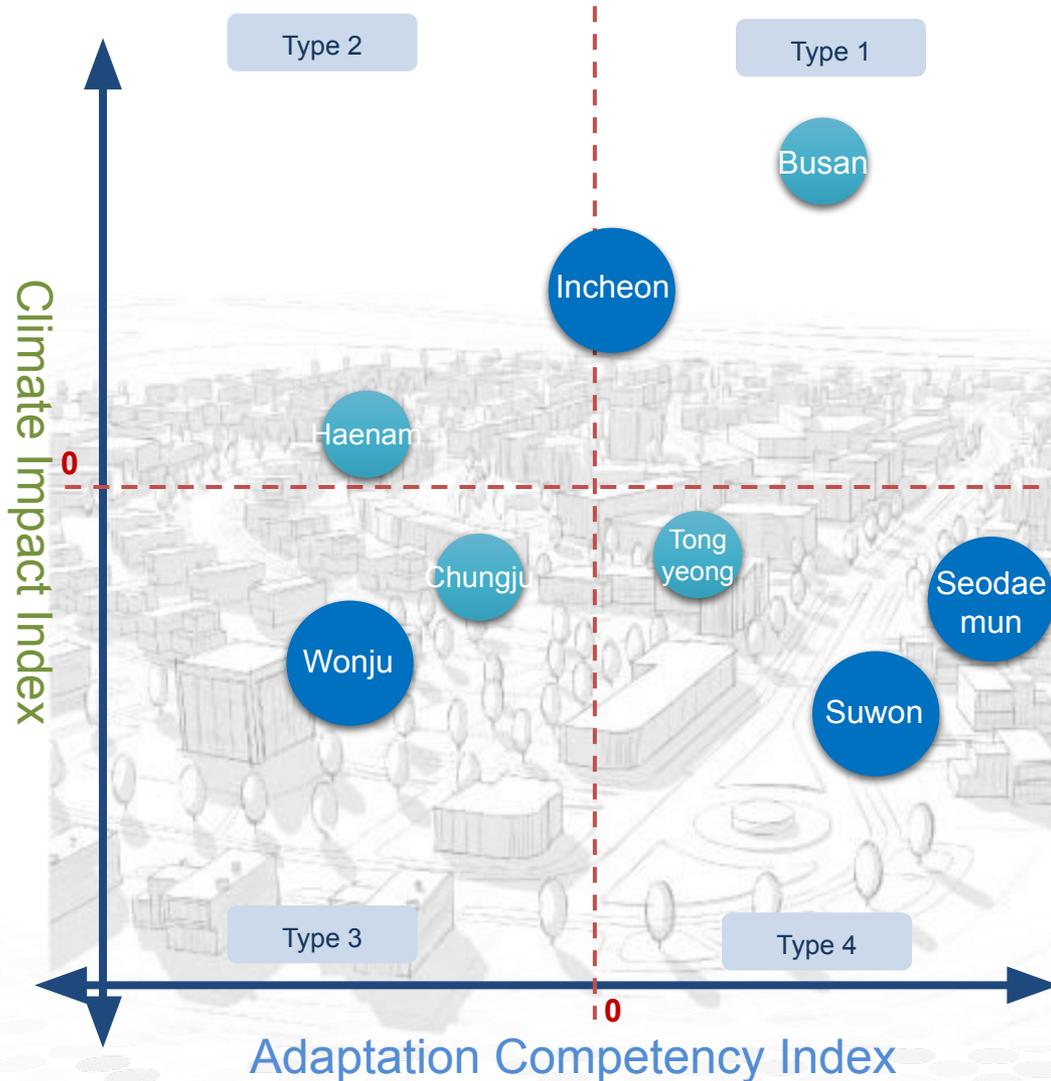
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08 Research Implementation Plan and System

R&D Promotion System



Research Implementation Plan and System REGION: INCHEON, SUWON, WONJU, Seodaemun



- Exposed to climate disaster (shore location)
- Higher percentage of Primary Industry
- Aged Population, Old living alone people
- Higher Local Gov adaptation capacity
- Climate Living Lab (included in Incheon 15 tasks)



