



# **SMART & RESILIENT**

## **BANGKOK BEST PRACTICES**

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# Smart city



A smart city is an urban area that uses different types of electronic Internet of things sensors to collect data and then use these data to manage assets and resources efficiently.



- **Resilient Cities.** Resilient cities are cities that have the ability to absorb, recover and prepare for future shocks (economic, environmental, social & institutional).
- **Resilient cities promote sustainable development, well-being and inclusive growth.**



- Ideally it should be interlinked but, in reality, most of the smart city projects are revolving around singular projects focusing on governance and IT solutions where the disaster component is not pronounced.
- **The smart city concept has been playing around for at least last 20 years under various names like sustainable city, green city, eco-city etc.**







# UNISDR

The United Nations Office for Disaster Risk Reduction

- **UNISDR started resilient cities project which is mainly focusing on disasters and propose the strengthening of government, community and other stakeholders for reducing the future impact of any disaster both physically and economically.**

An aerial night photograph of Bangkok, Thailand, showing the Chao Phraya River winding through the city. The skyline is filled with illuminated skyscrapers and buildings, with light trails from traffic on bridges and roads. A large construction crane is visible atop a tall building under development in the upper right. The sky is a mix of purple and blue from the twilight.

# **BANGKOK**

## **Thailand**



With more people than ever before living in and engaging with the city, it is a critical time to look ahead and make a plan for a better, more resilient Bangkok. One that is safe, livable and sustainable for all.





- How can we make Bangkok a vibrant city of opportunity for everyone, rather than a select few?
- **How can we create space for collaboration and communities, rather than of division and exclusion?**
- How can we work together to embrace water and its opportunities and values, rather than battle to keep it out?



**The most urgent threats to Bangkok's resilience and the integrated and participatory actions will focus on three, interconnected Strategic Action Areas.**

**INCREASING QUALITY OF LIFE**

**REDUCING RISK AND INCREASING ADAPTATION**

**DRIVING A STRONG AND COMPETITIVE ECONOMY**

**Each Strategic Action Area comprises a number of goals and each goal has a range of initiatives with specific, implementable projects.**

# BRIEF HISTORY

- Bangkok, or Krung Thep Mahanakorn in Thai, means the City of Angels.
- It is Thailand's capital and the national centre of administration, education, transportation, finance and commerce and development.





- Central Thailand is known for its flat and fertile plains which are reliant on natural and man-made waterways to irrigate and drain farmland during dry and green seasons.
- **This centuries-old relationship with water, as the source of life and livelihoods, means the city is no stranger to floods and the disruption caused by severe weather, which is now intensified with climate change.**



- Freight is transported up the Chao Phraya to Northern provinces, and down to the Gulf of Thailand on barges.
- The importance of roads in attracting national and global investment emerged in 1851, with rail and tram transport connecting Bangkok to neighboring areas.





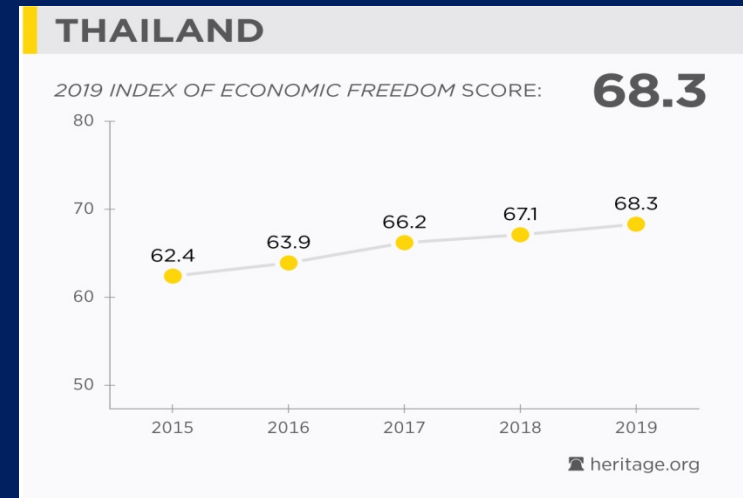
- The city's rapid growth and industrial success has made it a magnet for migration from across the country and beyond, marking the beginning of a trend of rapid urbanization, which to this day, shows no signs of slowing down.





# CITY IMPORTANCE AND NATIONAL AND REGIONAL CONTEXT

- Thailand has demonstrated remarkable economic progress experiencing 21 per cent growth in Foreign Direct Investment inflows over the past 6 years, compared to the global percentage of 0.7%.
- Occupying the 4th rank in Asia's top prospective host economies, Thailand has gained a solid reputation as a second home for various global multinational enterprises (MNEs).



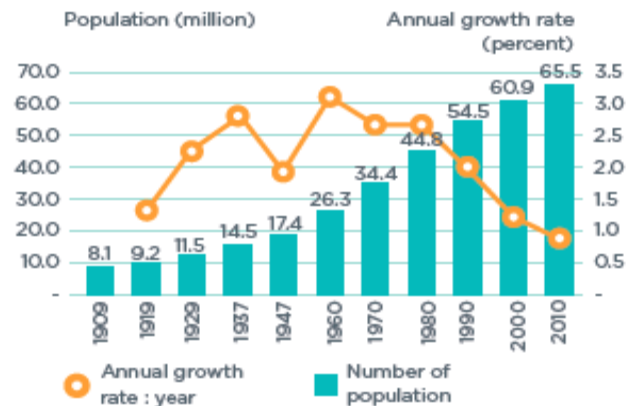
# CITY DYNAMICS URBANIZATION

- Bangkok is world renowned for its incredible street food, shopping and architecture and as a base for important tourism and business sectors.
- **The way traditional and modern practices come together is a critical part of its attractiveness to visitors and those who live here.**
- It also reflects, and caters for a significant income divide, which is experienced in most large cities.
- **The authorities, as well as Bangkok's citizens, are working to build their economic opportunities, and it is critical that legislative, social and governance structures support fair livelihood opportunities for all Bangkok citizens individually to contribute to the country's economy.**

