Leveraging Spatial Data for Pandemic-Resilient Cities

Australian Government
Department of Foreign Affairs and Trade

ASEAN AUSTRALIA SMART CITIES TRUST FUND
Asian Development Bank

(FCL) FUTURE CITIES LABORATORY
(SEC) SINGAPORE-ETH CENTRE

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Asian Development Bank – Future Cities Laboratory

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FOREWORD

Cities are at the frontline of safeguarding their citizens from unforeseen shocks and challenges – whether economic, physical, social, or environmental. The cities in the Asia-Pacific have found themselves heading to a perfect macro-economic storm following the coronavirus disease (COVID-19) pandemic. The pandemic has amplified the vulnerability of cities' urban structure, service systems, and societies and further entrenched socio-economic and gender inequalities in the city ecosystems. Addressing these vulnerabilities and inequalities demands the development of holistic and integrated solutions that enhance citywide urban resilience and prioritize the expansion of adaptive capacities of the most vulnerable citizens who are typically most adversely impacted by these significant shocks.

Cities and infrastructure planned and built today will define a city's physical development structure for many years. The key to building back better is to 'build back smarter.' A human-centered approach to planning and development, combined with smart and evidence-based solutions, can support cities to expediently move from best practice (traditional retrospective thinking) to "next practice" (preparatory forward-thinking). This people-centered, next practice planning and development approach can enable cities to tunnel through learning curves on their path to achieving truly green, inclusive, competitive, healthy, and resilient societies—cities that can respond to future shocks and stresses such as global economic recessions, health epidemics, natural disasters, and security threats.

This manual outlines an approach of how to leverage data to better understand the challenges pertinent to urban areas and how to use these data to build back smarter.

We thank our colleagues in the city of Makassar, Future Cities Laboratory, Singapore and all those who contributed to developing and testing this approach.

Srinivas Sampath

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INTRODUCTION

The COVID-19 pandemic that is currently happening globally underlines the urgency of resilient city planning. While previous resilient city discourses dwell on issues such as climate change and sustainable development, now it recognizes pandemic as one of the most urgent issues.

Pandemic-proof city planning is a relatively new concept. While we have seen SARS and Swine Flu pandemics in the past, their impacts were relatively small compared to the current global pandemic, to warant a new planning approach. New planning approaches to achieve pandemic-proof cities are urgently needed.

To plan such cities, better understanding of how the pandemic interacts with cities (i.e. urban systems, land use systems and other dimensions) are crucial. Conclusive research and knowledge surrounding the issue however are still limited. Nevertheless, cities must act urgently to ensure their preparedness.

Pandemic is an example of planning's complex problems. Complex problems are problems that are often ambiguously defined, combining multiple interdependent factors, incubating unforeseen risks, requiring urgent attention are resisting readymade solutions

Data can help to better understand complex problems. In the case of the pandemic, data can help city makers to better understand how the pandemic interacts with the cities by analysing their existing data sets. This may cover questions such as which area have higher risk of transmission, which community is more vulnerable, and which areas have less capacity for pandemic response.

This manual is developed to help city makers to acquire better understanding of their existing data sets, which eventually can be translated practically into pandemic-proof city planning and policymaking processes.

This manual hinges on 'Design-Research' (DR) approach that was developed by the Future Cities Laboratory. DR is used to help solve complex problems. The DR approach is premised on the interdependence of human and nonhuman communities. This acknowledges the anthropogenic character of complex problems, diversifies the 'stakeholders' needed to understand them, and foregrounds collaborative ways of solving them.

DR combines design practice and scientific research. Design offers transdisciplinary creativity, participatory techniques and visual communication, while research offers evidence-based insights, system perspectives and quantitative tools. In combination, design and research can draw out the conflicting impulses underlying complex problems – such as function, profit, ethics, comfort, convenience, identity, security, concern, satisfaction, aspiration and desire – and harness them to generate empowering visions and effective solutions.

This manual is designed to complement the recently launched 'Makassar Recover', a COVID-19 response initiative that was launched by the City last March 2021. It is expected to support the City's effort to recover the City and eventually help them to plan for pandemic-proof city.

This manual is targeted for city authorities, city planners, researchers, policy makers and other relevant stakeholders who are involved in the process of city planning and policy making.

METHODOLOGY

Design-Research (DR) contributes to solving complex problems in fresh, credible and practical ways. Complex problems, such as sustainable urbanization, green growth or inclusive development, have unique characteristics such as:

- Being ambiguously defined
- Combining multiple interdependent factors
- Incubating unforeseen risks
- Requiring urgent attention
- Resisting readymade solutions.