- High risk of Climate Change Damage due to high economic capabilities based on advanced infrastructure and population density



- Same as Seodaemun's Type 4: High risk of Climate Change Damage due to high population density and demographicization



- Inland Area in Gangwon Province
- Less disaster exposure and sensitivity

비전 1.5도 선언, 2045 탄소중립 실현
탄소중립 세계도시 인천

탄소 중립 목표

2018년 27,042천톤(발전 제외) 69,242천톤(발전 포함)	2030년 18,197천톤(▲49.1%) 48,383천톤(▲27.0%)	2045년 넷제로(▲100%)
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4대 정책 방향	기원소 경제 생태계 조성	맞춤형 시민 기후응답 확대	글로벌 기후 협력 체계 활성화	안전한 기후유기 적응강화
15대 과제	에너지 전환 가속화 에너지 자립성 건물 확대 신기후 산업 육성 친환경 교통수단 확충	탄소중립 주택안거 서비스 구축 미래세대 교육 강화 녹색실업 운동 확대 기후변화 리빙랩 추진	기후 클러스터 조성 기후주체(시민·기업·공공) 확대 글로벌 네트워크 구축	탄소 흡수원 확충 자연의 선순환 강화 공명권 전환 실현 맞춤형 기후복지 실현
기반 체계	제도/재무구조 - 인천시·광역시·자치단체 - 탄소중립 특구 지정 - 인천시·광역시·자치단체	거버넌스 혁신 - 인천시·광역시·자치단체 - 탄소중립 거점형 운영 - 인천시·광역시·자치단체	국제 리더십 - 탄소중립 인화 5차 - G27 Complete 2022	재원 확보 방안 - 기후특구 지정 - 재정투자 연계에 주력

• 1.5도 선언서인행: 송도에서 개최된 제68회 UNFCCC 총회(11.10.5)에서 채택된 지구온난화도 1.5°C목표를 실현하는 UNFCCC특별보고서 최종본인

• 1.5도: 유엔기후변화협약(UNFCCC) 총회(11.10.5)에서 채택된 지구온난화도 1.5°C목표를 실현하는 UNFCCC특별보고서 최종본인

Phasic Research on Local Government Climate Adaptation Living Lab

Phasic Research Plan

Process

Living Lab Technique Development

Step 1 ✓ Conceptualize & design

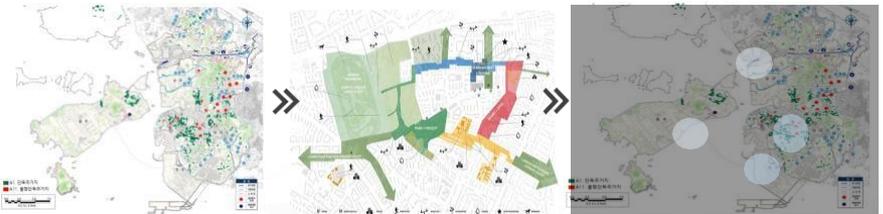
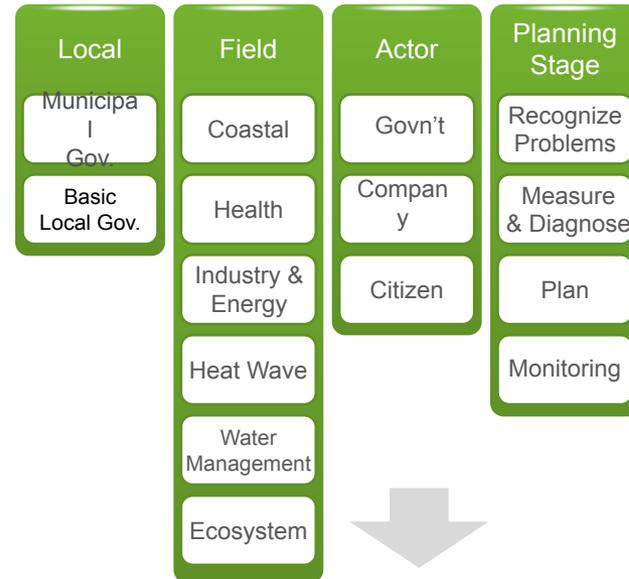
- Categorization/Case selection
- MOU with local governments
- pre-research
- Guideline Design