Figure 3: Number of Tourists in Thailand



Figure 4: Population of Thailand

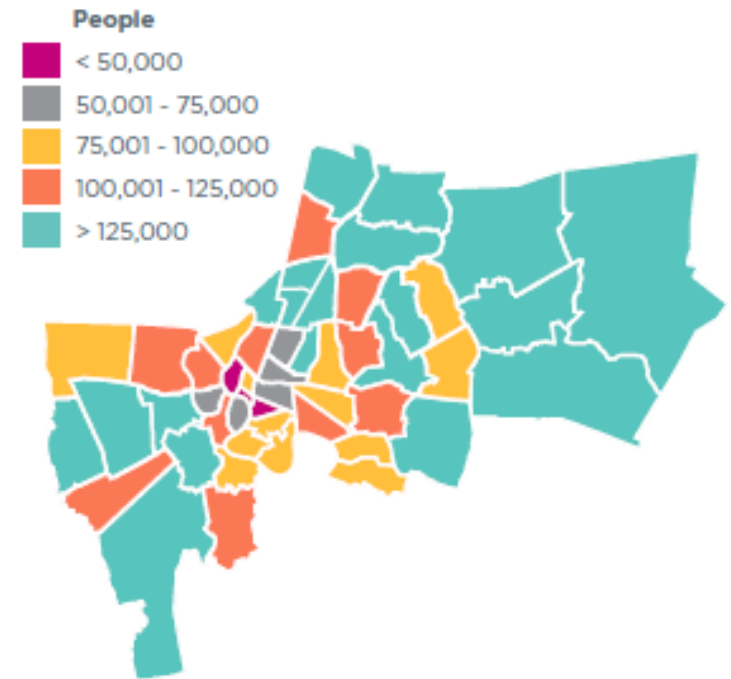


# CITY DYNAMICS URBANIZATION

Effective control of land use in Bangkok influences a great number of other development areas including :

- industrial and agricultural output,
- transportation,
- water and food security,
- environmental protection,
- climate change,
- drainage and solid waste management,
- subsidence control,
- migration and illegal immigration,
- disaster mitigation and
- social welfare.

Figure 5: Population Density Map of BMA Area



# WHY DO WE NEED TO WORRY?

## RESILIENCE CHALLENGES TRANSPORT AND AIR QUALITY

- One of the most obvious urban problems for Bangkok is its traffic congestion.
- **Bangkok experiences the second worst traffic congestion in the world after Mexico City (TomTom, 2016).**
- Insufficient public transportation facilities and increasing private car ownership have caused an acute problem across major thoroughfares in the city for over a decade.



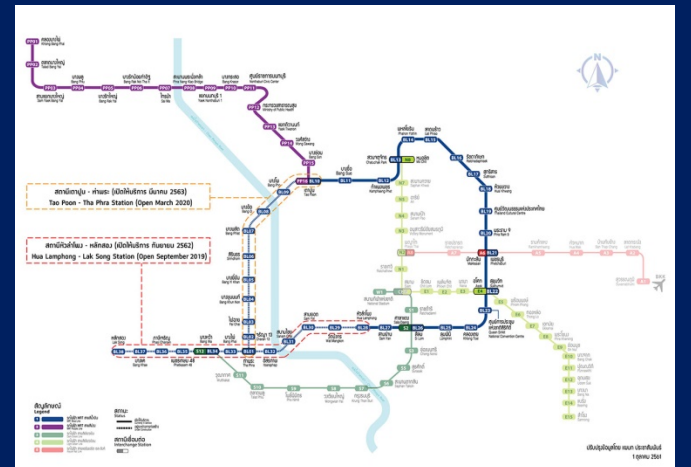


# WHY DO WE NEED TO WORRY?

- The road system has not been able to keep up with the city's intensifying road use.
- **The daytime commuting population is so high in number that congestion problems have remained despite the construction of several high-speed elevated expressways.**
- The use of private vehicles by city dwellers and those commuting from surrounding areas has reached 53 percent and is projected to rise to 59 per cent by 2037.

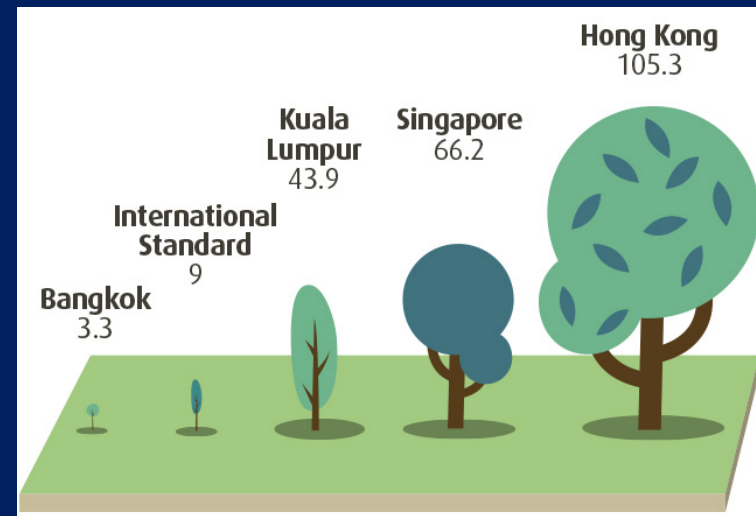


- Recent electric-powered underground and overhead ('BTS Skytrain') transport links have provided many commuters with traffic-free, but relatively expensive options; however old buses and an ever-growing number of cars, vans and trucks continue to be a critical way to transport goods and people around the city.
- **Blocked roads and harmful carbon monoxide emissions cause difficulties as well as serious health issues.**
- The city needs a complex and widespread system of rail, boat, sky train and underground mass transit systems to answer all the requirements for a cheap, resilient and extensive public transport system which reaches to the suburbs where most residents need it