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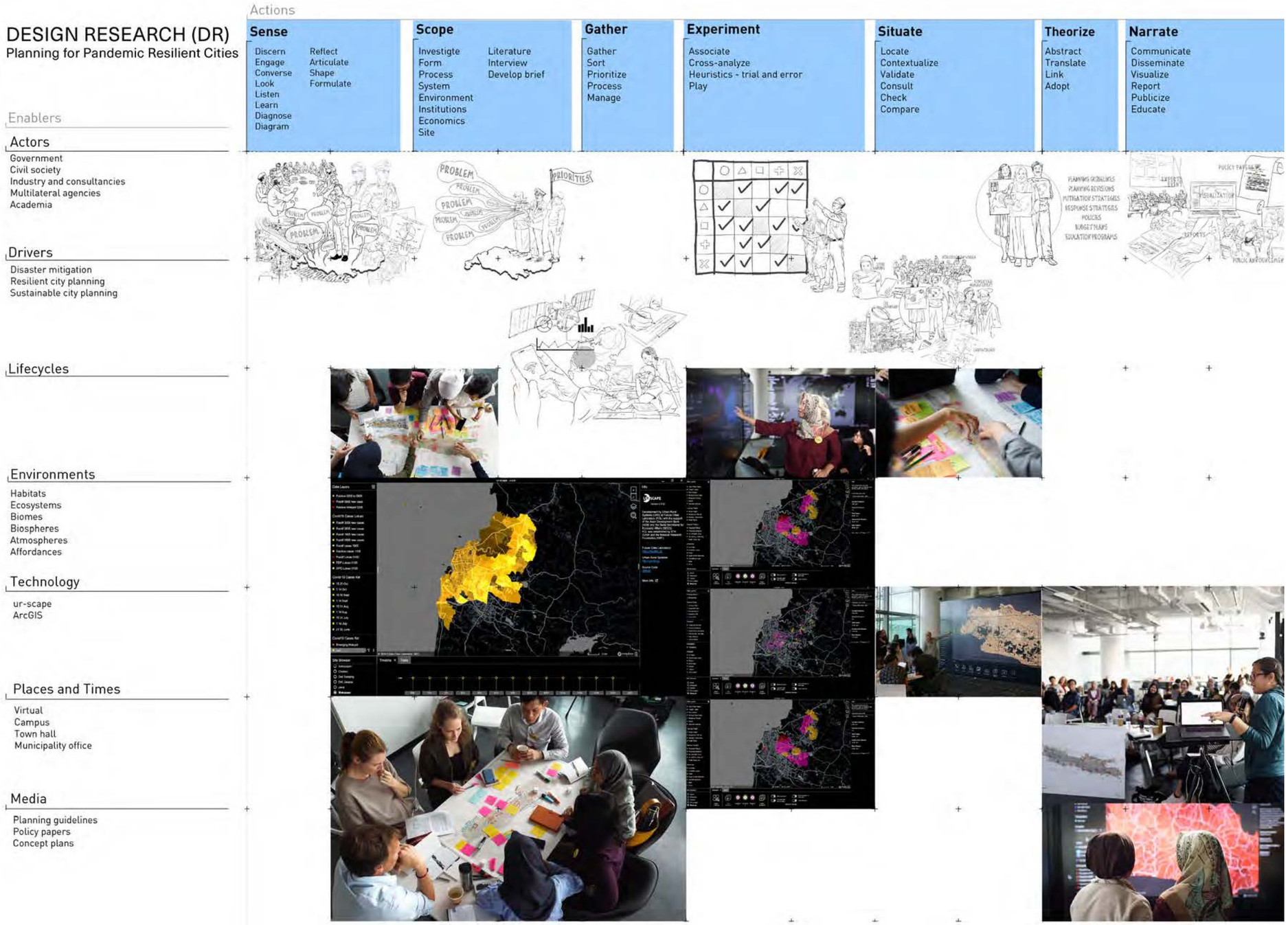
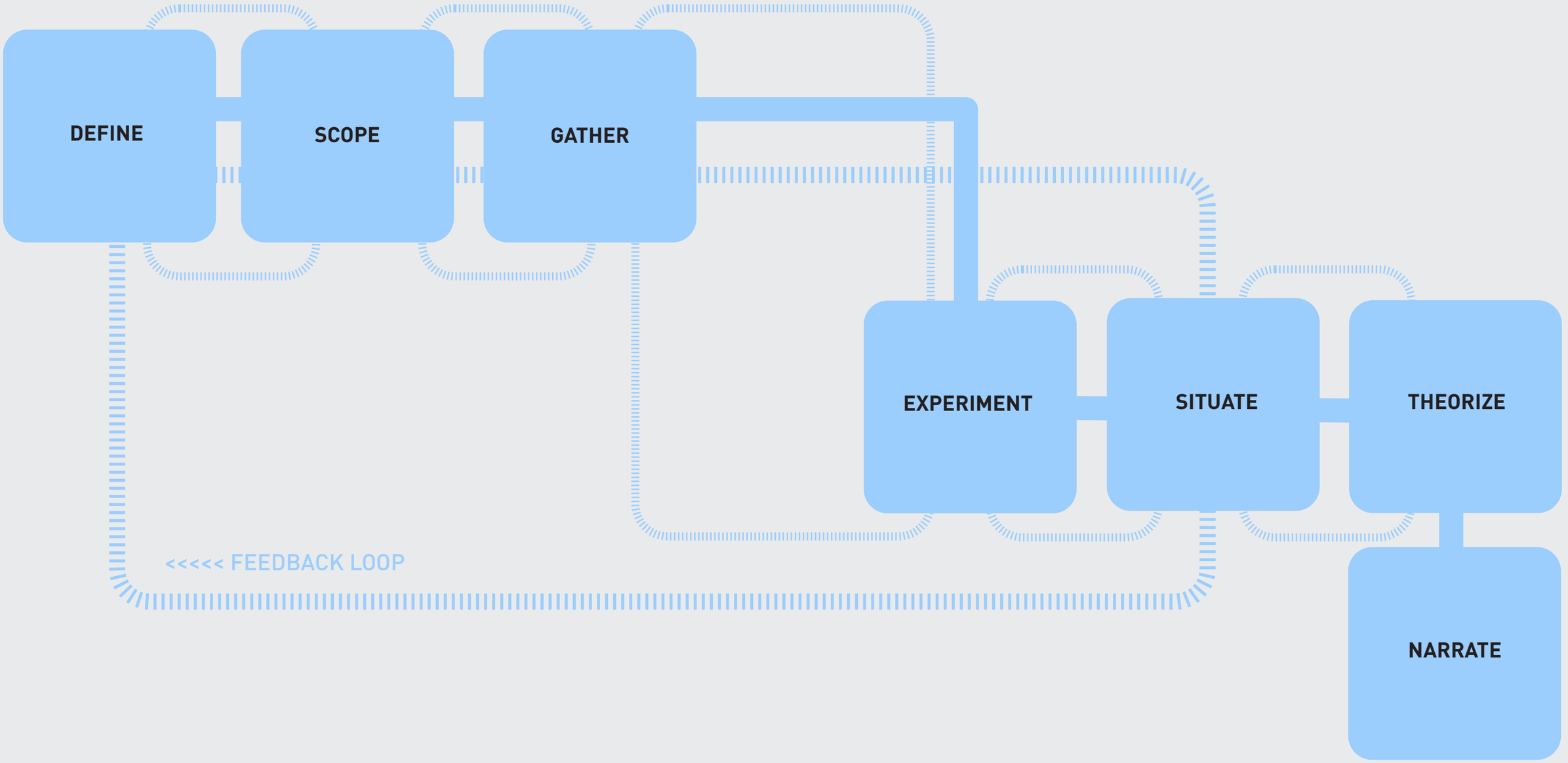
Seven Actions and Seven Enablers
Design-Research (DR) works through the following seven actions:
- Sense human and nonhuman needs
- Scope parameters and emergent phenomena
- Gather best available data
- Experiment across solution spaces
- Situate fresh ideas
- Theorize experience
- Narrate processes



And the following seven enablers:

- Actors
- Places
- Lifecycles
- Environments
- Drivers
- Media
- Technologies

The seven actions are integral to the design-research process but need not be enacted in any particular sequence. They may be repeated, combined and recombined in various ways depending on the complexity of the problem, composition of the actors, and contingencies of the situation.