Step 2 ✓ Pilot Operation

- Climate Adaptation Pilot Operation
- Resident- Local Government co-decision-making solutions
- Validate the utility of living lab techniques:
..... Validate causal effects

Step 3 ✓ Test Operation with system

- Manual for users
- PR, Education, and expansion



- Developing Govn't climate adaptation plan
- Establishing the Decision Support System

Utilization of Research Results

State, Local Government, Corporation, Public Institution Adaptation Plan

- Reflection on collective effect of Climate Change Adaptation Behavior like Inundation, Drought, Water Management, Heat Wave, Ecosystem Conservation
- Present Urban-Corporate Adaptation Technique and Policy Guideline
- Evaluation on impact and vulnerability by sector, regional, stakeholder



Report to the International Community

- Utilization as system of reporting local government-leading adaptation efforts and accepting to the international community
- Monitoring and Evaluation
 - using in bottom-up reporting, top-down verification



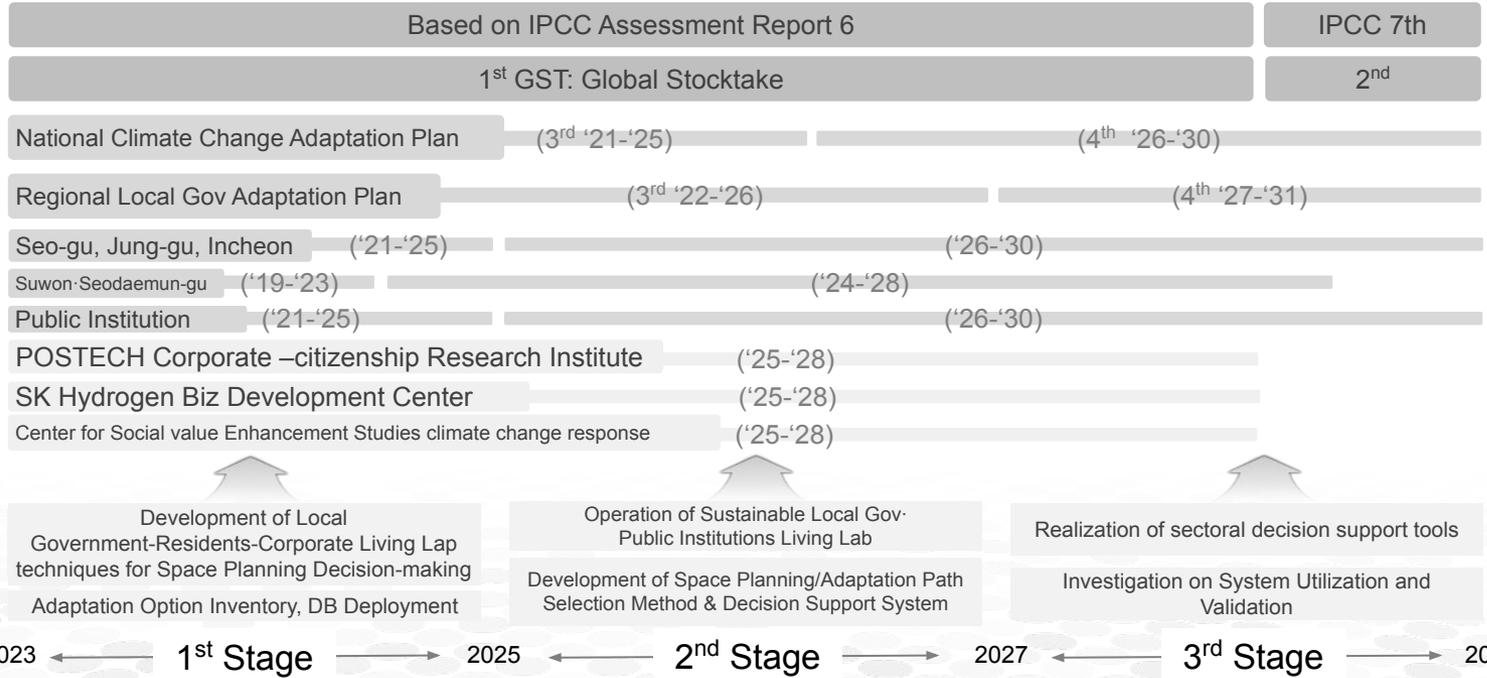
International Report

National, Regional Adaptation Measure

Detailed Implementation Plan of Basic Local Gov, Public Institution

Corporate-level Climate Change Response Report

Task Performance



Researchers Composition

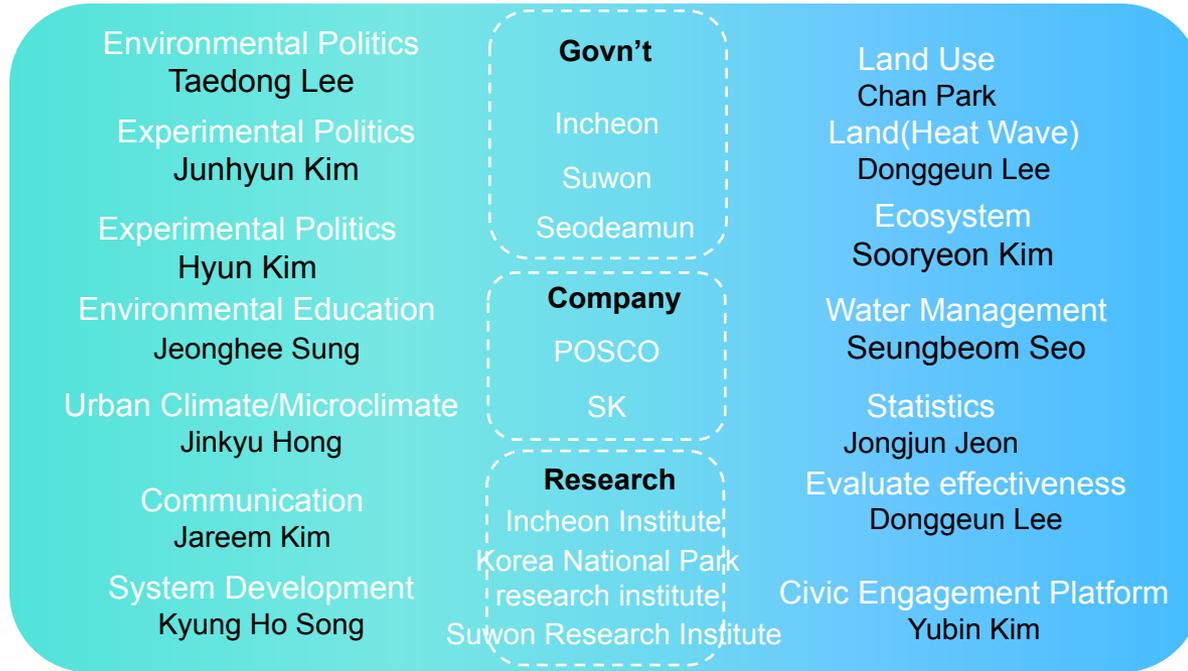
Principal Investigator

Prof. Taedong Lee

Convergence Researchers

Policy·Social Science professionals

Spatial·Environmental Science professionals



Building integrated systems

cooperation

Develop a spatial planning decision support tool package

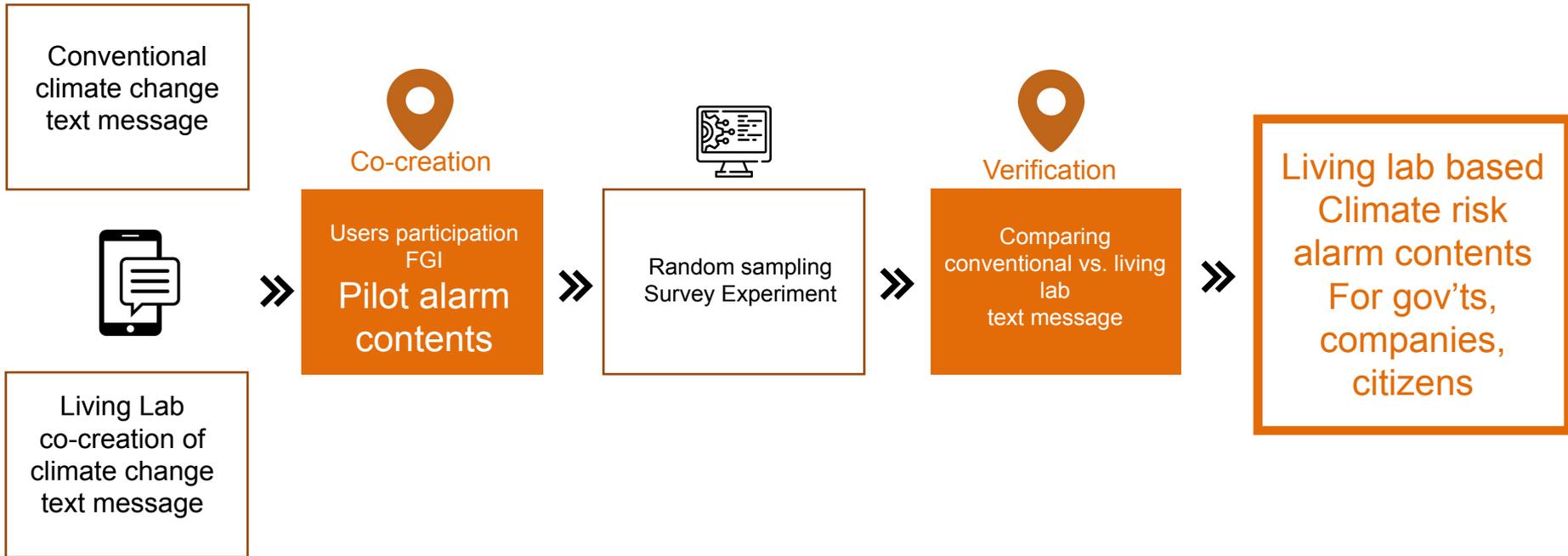
04

Development and Implementation of Living Lab

: Climate Disaster Messages and Shade Adaptation

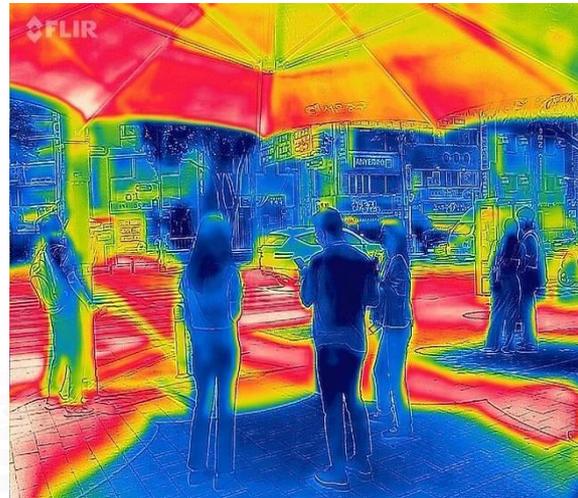


Climate Disaster Alarm message system based on living lab message creation and verification



What is Shade Adaptation?

- **'Shade Adaptation'** means installing and operating shade structures at pedestrian crossings, sidewalks, and bus stops as a visible climate adaptation measure
- Since 2017, Korean municipalities have been increasingly installing shade structures to protect citizens from intensifying heat waves
- Research shows a temperature reduction of 3–16 °C between shaded and unshaded areas, with consistently high satisfaction among citizens



Significance of Shade Adaptation

Rising urban heat risks

- **Climate change is intensifying heat waves worldwide, and shade adaptation offers immediate protection under these extreme conditions.**

Institutional and infrastructural gaps

- **Shade infrastructure is still missing in many Southeast Asian cities. Shade adaptation offers proven models that can be shared.**

Pathway to global cooperation and innovation

- **Shade adaptation goes beyond local comfort, creating an exportable package of technology, policy, and practice that can become a globally recognized climate adaptation solution.**



Collaboration on Climate Adaptation Living Labs with Osaka University and Philippine Local Governments