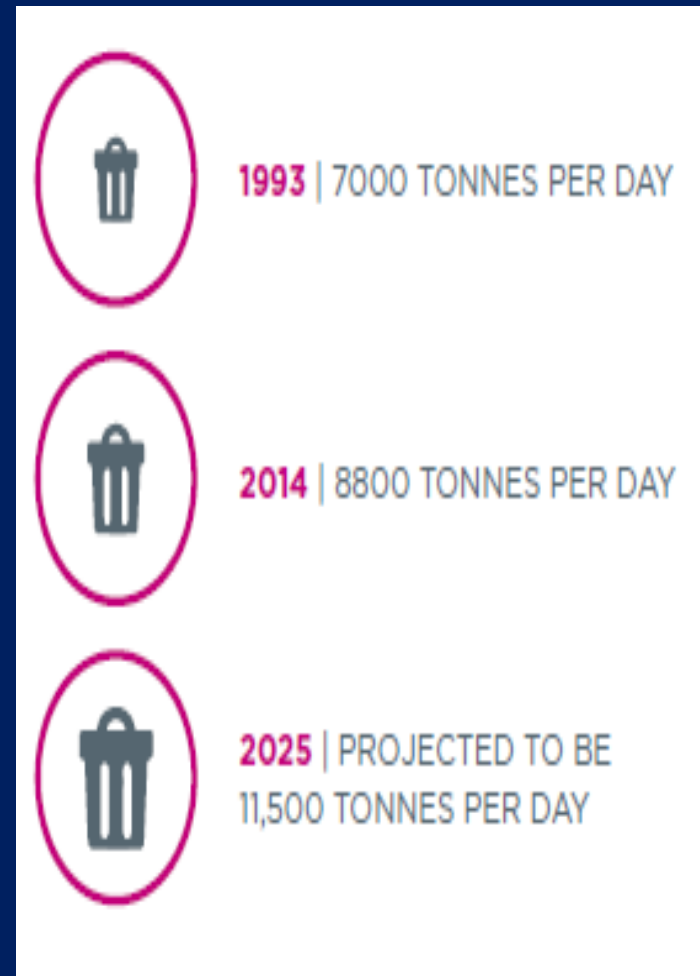
- Bangkok has one of the lowest percentages of green areas of any major capital in Asia.
- On average, urban citizens in Asia enjoy 39 sq.m. of green space each, while Bangkok has a mere 3sq.m.
- Green areas act as a CO2 sink and filter many pollutants from the air, thereby improving air quality and lowering the health risk.
- Resilient development that balances environmental conservation, and the health and wellbeing of the population remains a challenge for Bangkok





# WASTE AND WATER

- Bangkok faces challenges related to the separation of solid waste once collected. Much of this waste could be dealt with more sustainably.
- **Around 14 per cent is recyclable, and up to 48 per cent is organic waste and could be mulched, incinerated or otherwise disposed of.**
- In response to this challenge, the city is focusing on improving the efficiency of organic waste management and supporting solid waste reuse and recycling.



# WASTE AND WATER

- Bangkok is also situated between 1 metre below and 2 metres above mean sea level.
- Those areas below sea level are particularly vulnerable to any changes in water level.
- This threat will become more important as relative sea-levels rise, both from subsidence and as a result of a changing climate.
- Relative sea-level rise increases the risk of salt-water incursion into the Chao Phraya River as well as increasing flood risk in the delta as water drains slower in times of flood and high river water.



# FLOOD RISK

- With the trend of urbanization, water bodies were slowly replaced by settlements and roads, and Bangkok started to experience floods as one of the first recognized urban hazards.





An aerial perspective of a futuristic Bangkok skyline. The scene is dominated by several tall, modern skyscrapers with glass and steel facades. The most prominent building on the right is a very tall, slender tower with a golden-brown vertical stripe. To its left are several other high-rise buildings of varying heights and designs, some with unique architectural features like cantilevered sections. The foreground shows a mix of urban development, including lower-rise commercial buildings, parking areas, and green spaces with trees. A body of water is visible on the left side of the image. The sky is a clear, light blue, suggesting a bright, sunny day. The overall impression is one of a highly developed, modern city.

# **BANGKOK FOR TOMORROW**

# STRATEGIC ACTION AREA 1: INCREASING QUALITY OF LIFE

- Goal 1: health and wellbeing for all city residents, now and into the future
- **Goal 2: safe, accessible and convenient transportation network**
- Goal 3: environmentally friendly urbanization (green space, pollution, traffic)





# GOAL 1: HEALTH AND WELLBEING FOR ALL CITY RESIDENTS, NOW AND INTO THE FUTURE

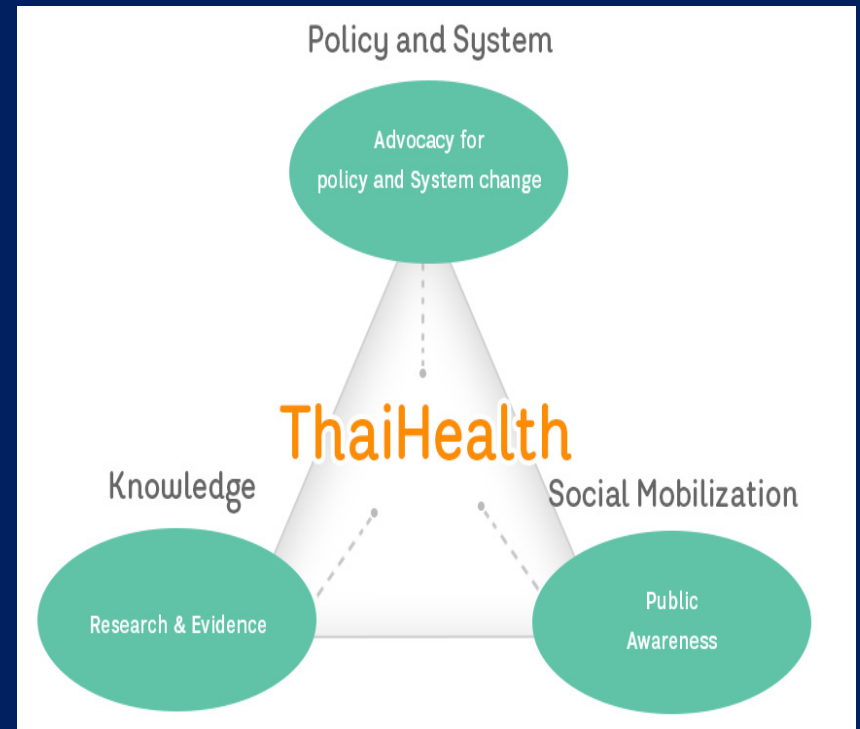
- To address health-related issues and the physical wellbeing of different population segments in the city, this goal will focus on improving systems to deliver comprehensive health care services.
- **Specific groups who are vulnerable to health conditions, including the elderly, migrant workers, and those living in squalid environments will benefit from the following interventions:**
  - Promoting healthy living and lifestyles
  - Epidemic prevention in urban communities
  - Preparing for quality ageing.





# 1.1 PROMOTING HEALTHY LIVING AND LIFESTYLES

- Living in a busy city can result in less healthy lifestyles, which can increase the risk of non-communicable diseases, including diabetes.



# 1.2 PREPARING FOR QUALITY AGEING

Consisting of the three sub-projects described below, this initiative will address the implications of ageing from various perspectives – social, economic, environmental, mental, and behavioral.