SENSE

SENSE HUMAN AND NONHUMAN NEEDS

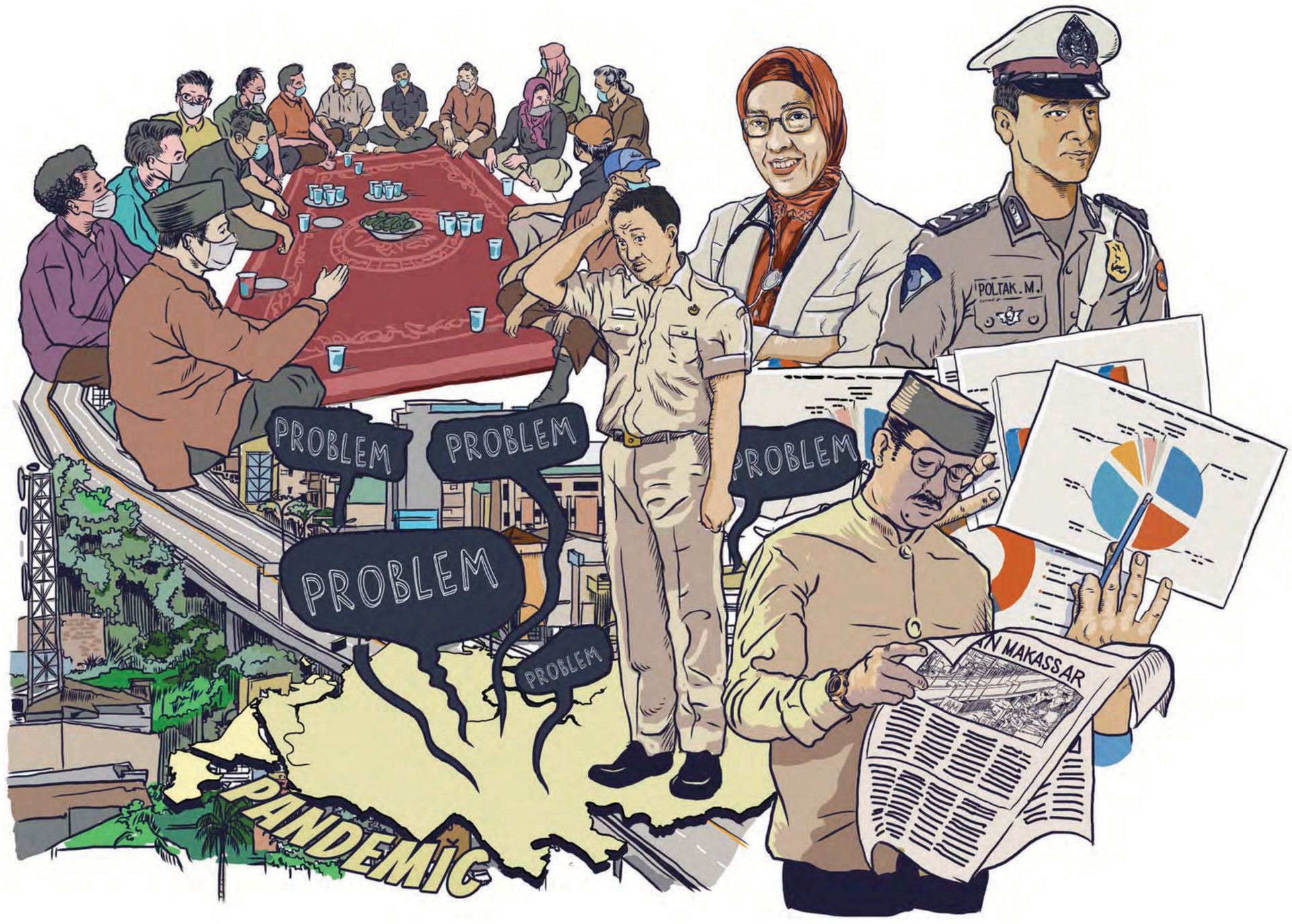
WHY
To define the problem pertinent to the pandemic. The needs, desires and aspirations of people are not always expressed nor received well. The structuring power of institutions is often disregarded. Natural environments and their nonhuman inhabitants are routinely marginalised.

WHAT
Shape problems inclusively. Listen to, sound out, feel for aspirations of individuals and communities, rules and resources of social institutions, and the affordances of natural environments.

HOW
Talk about, describe and illustrate individual and collective aspirations. Diagnose, compare and tabulate social institutions. Walk, map and record the affordances of natural environments.

Discuss how the pandemic is adversely impacting the city, urban systems and the community! Consider the following dimensions:

- Urban infrastructures (i.e. water, transport, energy, waste/drainage/sanitation, etc.)
- Public facilities and civic functions (i.e. open spaces, health, market and commerce, education, religious facilities, touristic areas, etc.)
- Housing
- Informal economic sector (i.e. offices, manufactures, constructions, service and trading, etc.)
- Informal economic sector (i.e. market, street vendors, home industries, etc.)
- Digital economic sector and gig economies
- Local communities (including marginalised households, single mothers and children, elderlies, low income group, disabled group, etc.)
- Transient communities
- Disaster-prone areas (flooding, cyclone, fire, sea level rise, etc.)
- Environment



SCOPE

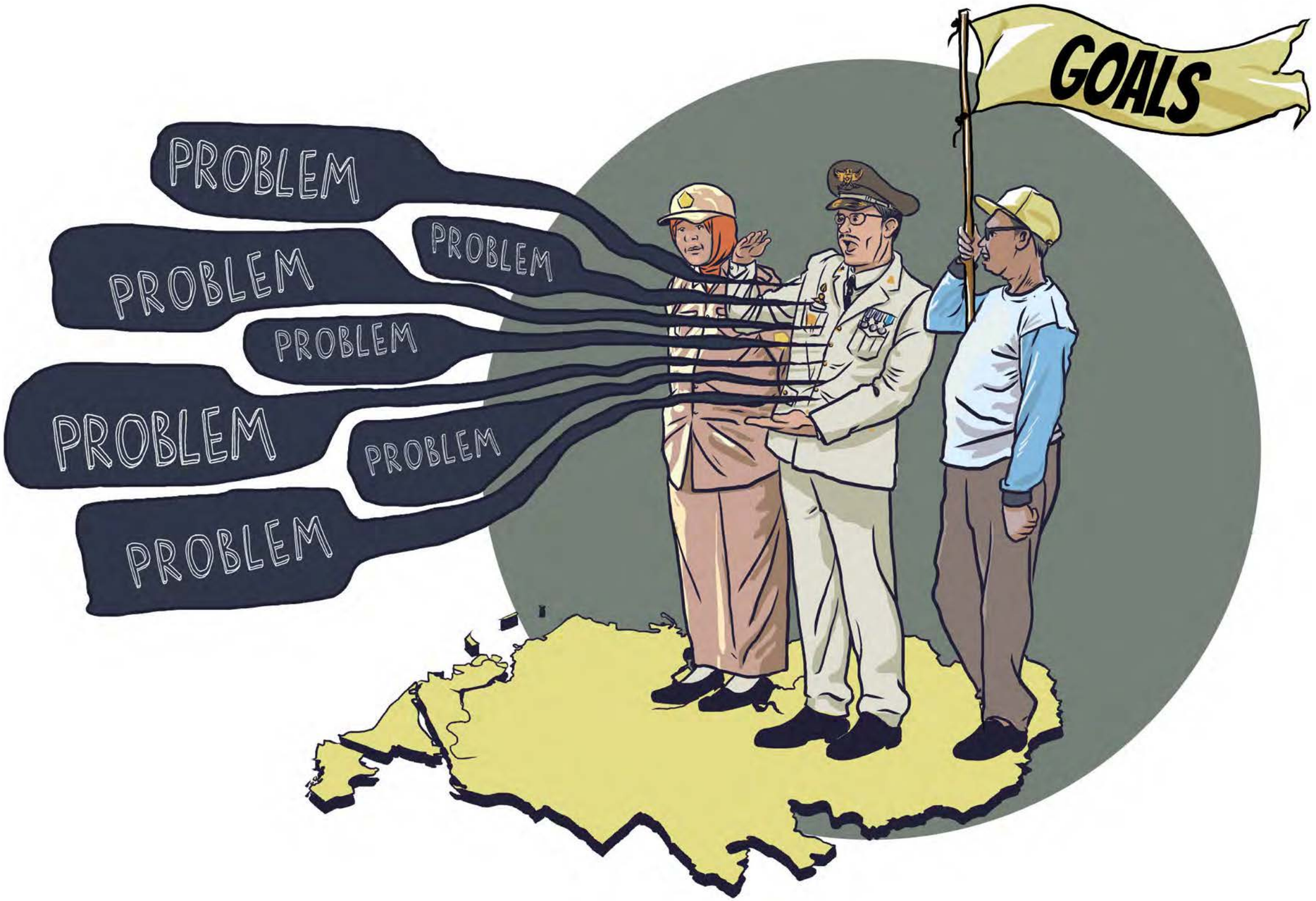
SCOPE PARAMETERS AND EMERGENT PHENOMENA

WHY
To formulate goals. Problems that are formulated inclusively can be overwhelming and bewildering. Special effort is needed to structure, evaluate and navigate them.

WHAT
Formulate goals in the form of requirements, hypotheses, research questions, and concept papers. Ensure they offer structure, inspire good solutions, and are flexible enough to anticipate and embrace new circumstances as they emerge.

HOW
Review relevant theory, literature and comparable cases globally. Assess against affordances, aspirations and social institutions. Formulate goals that are recognizable locally, feasible, and motivating

Formulate goals by considering targeted planning instruments (short, medium and long term plans), decision-making mechanism, implementation scale, relevant supporting policies and relevant stakeholders.



GATHER

GATHER BEST AVAILABLE DATA

WHY
To form solution spaces. The increasing volume of data on human activities promises new insights into complex problems. However, those data are often fragmented. They need to be gathered and organized to form credible solution spaces.

WHAT
Large volumes and new forms of qualitative and quantitative digital data need to be gathered, sorted, 'cleaned', stored and managed well. These data inform a large set of possible solutions that needs to explored in dialogue with problems and goals.

HOW
Examine available data and assess its coherence, completeness, timeliness, format and accessibility. Visualize and enable access to data sources to support broader understanding of the role of data in forming solution spaces and formulating feasible goals.

Consider the following points:

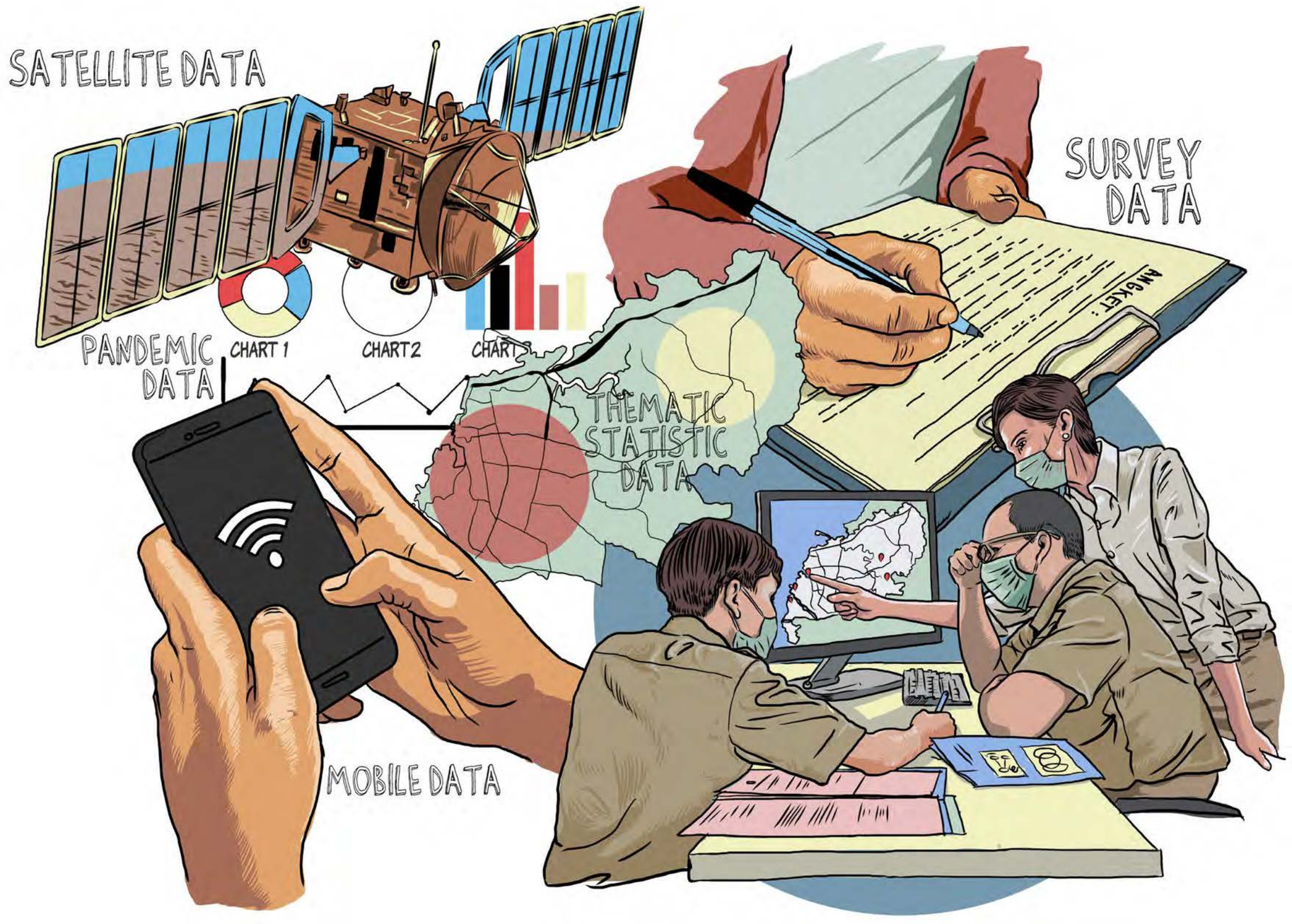
1) Purpose of the data - Why do we need the data and what can we understand from it?