1.2.1 Support for elderly residents

**1.2.2 Preparing the population aged 18 – 59 for old age**

1.2.3 Accessibility and safety of transport options for senior citizens



## GOAL 2: SAFE, ACCESSIBLE AND CONVENIENT TRANSPORTATION NETWORK

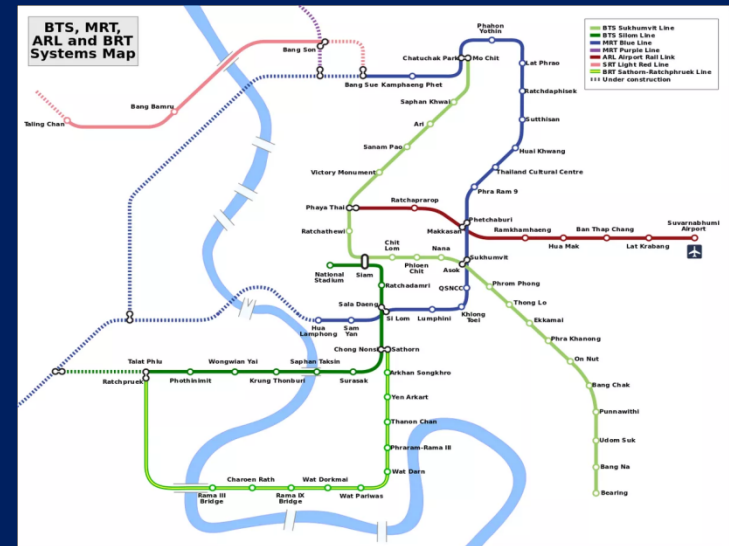
- The mobility of Bangkok residents is currently limited by significant traffic and inadequate and over-capacity public transport systems.
- These are complicated and interrelated issues –safe, accessible and convenient solutions that meet the diverse needs of different segments of the population.





# 2.1 INTEGRATED MASS TRANSPORT SYSTEM

- Mass transit systems are widely recognized as an effective part of the solution to traffic congestion in mega-cities. to make the public transport system in Bangkok more effective, linking its mass transit system to the city's other public transportation networks
- Under the current plan, due to be delivered by 2029, this will be expanded to 548 km. better connecting these systems is the core of this goal.



# 2.1 INTEGRATED MASS TRANSPORT SYSTEM

2.1.1 Integrated mass transport system master plan

2.1.2 Expansion of monorail feeder and light rail system

2.1.3 Expansion of the water transport network



## 2.2 IMPROVING TRAFFIC FLOW IN THE CITY

- Given that Bangkok citizen still predominately travel by road, traffic congestion, road conditions and driver behaviour is a major challenge in many people's daily lives.
- **This initiative seeks to improve traffic flow through a range of interventions.**





## 2.2 IMPROVING TRAFFIC FLOW IN THE CITY

2.2.1 Integrated information system for traffic management and planning

2.2.2 Reducing traffic congestion around schools

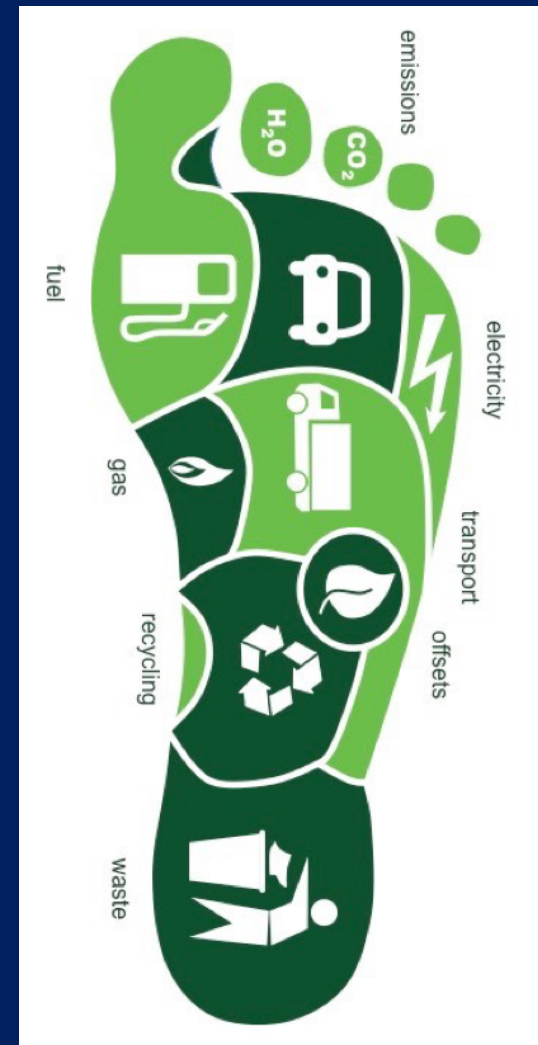
2.2.3 Study of integrated management of road network and development of a master plan

2.2.4 Feasibility study for driving credit measures and taxes



# GOAL 3: ENVIRONMENTALLY FRIENDLY URBANIZATION

- Bangkok seeks to be a world leader among other Asian cities that have experienced rapid and unplanned growth, waste management and land use challenges that impact on the health and wellbeing of its citizens.
- **BMA's program to lower the city's carbon footprint and lessen the effects of carbon emissions**



## GOAL 3: ENVIRONMENTALLY FRIENDLY URBANIZATION

- Green growth: supporting environmentally friendly growth and sustainable waste management
- Encouraging low-carbon transport
- Growing green space
- Improving air quality management and communication.





# **3.1 GREEN GROWTH: SUPPORTING ENVIRONMENTALLY FRIENDLY GROWTH AND SUSTAINABLE WASTE MANAGEMENT**

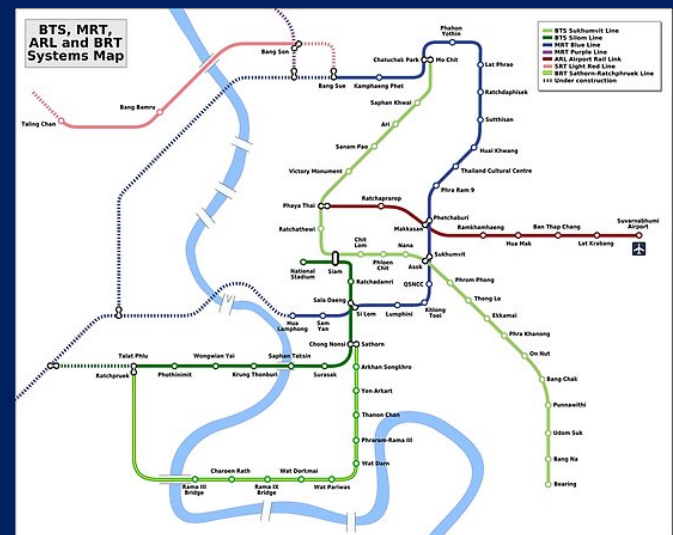
## **3.1.1 Sustainable waste management**

## **3.1.2 Development of waste-to-energy**



## 3.2 ENCOURAGING LOW CARBON TRANSPORT

- Access to, and use of, low carbon transport options in Bangkok will be increased by these two projects.
- By promoting existing emission-free transport and looking into building new bicycle pathways across the city, car use would be reduced and commuters will enjoy safer journeys with less traffic.