2) Level of priority - Data gathering requires time and resources, we need to prioritize the data selection based on the priority. Do we really need the data or is there any other data set that we need to gather first?

3) Format - Which format is appropriate for the analysis and better able to help us understand the problems in a more accurate manner?

4) Source and accessibility - What are the sources of data? Can we access it?

5) Alternatives or proxies - If the data that we need are not available, what are the potential proxies?



GATHER

(cont.)

TYPE OF DATA

WHICH DATA SETS DO WE NEED?

Indonesian cities have extensive data inventories that can be employed readily. Followings are some examples of thematic data sets that can be considered:

- COVID-19 data (i.e. number of positive cases per districts, long-lat coordinates of positive cases, hotspot locations, etc.)
- Demographic and social economic indicators
- Distribution of public facilities
- Coverage of basic infrastructures
- Land use
- Pandemic responses

FORMATS

To visualize and analyze the data effectively, the following formats are useful:
GIS, GeoTIFF, CSV, Excel

LEVEL

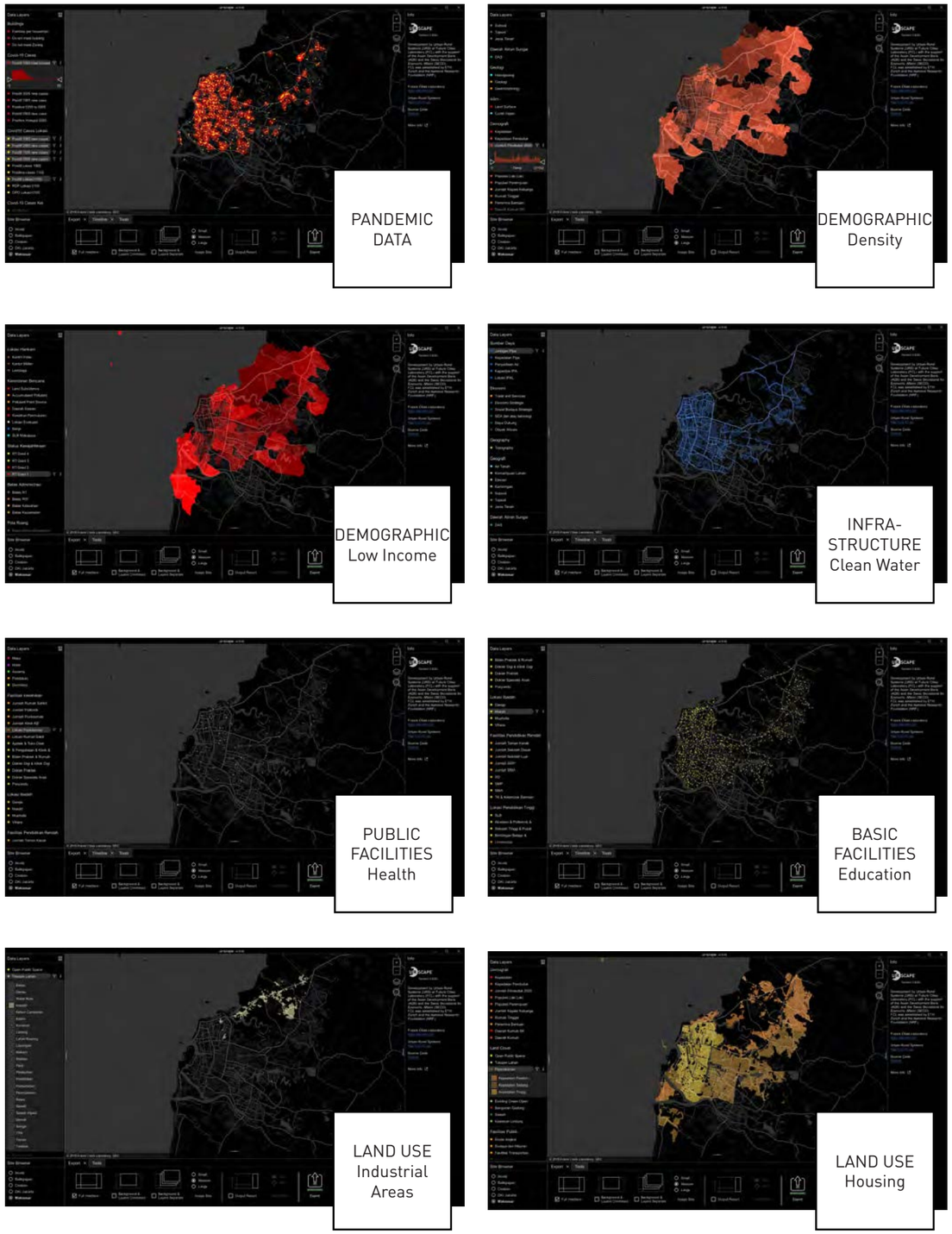
Point data and district level data (neighbourhood, kelurahan and kecamatan)

SOURCES

- City agencies
- City level census data
- Pandemic task force
- Civic organisations
- Crowd sourced (apps and social media data)
- Private companies
- Academic organizations

EXAMPLES OF DATA THAT CAN BE CONSIDERED

PANDEMIC DATA	Coordinates of positive cases Number of cases per districts Locations of pandemic hotspot
DEMOGRAPHIC	Population number Population density Age composition Gender composition Employment sectors Low income group Slums
LAND USE	Housing Commerce and trading Service and finance Industrial areas Open spaces Transportation hubs
BASIC INFRA-STRUCTURES	Clean water Energy Road
PUBLIC FACILITIES	Health Education Transport Religious facilities
PANDEMIC RESPONSES	Existence of pandemic task forces Dedicated pandemic responses facilities



Example of Makassar data visualization on ur-scape platform

EXPERIMENT

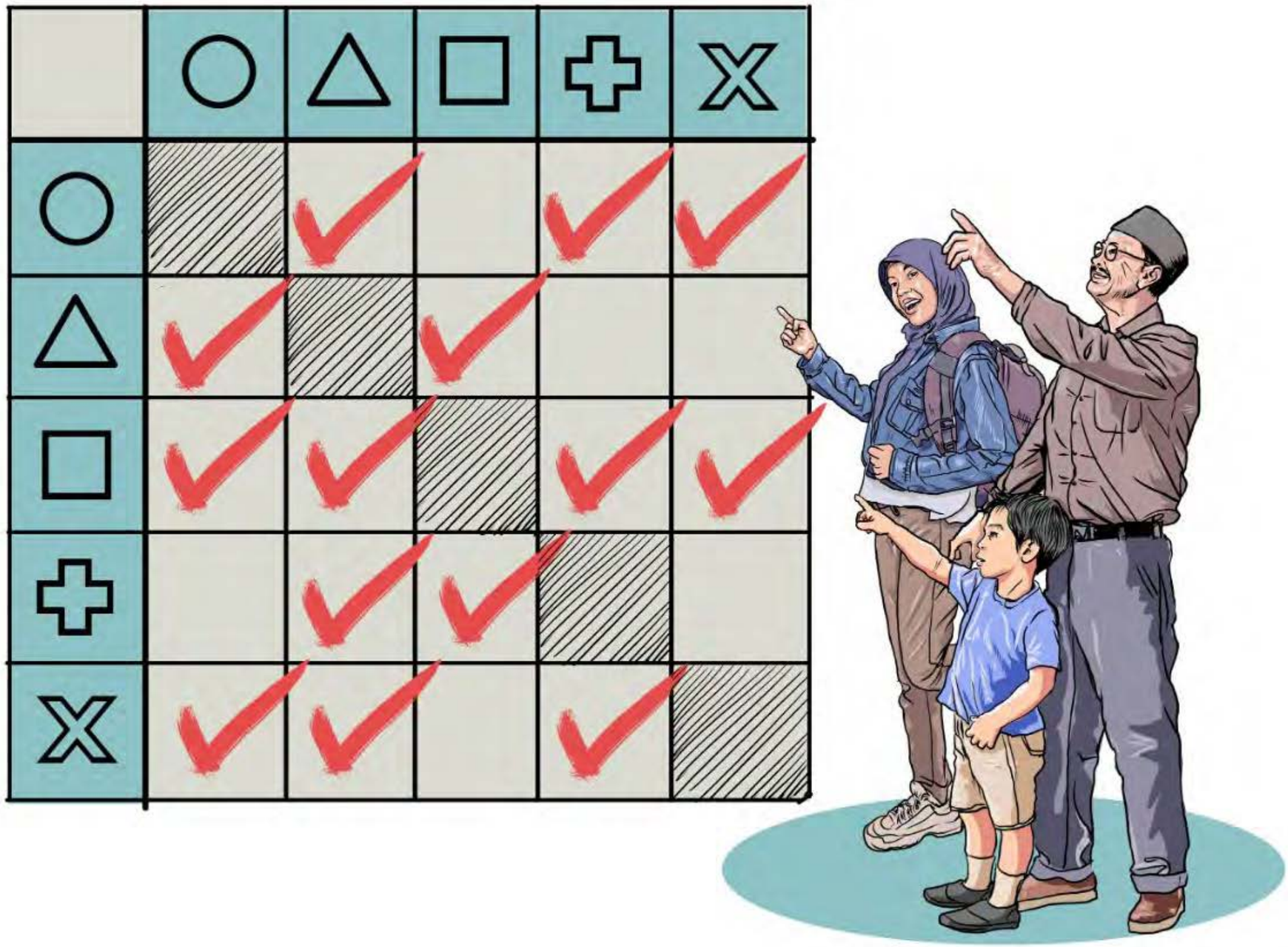
EXPERIMENT IN SOLUTION SPACES

WHY
To generate fresh ideas and insights. Solution spaces define parameters for possible solutions but do not deliver solutions themselves. Experimentation within and across solution spaces is needed to generate fresh insights and ideas.

In the context of the current pandemic where knowledge on how the pandemic interacts with cities are still limited, experiment can help to better understand the issue.

WHAT
Experimentation spans theoretical modelling and heuristic inquiry. In situations where parameters are especially ambiguous and data is uneven, heuristic approaches are useful. They use iterative, creative and satisficing (satisfy-suffice) approaches to generate new insights, ideas and possible solutions around defined goals.

HOW
Test problems, goals and solution spaces by controlled experiment, association, intersecting data, proxies, or plausible estimates. Produce 'safe' spaces – studios, labs, workshops – where intellectual and creative risks can be taken.



EXPERIMENT
(cont.)

DATA ASSOCIATION AND INTERSECTION

DATA SETS THAT CAN BE ASSOCIATED AND INTERSECTED

In the experiment stage, the following are several combinations of data association/ intersections that can be considered:

PANDEMIC-PRONE AREAS ANALYSIS

PANDEMIC-PRONE COMMUNITIES ANALYSIS

PANDEMIC RESPONSES CAPACITY ANALYSIS

PANDEMIC-PRONE AREAS

- PANDEMIC DATA + DEMOGRAPHIC Density
- PANDEMIC DATA + DEMOGRAPHIC Density + INFRA-STRUCTURE Clean Water
- PANDEMIC DATA + DEMOGRAPHIC Density + INFRA-STRUCTURE Transportation
- PANDEMIC DATA + DEMOGRAPHIC Density + INFRA-STRUCTURE Electricity
- PANDEMIC DATA + DEMOGRAPHIC Density + PUBLIC FACILITIES Health
- PANDEMIC DATA + DEMOGRAPHIC Density + PUBLIC FACILITIES Education
- PANDEMIC DATA + DEMOGRAPHIC Density + PUBLIC FACILITIES Markets
- PANDEMIC DATA + DEMOGRAPHIC Density + LAND USE Housing

PANDEMIC-PRONE COMMUNITIES

- PANDEMIC DATA + DEMOGRAPHIC Density
- PANDEMIC DATA + DEMOGRAPHIC Age
- PANDEMIC DATA + DEMOGRAPHIC Low Income
- PANDEMIC DATA + DEMOGRAPHIC Low Income + DEMOGRAPHIC Density
- PANDEMIC DATA + DEMOGRAPHIC Low Income + PUBLIC FACILITIES Health
- PANDEMIC DATA + DEMOGRAPHIC Low Income + INFRA-STRUCTURE Clean Water