## 3.2 ENCOURAGING LOW CARBON TRANSPORT

3.2.1 Encouragement of environmentally friendly transportation

3.2.2 Study on enhancing cycling pathways and facilities

3.2.3 Improving air quality management and communication





## 3.3 GROWING GREEN SPACE

3.3.1 Developing new recreational parks

3.3.2 Promote public engagement and measures to sustainably increase green space

3.3.3 Development of green space and riverside promenade along the banks for the Chao Phraya river



# STRATEGIC ACTION AREA 2: REDUCING RISK AND INCREASING ADAPTATION

- By supporting community-led disaster risk reduction action and strengthening institutional adaptive capacity,
  - **BMA will support all Bangkok residents to better adapt to natural hazards and the increasing risks posed by the changing climate.**
  - Increase Bangkok's capacity to withstand a range of shocks and stresses.



# STRATEGIC ACTION AREA 2: REDUCING RISK AND INCREASING ADAPTATION

**GOAL 4: Improving resilience to floods**

**GOAL 5: Increasing public and community-driven action on awareness, preparedness and adaptation**

**GOAL 6: Stronger institutional capacity and regulation**





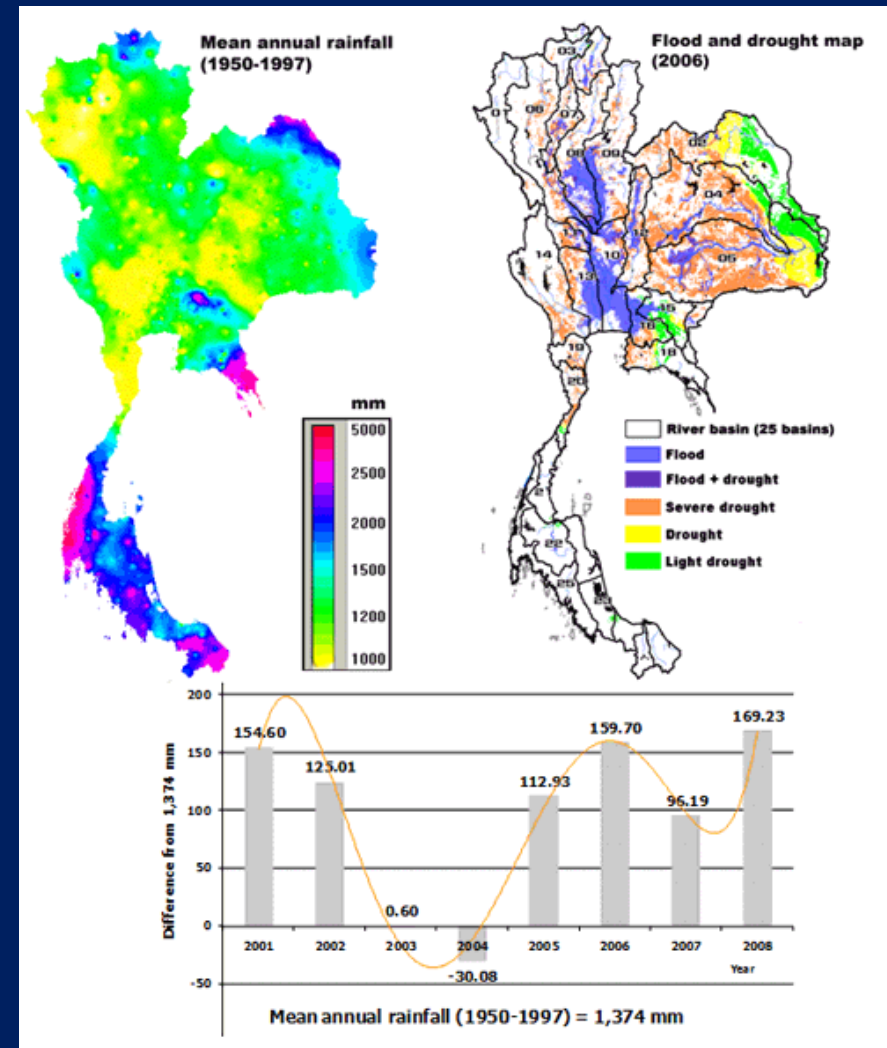
# GOAL 4: IMPROVING RESILIENCE TO FLOODS

- As a flood-prone city facing a changing climate, through different approaches for ‘living with water’.
- **More integrated and holistic way to manage different city water systems, rather than solely depending on flood protection via hard infrastructure.**



# GOAL 4: IMPROVING RESILIENCE TO FLOODS

- Initiatives to deliver this goal will focus on conservation and development of the city's blue and green infrastructure, primarily by improved catchment management, open space, and green areas to maximize natural infrastructure for water management.
- This will be combined with specific flood defence actions such as upgrading drainage and trialling the use of a flood resilience index in an urban area.



# 4.1 CATCHMENT MANAGEMENT STRATEGY AND VISION FOR THE CHAO PHRAYA BASIN

- With a changing climate and increasing urban development, catchment management in the Chao Phraya basin will only become more complex and important.
- This initiative will help to provide a clear narrative on how Bangkok, and cities up-stream, will approach holistic catchment management and set a future direction and objectives for innovative water management in the city.
- This require cooperation across the city on a new approach, not only to protect the city from flooding, but to harness water in the city for life and liveability



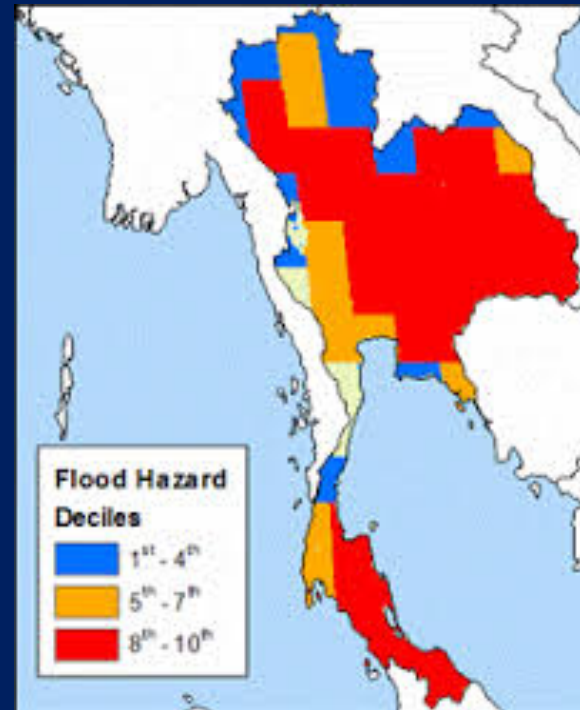


# 4.1 CATCHMENT MANAGEMENT STRATEGY AND VISION FOR THE CHAO PHRAYA BASIN

4.1.1 Study of lower Chao Phraya basin and setting vision for water management in Bangkok

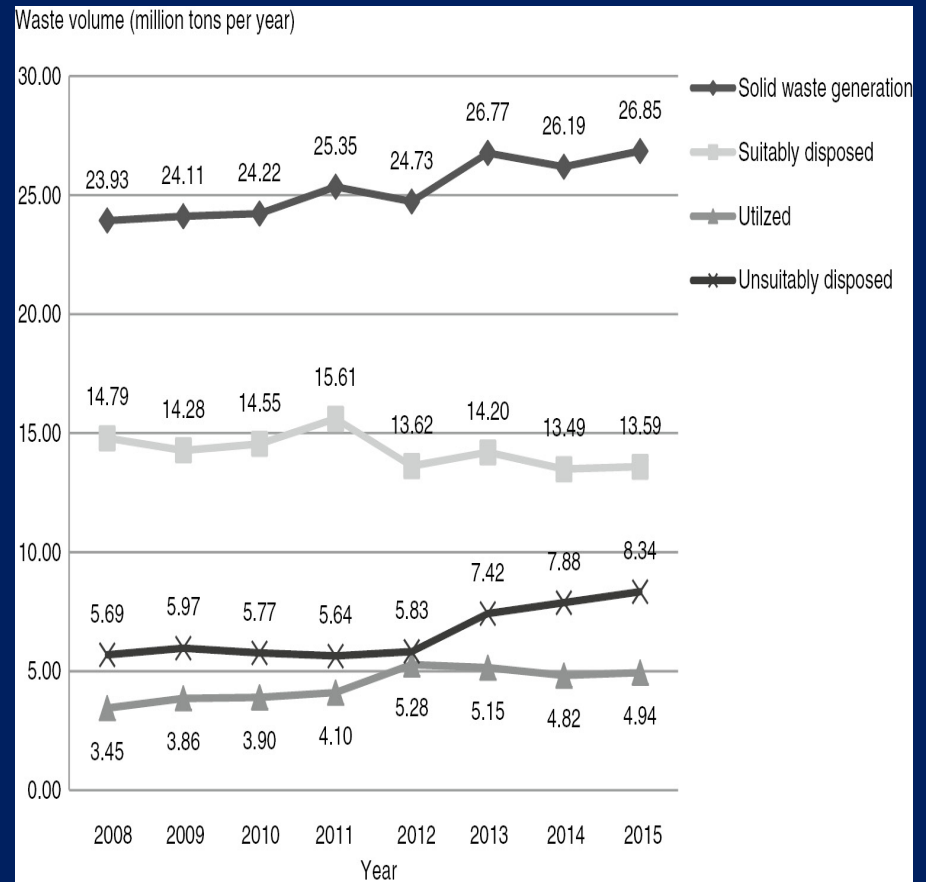
4.1.2 Development of a flood hazard map for management and to communicate with the public on preparation for flood events

4.1.3 Enhance effectiveness of weather and rainfall forecasts



## 4.2 COMMUNITY WATER RESOURCE MANAGEMENT PROGRAM

- Poor waste management and lack of prioritization of water resource conservation, has seen these watercourses decline in quality and amenity.
- This initiative highlights the critical contribution that the community has in water resource management and waterways restoration.
- Promoting community adaptation to a changing climate and urbanization, reduce waste and improve water quality and flood protection.



## 4.2 COMMUNITY WATER RESOURCE MANAGEMENT PROGRAM

4.2.1 Community water resource management

**4.2.2 Water-sensitive marketplace**

4.2.3 Management of waste collection for canal communities





## **4.3 URBAN FLOOD DEFENCES**

**4.3.1** Revision of design criteria for drainage

**4.3.2** Pilot study on developing urban water retention

**4.3.3** Improvement of drainage systems along main roads

**4.3.4** Development of drainage tunnels

**4.3.5** Improvement of major canals

**4.3.6** Study of the feasibility of developing combined utility tunnels

**4.3.7** Feasibility assessment of Flood Resilience Index (FRI) –Sukhumvit case study

## GOAL 5: INCREASE PUBLIC AND COMMUNITY DRIVEN ACTION ON AWARENESS, PREPAREDNESS AND ADAPTATION

- Bangkok is exposed to a number of different shocks and stresses which affect city residents exacerbated by climate change.
- **Effective communication systems through multiple channels and networks will improve promptness in emergency monitoring, alertness and responsiveness.**



# 5.1 COMMUNITY-BASED ADAPTATION AND DISASTER PREPAREDNESS AND COMMUNICATION

5.1.1 Community-based  
disaster risk  
management pilot

5.1.2 Community flood  
preparedness  
communication

5.1.3 Youth education  
program for disaster  
safety

5.1.4 Disaster Learning  
Centre for earthquake  
and fire hazards





# 5.2 MAKING BETTER USE OF TECHNOLOGY FOR PUBLIC COMMUNICATION AND DISASTER PREPAREDNESS

## 5.2.1 Disaster preparedness and flood information communication



Location

Flood Depth

Photo

Description

Submit

# GOAL 6: STRONGER INSTITUTIONAL CAPACITY AND REGULATION

- Striving to make Bangkok safer to live for all, BMA, as the primary agency for city administration, must be fully versed in disaster mitigation, preparedness, response and recovery.
- **Complex urbanization and multi-layer facilities and systems to run city functions make urban disaster management a unique discipline that requires a mix of expertise and practical skills to address.**



# GOAL 6: STRONGER INSTITUTIONAL CAPACITY AND REGULATION

- The capacity and capabilities of BMA to be able to reduce risks in Bangkok need to be assured, especially their ability to carry out emergency operations which require practical knowledge and skills.
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- **Certain areas that the city should target for capacity development include search and rescue, emergency drills in a given scenario, coordination mechanisms, and communications.**