PANDEMIC RESPONSES CAPACITY

- PANDEMIC DATA + PANDEMIC RESPONSES
- PANDEMIC DATA + PANDEMIC RESPONSES + DEMOGRAPHIC Density

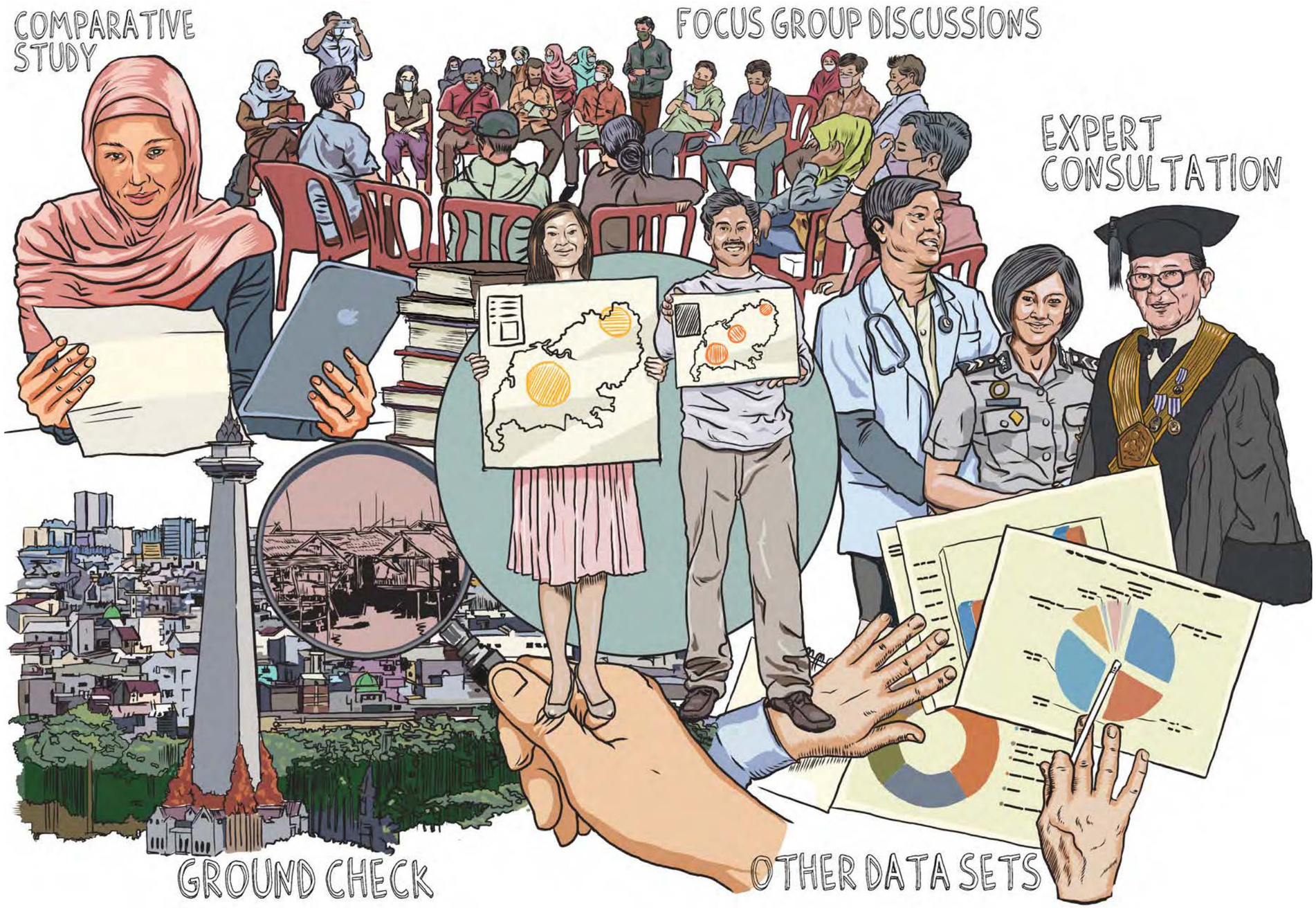
SITUATE

SITUATE OUTCOMES

WHY
To situate the outcomes of the data analysis. The outcomes need to be contextualized and validated, as they may not be conclusive enough or inaccurate.

WHAT
Validate the outcomes of the experiments by considering the local context and conditions. This step can help to better understand the conclusions of the analysis by examining the local institutional setting, community, geography, culture and history.

HOW
Develop strategies to situate the outcomes of the analysis by conducting:
- comparative studies
- expert consultations
- focus group discussions with communities
- data verification
- consulting other data sets
- ground check



THEORIZE

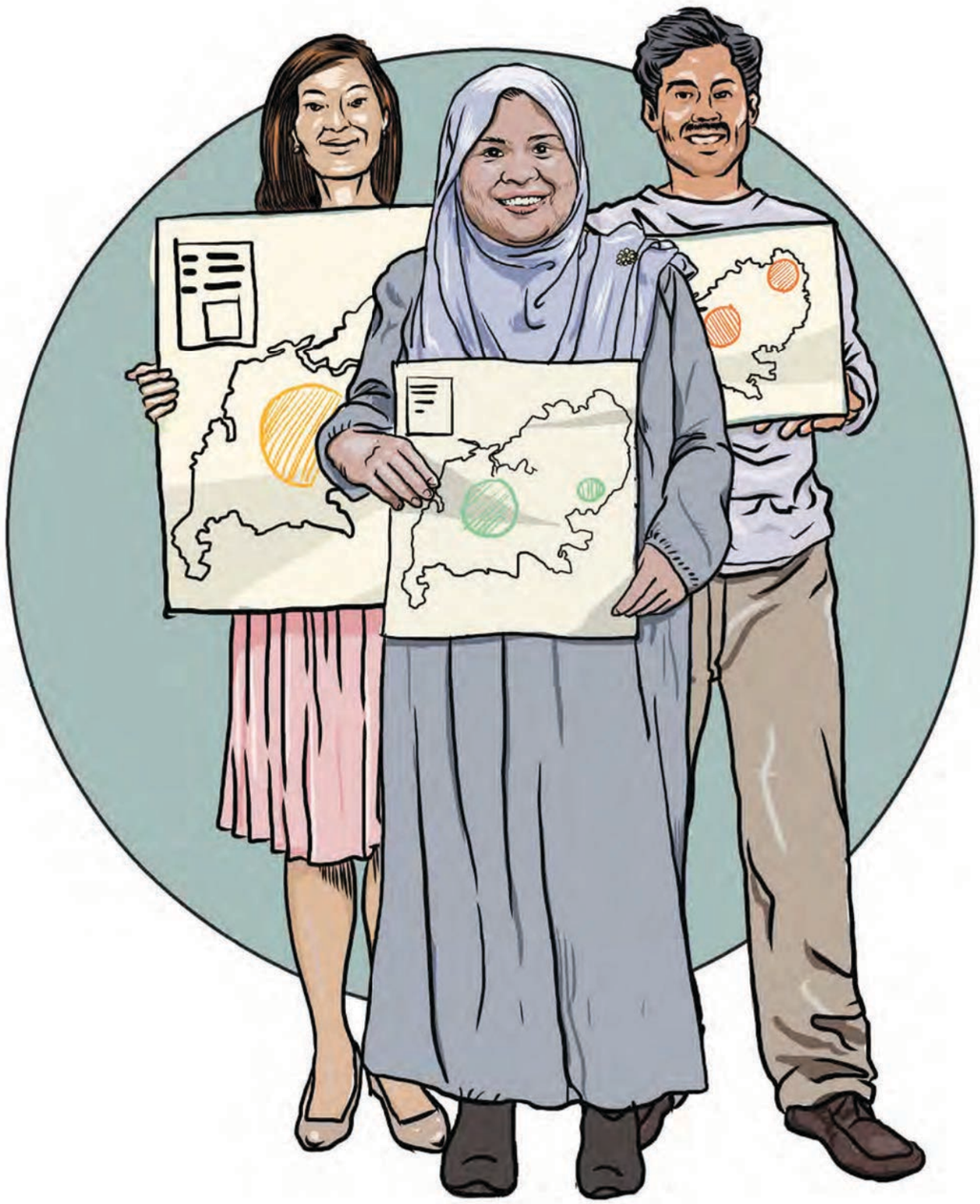
THEORIZE EXPERIENCE

WHY
To translate the outcome of the analysis in a practical and general manner within the the process of city planning.
To interlink local solutions and global principles. The experience of solving problems in one place usually holds insights for how they might be solved in other places. Particular experiences can contribute to general practices, principles and knowledge.