# 6.1 CAPACITY BUILDING FOR DISASTER RISK REDUCTION IN BMA

6.1.1 Disaster prevention and mitigation drills

6.1.2 ASEAN city network and cooperation on disaster prevention and mitigation

6.1.3 Search and rescue training program

6.1.4 Resilience training for BMA social planners and analysts



# 6.2 RESOURCES AND INFRASTRUCTURE FOR BETTER PREPAREDNESS AND RESPONSE

6.2.1 Inspection of BMA buildings for earthquake resilience

6.2.2 Equipment and devices for emergency response to building collapse

6.2.3 Bangkok disaster databank

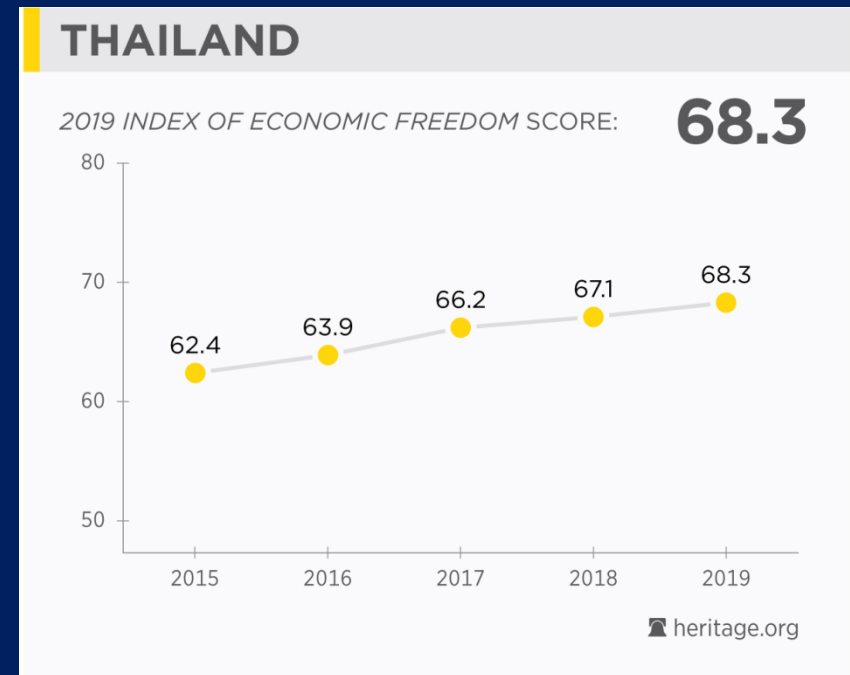
6.2.4 Disaster training centre

6.2.5 Establishment of a Bangkok command centre



# STRATEGIC ACTION AREA 3 - DRIVING A STRONG AND COMPETITIVE ECONOMY

- Increasing competitiveness and reducing economic vulnerability through diversification, both in terms of industries and employment opportunities.
- Build upon the existing strengths and the uniqueness of Bangkok's economic, social, infrastructural and environmental assets.



# STRATEGIC ACTION AREA 3 - DRIVING A STRONG AND COMPETITIVE ECONOMY

**GOAL 7: Facilitating city and community-based economy**

**GOAL 8: Expanding tourism, service industry and hospitality**





# GOAL 7: FACILITATING CITY AND COMMUNITY-BASED ECONOMY

BMA will proactively increase economic competitiveness and widen opportunity through:

- **Supporting economic resilience through:**
  - Establishing Bangkok as a Centre for trade and finance
  - Developing and preserving agriculture in the city



*Chulalongkorn University Centenary Park*

# 7.1 SUPPORTING ECONOMIC RESILIENCE IN COMMUNITIES AND ENCOURAGING THE PRESERVATION OF AGRICULTURE IN THE CITY

7.1.1 Enhancing resilience of vulnerable communities in Bangkok through integrated financial and social support



7.1.2 Promoting development of agriculture sector for sustainability



## 7.2 ESTABLISHING BANGKOK AS A CENTRE FOR TRADE AND FINANCE

7.2.1 Establishment of  
Bangkok Economic  
Development Centre for  
trade, finance

7.2.2 Develop economy,  
trade, finance and  
investment analysts for  
BMA

7.2.3 Reducing risk of  
economic shocks



# GOAL 8: EXPANDING TOURISM, SERVICE INDUSTRY AND HOSPITALITY

- This is important for the economic and social resilience of the city, and the country, as the tourism industry of Thailand is responsible for 19 per cent of the country's GDP.
- **Bangkok will further expand its tourism, service industry and hospitality offer through:**
  - Providing skills development for tourism operators
  - Enhancing tourist safety





# 8.1 PROVIDING SKILLS DEVELOPMENT FOR TOURISM OPERATORS.

8.1.1 Training program for tourism vendors and service providers

8.1.2 Tourism sector analysis and roadmap for tourism promotion

8.1.3 Model of management and development of cultural product for tourism promotion



## 8.2 RESOURCES AND INFRASTRUCTURE FOR BETTER RESPONSE AND PREPAREDNESS

### Enhancing tourist safety



# SDGs and The 20-Year National Strategy



# **Understanding climate change and variability for near term, middle and end of the 21st century over Bangkok Metropolitan Region based on the multi-models downscaling simulations**

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- **Rational**

Thailand is expected to be increasingly influenced by future climate change and climate variability. For minimizing the risk of future climate change and climate variability, robust and evidence-based adaptation measures need to be implemented.



# Understanding climate change and variability for near term, middle and end of the 21st century over Bangkok Metropolitan Region based on the multi-models downscaling simulations

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- **Rational**

The understanding of “climate information” in these multi-model outputs is needed especially in crucial area of Thailand like Bangkok Metropolitan Region and addressing these questions:

- 1) How would climate change in BMR changing in near, mid and end of the 21st century?
- 2) **How would extreme climate events in BMR changing in these periods?**
- 3) Are the GCM/RCM captured the major modes of variability and how climate change modifies these in future periods?
- 4) **How these variability would manifests over BMR?**

# Understanding climate change and variability for near term, middle and end of the 21st century over Bangkok Metropolitan Region based on the multi-models downscaling simulations

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- **Objectives**






- 1) To investigate climate change signals for BMR based on the multi-model downscaling simulation outputs for near, mid and end of 21st century periods.
- 2) To investigate changes in extreme events for these future periods
- 3) To investigate the signal of climate variability based on GCMs/RCMs and understands how climate variability signals manifest over BMR in the changing future climate

# Understanding climate change and variability for near term, middle and end of the 21st century over Bangkok Metropolitan Region based on the multi-models downscaling simulations