WHAT
Theorize the outcomes to create principles that may be relevant more generally. Develop codes, rules and typologies with sufficient abstraction that they may be transmissible and adaptable to divergent settings.

HOW
Link outcomes to existing planning dimensions and mechanisms, inclusing short, medium and long term planning, such as:
- Concept plans
- Urban strategic plans (i.e. distribution of urban centralities, transport planning,etc.)
- Land use plan
- Density plan
- Public facilities and basic infrastructure plans
- Budget plan
- Supporting planning policies

To ensure a sustainable knowledge transfer translate outcomes into a practical educational programs in collaboration with local academic institutions.



PLANNING GUIDELINES
PLANNING REVISIONS
MITIGATION STRATEGIES
RESPONSE STRATEGIES
POLICIES
BUDGET PLANS
EDUCATION PROGRAMS

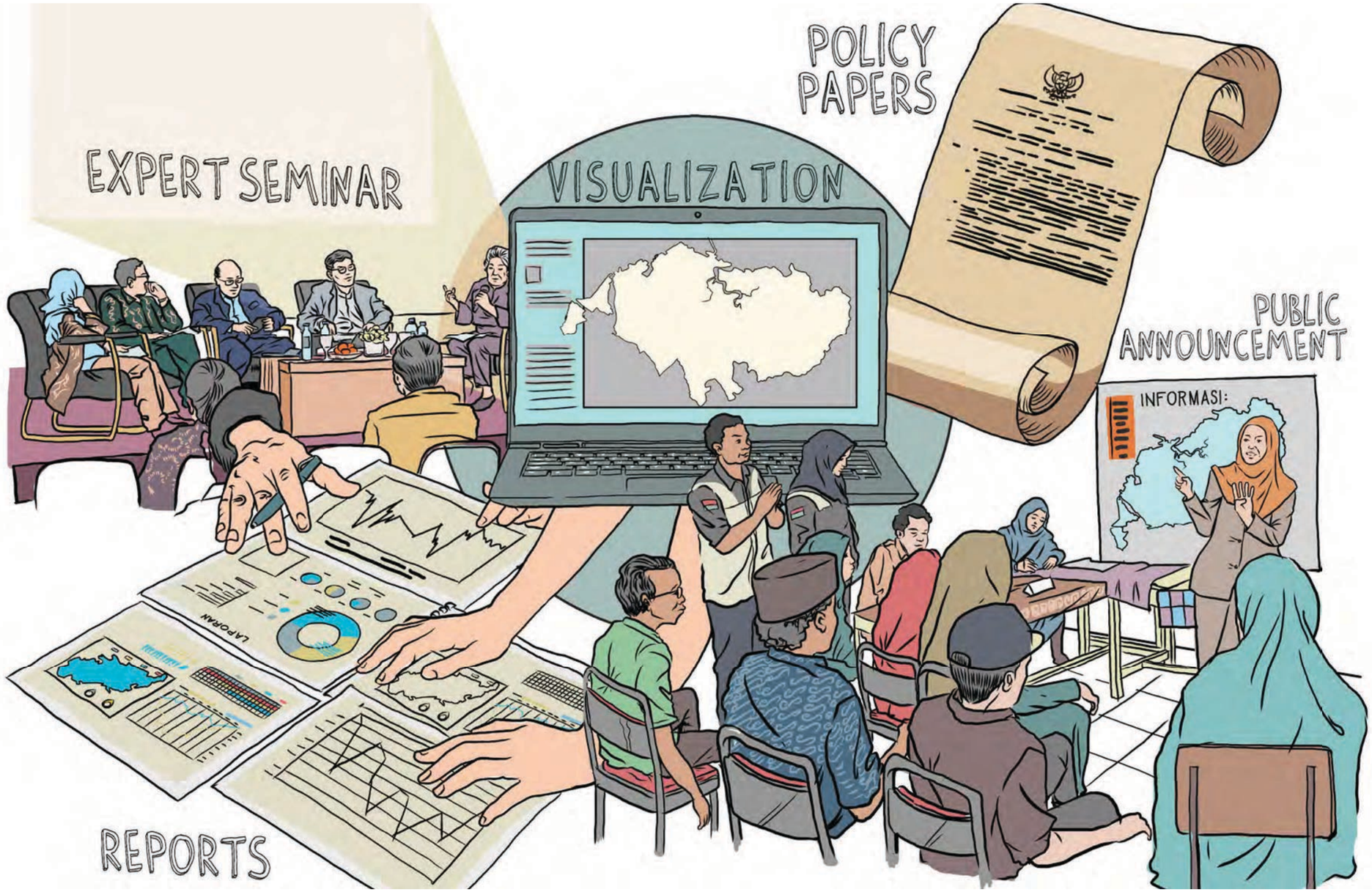
NARRATE

NARRATE PROCESSES

WHY
To build audiences. People are diverse and varied in their world views, ways of working and motivations. If they are to be involved in helping solve the complex problems they must be invited to do so.

WHAT
Narrating processes helps us appreciate the context of a given problem, how the goals were shaped, and range of solutions arrived at. This also helps generate ideas, discussion and supports from relevant communities.

HOW
Create multimedia narratives combining text, visual illustration and performance. Use various formats to communicate the narratives, such as with data visualization, policy papers, reports, expert seminars, and public announcements.



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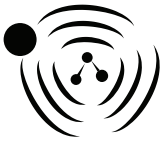

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The ASEAN Australia Smart Cities Trust Fund (AASCTF) works with participating ASEAN cities with the aim of enhancing city planning systems, governance, service delivery, and financial management through the identification and adoption of appropriate digital solutions and systems. These digital solutions address vital cross-cutting themes such as gender equity and women's empowerment, social inclusiveness, climate change and environmental sustainability, and public-private partnerships. By working with cities, AASCTF facilitates their transformation to become more livable, resilient, and inclusive, while in the process identifying scalable best practices that can be replicated across cities in Asia and the Pacific.