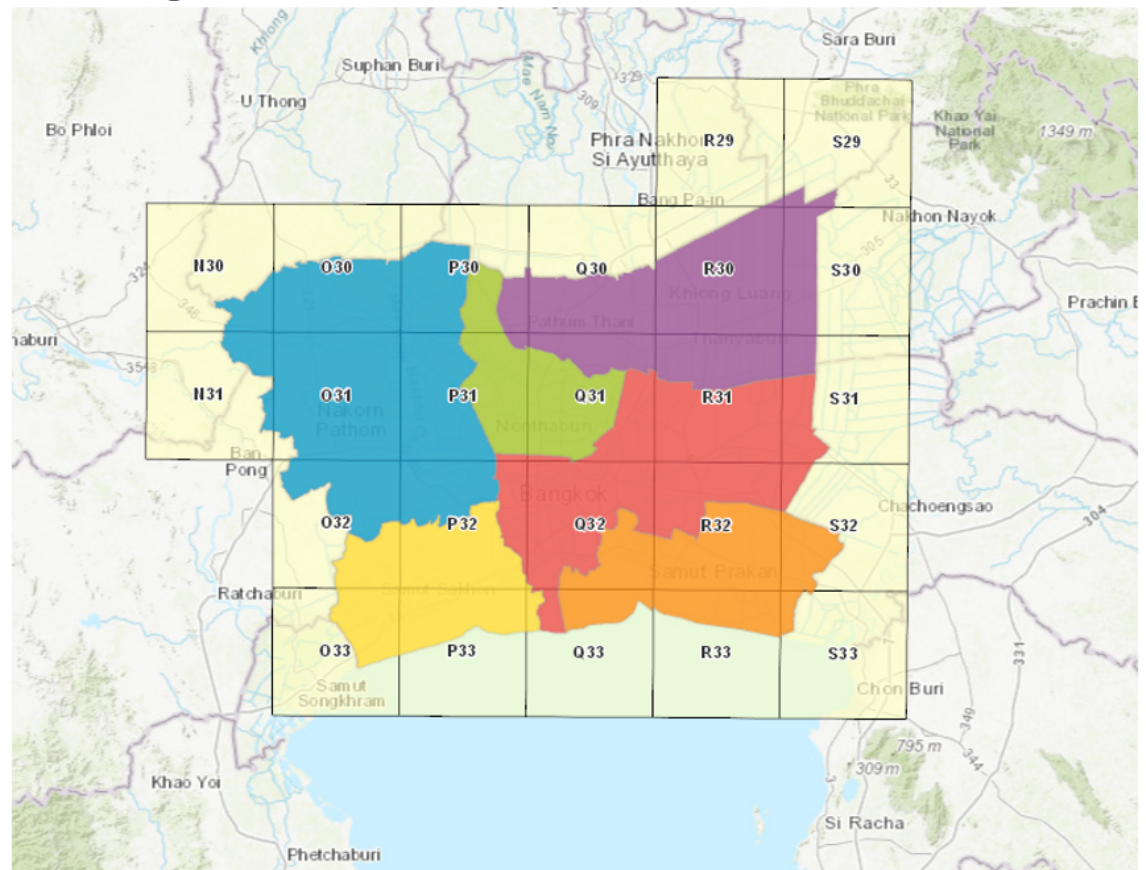
## GRID25KM\_Bangkok Metropolitan Region

### Legend

#### Bangkok Metropolitan Region

-  Bangkok
-  Nakhon Prathom Province
-  Nonthaburi Province
-  Pathum Thani Province
-  Samut Prakarn Province
-  Samut Sakhon Province

#### GRID25KM\_Bangkok Metropolitan Region



# **Understanding climate change and variability for near term, middle and end of the 21st century over Bangkok Metropolitan Region based on the multi-models downscaling simulations**

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- **Expected outputs**

- 1) Detailed understanding of model performances of multi-model regional climate simulations.
- 2) **Understanding of climate change extreme events over the study area on the multi-models simulation.**
- 3) Understanding of climate variability over study area and how climate variability changes in future periods



# Integrated assessment of SDGs using big earth observation data: A Case study for Bangkok Metropolitan Region (BMR)

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- **Rational**

- The location of BMR is in a major river delta of Chao Phraya basin, a biggest and most important in Thailand, connected to the Gulf of Thailand- considered as a significant coastal zone in SEA.
- Due to the rapid urbanization and industrialization, its complication of natural ecosystems, administrative and infrastructure/built environments as well socio-economic systems requires a development of suitable methodology for systematic and integrated assessment of progress related to SDGs with a good potential of utilizing big Earth Observation data.

# Integrated assessment of SDGs using big earth observation data: A Case study for Bangkok Metropolitan Region (BMR)

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- **Aims of the project**

- To support international collaboration with the “Digital Belt and Road (DBAR)” program under the DBAR International Centre of Excellence - Bangkok
- **To promote the implementation of SDGs in Southeast Asia region**
- To demonstrate the SDGs monitoring and evaluation using Earth observation and big Earth data technologies

# **Integrated assessment of SDGs using big earth observation data: A Case study for Bangkok Metropolitan Region (BMR)**

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- **Objectives**

The main objective of this project is to develop an integrated assessment of selected SDGs using the big Earth Observation (EO) technology in synergy with regional and local monitoring data and information applicable to the Metropolitan Region (BMR)

# Integrated assessment of SDGs using big earth observation data: A Case study for Bangkok Metropolitan Region (BMR)

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- **Expected outcomes**

- 1) To develop a set of regional-specific set of indicators for enhanced monitoring and assessing the sustainable development;
- 2) **To identify specific areas and indicators with different progress towards specific targets;**
- 3) To compile information on good practices / lessons learned incl. synergies / trade-offs in relation to SDGs performance.



## NEXT STEPS

- Bangkok city is on a journey, one that will see it grow to be a safe, livable and sustainable city for all its residents.
- It marks the beginning of a resilience building approach that will plan and resource actions that address those things that are important to Bangkok city and not just those that are the most urgent, breaking the cycle of being reactive instead of resilient.

## NEXT STEPS

- Bangkok has learnt from other cities in the network that resilience projects, by their very nature, cross silos, sectors and agencies.
- **Their implementation therefore requires collaboration and buy-in across multiple agencies to ensure that these agencies can work together to leverage investments, engage effectively with the community and deliver coordinated and transparent benefits to Bangkok residents.**
- Implementation agencies and partners will therefore be heavily involved in the development of an implementation plan to ensure coordination, streamline delivery and leverage investments for multiple resilience benefits.

